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EANM'24

Annual Congress of the
European Association of Nuclear Medicine
October 19–23, 2024
Hamburg, Germany

Abstracts

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Dear Colleagues,

I am very pleased to invite you to the 37th Annual Congress of the European Association of Nuclear Medicine. The EANM'24 will be held in Hamburg, on October 19-23, 2024.

Over the past years, we have seen the EANM's Annual Congress becoming larger, more impactful, and more successful, accompanying and shaping the fantastic growth of our diverse, exciting, and ever-growing specialty.

This year, once again, we will be able to exchange and discuss the latest theranostic advances, the most impactful clinical evidence, the most recently developed radiopharmaceuticals, and the most novel imaging and detection technologies. This is only possible because you send your most exciting works, your most original ideas, and your most accomplished results to the congress team, and I thank you once again for it.

This year, we will highlight with renewed emphasis our partnerships with clinical societies, with whom we work hand in hand to ensure that all patients can benefit from a timely diagnosis and an effective treatment.

We focus specifically on facilitating interactions and exchanges across disciplines, competences, and generations. Indeed, in my vision, one central mission of the EANM's annual congress is to motivate and inspire the youngest members of our community, who will be shaping the future of our field. The only everlasting element in our discipline is change, making adaption essential to guarantee our continued success. This can only be achieved with the contribution and active involvement of younger specialists and collaborators, who will bring our developments and advances forward. New communications technologies also play a pivotal role in knowledge sharing. This is why the online material will be made accessible during and after the congress, to reach the largest possible audience.

For all these reasons, I want to thank you already because I know that each and every one of you in your daily clinical, research, and teaching practice is preparing the content that will be discussed at the EANM'24. Rest assured that from our side, we are doing our best to prepare everything adequately and provide you with the most exciting platform.

I look forward to seeing you in Hamburg!

Valentina Garibotto
EANM Congress Chair 2023–2025

Saturday, October 19, 2024

Location/ Time	Hall 1				Location/ Time
08:00–08:30					08:00–08:30
08:30–09:00					08:30–09:00
09:00–09:30					09:00–09:30
09:30–10:00					09:30–10:00
10:00–10:30					10:00–10:30
10:30–11:00					10:30–11:00
11:00–11:30		Advisory Council Meeting (11:00–13:00)			11:00–11:30
11:30–12:00					11:30–12:00
12:00–12:30					12:00–12:30
12:30–13:00					12:30–13:00
13:00–13:30					13:00–13:30
13:30–14:00					13:30–14:00
14:00–14:30			Delegates' Assembly (14:00–16:00)	EANM Committee Meetings (14:00–17:45)	14:00–14:30
14:30–15:00					14:30–15:00
15:00–15:30					15:00–15:30
15:30–16:00					15:30–16:00
16:00–16:30					16:00–16:30
16:30–17:00					16:30–17:00
17:00–17:30					17:00–17:30
17:30–18:00					17:30–18:00
18:00–18:30	Opening Ceremony including Awards Ceremony (18:00–18:35)				18:00–18:30
18:30–19:00	101 Plenary 1 Highlights Lecture (18:35–19:35)				19:30–20:30
20:30–21:00	Welcome Reception (19:45–21:45)				20:30–21:00
21:00–21:30					21:00–21:30
21:30–22:00					21:30–22:00

Sunday, October 20, 2024

Location/ Time	Hall 1	Hall 4 – Arena	Hall X9-X12	Hall X1-X4	Hall Y4-Y9	Hall Z	Hall Y10-Y12	Hall G2	Hall F	Hall G1	Hall Y1-Y3	Location/ Time
	LIVE STREAM									LIVE STREAM		
08:00–08:30	201 CME 1 Inflammation & Infection Committee **Towards the Holy Grail of Infection Imaging**	202 Special Track Oncology & Theranostics Committee **Debate: FAPI RIP FDG**	203 Learn & Improve Professional Skills (LIPS) Track (Interactive) Physics Committee **CZT-based Gamma Cameras**	204 M2M Track TROP Session Radiopharmaceutical Sciences + Translational Molecular Imaging & Therapy Committee **Tracer (Pharmaco) Kinetics**	205 Cutting Edge Science Track TROP Session Dosimetry Committee **Preclinic and Radiobiology**	206 Clinical Oncology Track TROP Session Oncology & Theranostics Committee **Breast**	207 Featured Session Paediatrics Committee **Paediatric Oncology**	208 TROP Session Cardiovascular Committee **From Flow to Myocardium the Unsuspected Virtues of Molecular Cardiology**	209 e-Poster Presentations Session 1 Neuroimaging Committee **Neuroimaging Session**	210 Technologists' Track Opening CTE 1 Technologists Committee / SNMMI **Technologists' Guide Launch**	211 Theranostics Track TROP Session Oncology & Theranostics Committee **Other Oncological Treatments**	08:00–08:30
08:30–09:00												08:30–09:00
09:00–09:30												09:00–09:30
09:30–10:00												09:30–10:00
10:00–10:30	301 CME 2 Oncology & Theranostics Committee **PSMA PET and Radioligand Therapy**	302 Special Track Thyroid Committee **Challenge the Expert: Therapeutic Dilemmas in Patients with Low-Intermediate Risk Thyroid Cancer**	303 Learn & Improve Professional Skills (LIPS) Track (Interactive) Neuroimaging Committee **Clinicians' Expectations for Neurological PET Imaging?**	304 M2M Track TROP Session Radiopharmaceutical Sciences + Translational Molecular Imaging & Therapy Committee **Antibodies & Co.**	305 Cutting Edge Science Track TROP Session Radiation Protection Committee / EARL **Radiation Protection for Radionuclide Therapy and Animal Protection**	306 Clinical Oncology Track TROP Session Oncology & Theranostics Committee **Head & Neck**	307 TROP Session Paediatrics Committee **Paediatric Nephrourology & Others**	308 Joint Symposium 1 Cardiovascular Committee / EACVI **Coronary Artery Disease in Women: The X Factor?**	309 e-Poster Presentations Session 2 Oncology & Theranostics Committee **Neuroendocrine and Gastrointestinal Cancers**	310 Technologists' Track CTE 2 Technologists Committee **Whole-Body Multimodality Imaging**	311 Special Symposium 1 EARL **Harmonisation – The Path for New Criteria and New Accreditations**	10:00–10:30
10:30–11:00												10:30–11:00
11:00–11:30												11:00–11:30
11:30–12:00	401 Plenary 2 **The Age of Theranostics**											11:30–12:00
12:00–12:30												12:00–12:30
12:30–13:00												12:30–13:00
13:00–13:30	Lunch Break			Satellite Symposium	Satellite Symposium	Satellite Symposium	Satellite Symposium	Satellite Symposium	Members' Assembly (13:15–14:45)	Satellite Symposium	Satellite Symposium	13:00–13:30
13:30–14:00												13:30–14:00
14:00–14:30												14:00–14:30
14:30–15:00												14:30–15:00
15:00–15:30	501 CME 3 Cardiovascular Committee **Myocardial Perfusion Imaging with PET: Go with the Flow**	502 Special Track Physics Committee **Debate: Generative AI for Nuclear Medicine: Blessing or Curse?**	503 Learn & Improve Professional Skills (LIPS) Track (Interactive) Bone & Joint Committee **MSK Multiverse: Old and New!**	504 M2M Track TROP Session Radiopharmaceutical Sciences + Translational Molecular Imaging & Therapy Committee **Receptor-Targeted and Radionuclide Therapy**	505 Cutting Edge Science Track TROP Session Dosimetry Committee **Dosimetry: A Question of Time**	506 Clinical Oncology Track TROP Session Oncology & Theranostics Committee **Lung**	507 TROP Session Thyroid Committee **Radioiodine Therapy in Benign and Malignant Thyroid Disease: An Evergreen Treatment**	508 Joint Symposium 2 Oncology & Theranostics Committee / EAU **Prostate Cancer Radionuclide Therapy in the Post Vision-Era**	509 e-Poster Presentations Session 3 Inflammation & Infection Committee **Best e-Posters on Infection & Inflammation**	510 Technologists' Track Oral Presentations 1 Technologists Committee **Clinical PET Study Applications**	511 Special Symposium 2 Radiation Protection Committee **Creating a Patient-Centered Care Culture in Nuclear Medicine: Challenges and Best Practices**	15:00–15:30
15:30–16:00												15:30–16:00
16:00–16:30												16:00–16:30
16:30–17:00	601 CME 4 Physics Committee **Clinical Applications of AI**	602 Special Track Oncology & Theranostics Committee **Round Table: Readiness Session for Radioligand Therapy**	603 Learn & Improve Professional Skills (LIPS) Track (Interactive) Oncology & Theranostics Committee **Residents for Residents – 2024 Edition**	604 M2M Track TROP Session Radiopharmaceutical Sciences + Translational Molecular Imaging & Therapy Committee **Improving FAP Targeting**	605 Cutting Edge Science Track TROP Session Physics Committee **QA / Performance Assessment / Standardisation**	606 Clinical Oncology Track TROP Session Oncology & Theranostics Committee **Prostate: Staging**	607 TROP Session Inflammation & Infection Committee **FAPI in Inflammation & Infection**	608 TROP Session Neuroimaging Committee **Epilepsy, Inflammation and Connectivity**	609 e-Poster Presentations Session 4 Radiopharmaceutical Sciences Committee **Radiochemistry**	610 Technologists' Track CTE 3 Technologists Committee **Patient's Advocacy**	611 Theranostics Track TROP Session Oncology & Theranostics Committee **Neuro-Endocrine Therapy**	16:30–17:00
17:00–17:30												17:00–17:30
17:30–18:00												17:30–18:00
18:00–18:30												18:00–18:30

Monday, October 21, 2024

Location/Time	Hall 1	Hall 4 – Arena	Hall X9-X12	Hall X1-X4	Hall Y4-Y9	Hall Z	Hall Y10-Y12	Hall G2	Hall F	Hall G1	Hall Y1-Y3	Location/Time
	LIVE STREAM									LIVE STREAM		
08:00–08:30	701 CME 5 Paediatrics Committee **Children on Fire (FUO in Paediatrics)**	702 **Special Track** Translational Molecular Imaging & Therapy Committee **Challenge the Expert Transatlantic Comparison: Who does What and Why in PSMA-Image-Guided Therapy**	703 **Learn & Improve Professional Skills (LIPS) Track** (Interactive) Translational Molecular Imaging & Therapy Committee **How to Set-Up a Delphi Consensus**	704 **M2M Track TROP Session** Radiopharmaceutical Sciences + Translational Molecular Imaging & Therapy Committee **Applications for Nanoparticles and Nanocarriers**	705 **Cutting Edge Science Track TROP Session** Physics Committee **Data Corrections / Image Enhancement**	706 **Clinical Oncology Track TROP Session** Oncology & Theranostics Committee **Gastrointestinal**	707 **TROP Session** Inflammation & Infection Committee **Top on Inflammation and Infection Imaging**	708 **Joint Symposium 3** Neuroimaging Committee / EAN **Image-Guided Anti-Amyloid Treatment in Alzheimer's Disease**	709 **e-Poster Presentations Session 5** Oncology & Theranostics Committee **Novel Tracer and Oncology Imaging**	710 **Technologists' Track Oral Presentations 2** Technologists Committee **Diagnosis and Therapy**	711 **Featured Session** Cardiovascular Committee **Inflammatory Cardiopathies, a New Entity of New Tracers**	08:00–08:30
08:30–09:00												08:30–09:00
09:00–09:30												09:00–09:30
09:30–10:00												09:30–10:00
10:00–10:30	801 CME 6 Oncology & Theranostics Committee **Radioligand Therapy in NEN**	802 **Special Track** Neuroimaging Committee **Round Table: Molecular Imaging of Brain Connectivity**	803 **Learn & Improve Professional Skills (LIPS) Track** (Interactive) Inflammation and Infection Committee **Incidental Inflammatory/ Infective Findings with PET Tracers**	804 **M2M Track TROP Session** Radiopharmaceutical Sciences + Translational Molecular Imaging & Therapy Committee **From Synthesis to Clinical Translation**	805 **Cutting Edge Science Track TROP Session** Dosimetry Committee **Advancements in Clinical Dosimetry**	806 **Clinical Oncology Track Featured Session** Oncology & Theranostics Committee **Haemato - Oncology**	807 **Featured Session** Thyroid Committee **Nuclear Medicine Imaging in Parathyroid Disorders**	808 **TROP Session** Cardiovascular Committee **Cardiac Amyloidosis: Can We Do More?**	809 **e-Poster Presentations Session 6** Physics Committee **Radiomics, Artificial Intelligence, Quantification**	810 **Technologists' Track CTE 4** Technologists + Oncology & Theranostics Committee **PET-CT Cancer Staging Management**	811 **Special Symposium 3** Bone & Joint Committee **MSK in 2024: Follow the Guide(lines)!**	10:00–10:30
10:30–11:00												10:30–11:00
11:00–11:30												11:00–11:30
11:30–12:00	901 **Plenary 3 Nuclear Medicine as Answer to All Clinical Questions**											11:30–12:00
12:00–12:30												12:00–12:30
12:30–13:00												12:30–13:00
13:00–13:30												13:00–13:30
13:30–14:00	Lunch Break			Satellite Symposium	Satellite Symposium	Satellite Symposium	Satellite Symposium	Satellite Symposium		Satellite Symposium	Satellite Symposium	13:30–14:00
14:00–14:30												14:00–14:30
14:30–15:00												14:30–15:00
15:00–15:30	1001 CME 7 Neuroimaging Committee **CZT SPECT in Neurological Imaging: From Scintigraphy to Theranostics**	1002 **Special Track** **EANM Sanjiv Sam Gambhir Award – Compete and Win!**	1003 **Learn & Improve Professional Skills (LIPS) Track** (Interactive) Cardiovascular Committee **Motion Correction in Cardiac PET**	1004 **M2M Track Featured Session** Radiopharmaceutical Sciences + Translational Molecular Imaging & Therapy Committee **Tumour Response to Immunotherapy**	1005 **Cutting Edge Science Track TROP Session** Physics Committee **AI: Modelling, Generative and Large Language Models**	1006 **Clinical Oncology Track TROP Session** Oncology & Theranostics Committee **Prostate: Biochemical Recurrance and Re-Staging**	1007 **TROP Session** Thyroid Committee **Current and Future Perspectives in the Treatment of Thyroid Cancers**	1008 **Joint Symposium 4** Translational Molecular Imaging & Therapy Committee / ENETS **What Role Can Nuclear Medicine Play in Neuroendocrine Tumor Surgery?**	1009 **e-Poster Presentations Session 7** Dosimetry Committee **Evolving Dosimetry Strategies**	1010 **Technologists' Track Technologists' e-Poster Presentations Session** Technologists Committee **Technologists' e-Posters**	1011 **TROP Session** Radiation Protection Committee **Radiation Protection in Diagnostic Imaging Procedures**	15:00–15:30
15:30–16:00												15:30–16:00
16:00–16:30												16:00–16:30
16:30–17:00	1101 CME 8 Oncology & Theranostics Committee **Locoregional Therapies in Nuclear Medicine**	1102 **Special Track** Physics and Oncology + Theranostics Committee **Debate: Health Economics in Nuclear Medicine**	1103 **Learn & Improve Professional Skills (LIPS) Track (Interactive)** Radiation Protection Committee **What Would You Do If…? Radiation Protection Issues in Special Cases of Everyday Practices**	1104 **M2M Track Featured Session** Radiopharmaceutical Sciences + Translational Molecular Imaging & Therapy Committee **FAP Therapies: Mechanisms and Response**	1105 **Cutting Edge Science Track TROP Session** Physics Committee **Data Analysis: Onco**	1106 **Clinical Oncology Track TROP Session** Oncology & Theranostics Committee **Lymphoma**	1107 **TROP Session** Neuroimaging Committee **Movement Disorders**	1108 **Joint Symposium 5** Dosimetry Committee / ESTRO **Combination of Different Radiation Treatments**	1109 **e-Poster Presentations Session 8** Paediatrics Committee **Paediatric Nuclear Medicine and Adults General Nuclear Medicine**	1110 **Technologists' Track CTE 5** Technologists Committee **Radioguided Surgery**	1111 **TROP Session** Case Report Session 1 **Building Our Collective Knowledge on Theranostics**	16:30–17:00
17:00–17:30												17:00–17:30
17:30–18:00												17:30–18:00
18:00–18:30												18:00–18:30

Tuesday, October 22, 2024

Location/Time	Hall 1	Hall 4 – Arena	Hall X9-X12	Hall X1-X4	Hall Y4-Y9	Hall Z	Hall Y10-Y12	Hall G2	Hall F	Hall G1	Hall Y1-Y3	Location/Time
	LIVE STREAM									LIVE STREAM		
08:00–08:30	1201 CME 9 Thyroid Committee **From Radioiodine-Refractory to Radioiodine-Sensitive DTC – a Power of Novel Redifferentiation Therapies**	1202 **Special Track** Inflammation & Infection Committee **Challenge the Expert: Diagnostic Challenges in Fever/Inflammation of Unknown Origin in Adults and Children: Clues from FDG-PET/CT ?**	1203 **Learn & Improve Professional Skills (LIPS) Track** (Interactive) Translational Molecular Imaging & Therapy Committee **Combination Therapies: From Mouse to Man**	1204 **M2M Track TROP Session** Radiopharmaceutical Sciences + Translational Molecular Imaging & Therapy Committee **From Radionuclide to Clinical Translation**	1205 **Cutting Edge Science Track TROP Session** Physics Committee **SPECT CT Quantification**	1206 **Clinical Oncology Track TROP Session** Oncology & Theranostics Committee **FAPI & Gastrointestinal**	1207 **TROP Session** Neuroimaging Committee **Neurodegeneration: FDG, Amyloid and other PET Tracers**	1208 **Joint Symposium 6** Radiation and Protection Committee/AEA **Nuclear and Radiological Emergencies - Preparedness and Response**	1209 **e-Poster Presentations Session 9** Cardiovascular Committee **Nuclear Cardiology in All its States**	1210 **Technologists' Track CTE 6** Technologists Committee **Artificial Intelligence and Radiomics**	1211 **Theranostics Track TROP Session** Oncology & Theranostics Committee **Prostate Cancer Therapy I**	08:00–08:30
08:30–09:00												08:30–09:00
09:00–09:30												09:00–09:30
09:30–10:00												09:30–10:00
10:00–10:30	1301 CME 10 Oncology & Theranostics Committee **Joint EANM-SNMMI Guideline on the Role of 2-^{18F}FDG PET/CT in No Special Type Breast Cancer**	1302 **Special Track** Radiobiology Initiative **Debate: How Can We Improve TRT Efficacy**	1303 **Learn & Improve Professional Skills (LIPS) Track** (Interactive) Physics, Neuroimaging, Oncology & Theranostics and Dosimetry Committee **More You Need to Know about Kinetic Modelling**	1304 **M2M Track TROP Session** Radiopharmaceutical Sciences + Translational Molecular Imaging & Therapy Committee **Molecular Imaging in Cardiology**	1305 **Cutting Edge Science Track TROP Session** Physics Committee **Innovative Instrumentation and Measurements**	1306 **Clinical Oncology Track TROP Session** Oncology & Theranostics Committee **Neuro-Endocrine**	1307 **Featured Session** Neuroimaging Committee **Tau PET Imaging**	1308 **TROP Session** Thyroid Committee **Clinical Factors and Diagnostic Management of Differentiated Thyroid Cancer**	1309 **e-Poster Presentations Session 10** Oncology & Theranostics Committee **Lung, Breast and Haemato Oncology**	1310 **Technologists' Track Oral Presentations 3** Technologists Committee **Dose and Image Optimisation**	1311 **M2M Track Featured Session** Radiopharmaceutical Sciences + Translational Molecular Imaging & Therapy Committee **Combination Therapies in Oncology**	10:00–10:30
10:30–11:00												10:30–11:00
11:00–11:30												11:00–11:30
11:30–12:00	1401 **Plenary 4 Trailblazing Trends for Tomorrow's Nuclear Medicine**											11:30–12:00
12:00–12:30												12:00–12:30
12:30–13:00												12:30–13:00
13:00–13:30												13:00–13:30
13:30–14:00	Lunch Break			Satellite Symposium	Satellite Symposium	Satellite Symposium	Satellite Symposium	Satellite Symposium		Satellite Symposium	Satellite Symposium	13:30–14:00
14:00–14:30												14:00–14:30
14:30–15:00												14:30–15:00
15:00–15:30	1501 CME 11 Radiopharmaceutical Sciences Committee **Pre-Targeting Approach: Moving into Clinical Application, Utopia or Reality?**	1502 **Special Track** Cardiovascular Committee **Debate: Cardiovascular Imaging: Quantification is the Way to Go, Yes or No?**	1503 **Learn & Improve Professional Skills (LIPS) Track (Interactive)** Thyroid Committee **Tips and Tricks in Ultrasonography combined with Molecular Imaging of Thyroid and Parathyroid Imaging**	1504 **M2M Track TROP Session** Radiopharmaceutical Sciences + Translational Molecular Imaging & Therapy Committee **Targeted Radionuclide Therapy**	1505 **Cutting Edge Science Track TROP Session** Physics Committee **Radiomics**	1506 **Clinical Oncology Track TROP Session** Oncology & Theranostics Committee **Prostate Cancer Therapy and Gynaecolgical Tumours**	1507 **TROP Session** Inflammation & Infection Committee **More on Inflammation & Infection Imaging**	1508 **Joint Symposium 7** Neuroimaging Committee / EANO **Advances in Meningioma Diagnosis and Therapy**	1509 **e-Poster Presentations Session 11** Physics Committee **Data Analysis, Image Recon, Hardware Developments**	1510 **Technologists' Track CTE 7** Technologists + Neuroimaging Committee **Brain PET Studies**	1511 **EU Policy Symposium 1** Policy & Regulatory Affairs Committee **EU Pharma Legislation & Basic Safety Standards - Navigating Legal Complexity in Member States**	15:00–15:30
15:30–16:00												15:30–16:00
16:00–16:30												16:00–16:30
16:30–17:00	1601 CME 12 Dosimetry Committee **Dose Response – How Far Have We Come?**	1602 **Special Track** Oncology & Theranostics Committee **Debate: Long Axial Field of View: Value for Money?**	1603 **Learn & Improve Professional Skills (LIPS) Track** (Interactive) Paediatrics Committee **Paediatric MSK: Pearls and Pitfalls**	1604 **M2M Track Featured Session** Radiopharmaceutical Sciences + Translational Molecular Imaging & Therapy Committee **Imaging Non-Oncological Targets**	1605 **Cutting Edge Science Track TROP Session** Physics Committee **Segmentation**	1606 **Clinical Oncology Track TROP Session** Oncology & Theranostics Committee **Other Malignancies**	1607 **TROP Session** Neuroimaging Committee **Neuro-Oncology**	1608 **Theranostics Track TROP Session** Oncology & Theranostics Committee **Prostate Cancer Therapy II**	1609 **e-Poster Presentations Session 12** Thyroid Committee **Endocrine Disoders: the Role of Nuclear Medicine**	1610 **Technologists' Track CTE 8** Technologists + Inflammation & Infection Committee **Imaging Infection in Specific Populations**	1611 **EU Policy Symposium 2** Policy & Regulatory Affairs Committee **Empowering Tomorrow – the Nuclear Medicine Community Strategic Role within EU Projects & Tenders on Workforce**	16:30–17:00
17:00–17:30												17:00–17:30
17:30–18:00												17:30–18:00
18:00–18:30												18:00–18:30

Wednesday, October 23, 2024

Location/ Time	Hall 1	Hall 4 – Arena	Hall X9-X12	Hall X1-X4	Hall Y4-Y9	Hall Z	Hall Y10-Y12	Hall G2	Hall F	Hall G1	Hall Y1-Y3	Location/ Time
	LIVE STREAM									LIVE STREAM		
08:00–08:30	1701 **CME 13** Neuroimaging Committee **What is the Road Map to Install a New Neurological PET Tool?**	1702 **Special Track** Dosimetry Committee **Debate: Voxel Dosimetry – Love it or Hate it**	1703 **Learn & Improve Professional Skills (LIPS) Track** (Interactive) Oncology & Theranostics Committee **PET/MRI What Should We Know?**	1704 **M2M Track TROP Session** Radiopharmaceutical Sciences + Translational Molecular Imaging & Therapy Committee **For Peptides Only**	1705 **Cutting Edge Science Track TROP Session** Physics Committee **Quantitative PET / CT Imaging**	1706 **Clinical Oncology Track TROP Session** Oncology & Theranostics Committee **Radioguided Surgery and Therapy Planning**	1707 **Special Session** EANM and EJNMMI **The Many Challenges in Scientific Writing**	1708 **Joint Symposium 8** Inflammation and Infection Committee / ESCMID **Are We Ready to Fight Global Infectious Diseases?**	1709 **e-Poster Presentations Session 13** Translational Molecular Imaging & Therapy Committee **Molecular Imaging & Therapy**	1710 **Technologists' Track Mini Courses** Technologists Committee 1710a **Mini Course 1** (08:05–09:00) **Lean Management** 1710b **Mini Course 2** (09:05–10:05) **Generators for PET/CT and PET/MRI** 1710c **Mini Course 3** Technologists + Radiopharmaceutical Sciences Committee (10:15–11:15) **Quality Management System**	1711 **TROP Session** Case Report Session 2 **You Won't Believe the Things I've Seen!**	08:00–08:30
08:30–09:00												08:30–09:00
09:00–09:30												09:00–09:30
09:30–10:00	1801 **CME 14** Translational Molecular Imaging & Therapy Committee **CXCR4 Targeted Theranostics in Hematological Cancers and Beyond**	1802 **Special Track** Neuroimaging Committee **Debate: Fluid vs. PET Biomarkers in Neurodegenerative Disorders**	1803 **Learn & Improve Professional Skills (LIPS) Track** (Interactive) Dosimetry Committee **Advanced Techniques and AI in Dosimetry**	1804 **M2M Track TROP Session** Radiopharmaceutical Sciences + Translational Molecular Imaging & Therapy Committee **PET & SPECT Imaging in Neurology**	1805 **Cutting Edge Science Track TROP Session** Physics Committee **Data Analysis: Neuro & Cardio**	1806 **Clinical Oncology Track TROP Session** Oncology & Theranostics Committee **Radioembolization and Therapy**	1807 **Featured Session** Bone & Joint Committee **50 Shades of MSK Cancer**	1808 **TROP Session** Cardiovascular Committee **Myocardio Perfusion and Coronary Plaque: The PET Area**	1809 **e-Poster Presentations Session 14** Oncology & Theranostics Committee Prostate and Local Therapy		1811 **TROP / Featured Session**	09:30–10:00
10:00–10:30												10:00–10:30
10:30–11:00												10:30–11:00
11:00–11:30	1901 **Closing Session**											11:00–11:30
11:30–12:00	**Farewell Drink**											11:30–12:00
12:00–12:30												12:00–12:30

OC

Saturday, October 19, 2024, 18:00 - 18:35
Hall 1

Opening Ceremony including Awards Ceremony

OP-000
Opening Ceremony
V. Garibotto;
Faculty of Medicine, Geneva University Hospitals, Geneva, SWITZERLAND.

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Saturday, October 19, 2024, 18:35 - 19:35
Hall 1

Plenary 1: Highlights Lecture

OP-001
Highlight Lecture
W. Wadsak;
MedUni Wien, Vienna, AUSTRIA.

OP-002
Highlight Lecture
D. Oprea-Lager;
Radboud University Medical Center, Nijmegen, NETHERLANDS.

OP-003
Highlight Lecture
A. Pietrzak;
Greater Poland Cancer Centre and Poznan University of Medical Sciences, Poznan, POLAND.

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Sunday, October 20, 2024, 08:00 - 09:30
Hall 1

CME 1 - Inflammation & Infection Committee - Towards the Holy Grail of Infection Imaging

OP-004
Novel radiotracers for infection imaging
S. Jain;
Center for Infection and Inflammation Imaging Research, Baltimore, UNITED STATES OF AMERICA.

OP-005
Total body PET: new opportunities for infection imaging
A. Glaudemans;
University Medical Center Groningen, Department of Nuclear Medicine and Molecular Imaging, Groningen, NETHERLANDS.

OP-006
Role of AI in infection and inflammation imaging
M. Kirienko;
Humanitas University, Department of Biomedical Sciences, Milan, ITALY.

OP-007
Indications for PET/MRI in infection
M. Sollini;
Faculty of Medicine and Surgery / Vita-Salute San Raffaele University, Department of Nuclear Medicine, Milan, ITALY.

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Sunday, October 20, 2024, 08:00 - 09:30
Hall 4

Special Track 1 - Oncology & Theranostics Committee - Debate: FAPI RIP FDG

OP-008
Point of View: FAPI rocks - FDG sucks
K. Pabst;
Essen University Hospital, Nuclear Medicine, Essen, GERMANY.

OP-009
Point of View: FDG rules - FAPI blows
C. Deroose;
UZ Leuven, Nuclear Medicine, Leuven, BELGIUM.

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Sunday, October 20, 2024, 08:00 - 09:30
Hall X9-X12

LIPS Session 1 - Physics Committee - CZT-Based Gamma Cameras

OP-010
The science and possibilities of CZT based scanners
L. Imbert;
CHRU Nancy Brabois, Nuclear Medicine Department, Nancy, FRANCE.

OP-011
A clinical case series of CZT based scans
R. Garaham;
CHRU Nancy, Nuclear Medicine Department, Nancy, FRANCE.

OP-012
CZT scanners and dosimetry
R. Danieli;
Department of Medical Physics, Institut Jules Bordet, Hôpital Universitaire de Bruxelles (H.U.B), Université Libre de Bruxelles (ULB), Brussels, BELGIUM.

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Sunday, October 20, 2024, 08:00 - 09:30
Hall X1-X4

M2M Track - TROP Session: Translational Molecular Imaging & Therapy Committee + Radiopharmaceutical Sciences Committee: Tracer (Pharmaco) Kinetics

OP-013

Influence of amino acid chains in mercaptoacetyl-based chelator on biodistribution properties of PSMA inhibitors labelled with 99mTc

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Aim/Introduction: Development of diagnostic imaging agents for SPECT is needed due to large numbers of cancer patients. Earlier, we have designed EuK-based PSMA ligand [99mTc]Tc-BQ0413 with maEEE chelator [Bezverkhniaia 2023]. It showed efficient tumor targeting, but preclinical and preliminary clinical data have indicated high renal activity accumulation. We hypothesized that it could be reduced by decreasing of ligand's total negative charge, e.g. by substituting glutamate in the chelator with polar serine. We aimed to evaluate the tumor targeting and biodistribution of two new constructs containing maESE and maSSS chelators compared to maEEE in BQ0413. ***Materials and Methods:*** Constructs were radiolabelled with 99mTc using transchelation from gluconate. Labelling stability was evaluated in vitro. In vitro PSMA-binding specificity, cellular processing and binding kinetics were evaluated using PSMA-transfected PC-3.pip cells. Biodistribution was measured in NMRI mice; tumor targeting properties, in vivo specificity and imaging were obtained in xenografted BALB/c nu/nu mice. ***Results:*** New constructs were radiolabelled with radiochemical yield above 95%. The label was stable during 1 h in 300-molar excess of L-cysteine and PBS at room temperature. The octanol-water distribution coefficient showed similar logD values for all three tracers, suggesting that chelator modification did not result in a shift of hydrophilicity. The binding to PC-3.pip cells was PSMA mediated. The internalized fraction was approximately 35% after 8 h. The equilibrium dissociation constants were in picomolar range for new peptides, but worse than for BQ0413. The biodistribution profile demonstrated rapid clearance from all organs and tissues (excluding kidneys). Major clearance was through glomerular filtration. Construct containing maSSS chelator demonstrated the lowest kidney uptake, but higher hepatobiliary excretion, resulting in elevated uptake of activity in gastrointestinal tract compared to other constructs. At the same time BQ-maSSS has demonstrated the highest tumor uptake (35±4%IA/g vs 31±4%IA/g for peptide with maESE and 17±3%IA/g for BQ0413) and the most optimal tumor-to-background ratios, e.g. tumor-to blood ratio for maSSS, maESE and maEEE variants were 300±160, 109±21, 94±3 respectively. In vivo targeting was dependent on PSMA expression in PC3-pip (PSMA+) and PC-3 ($PSMA^-$) xenografts. SPECT/CT imaging has demonstrated that tumors could be visualized already 1 h post injection. ***Conclusion:*** PSMA-targeting peptides containing maESE and maSSS chelators can be easily radiolabelled with technetium-99m using techniques permitting development of a single-vial kit. [99mTc]Tc-BQ-maSSS has demonstrated optimal PSMA-targeting properties and biodistribution profile favourable for imaging shortly after administration. ***References:*** 1. Bezverkhniaia et al. International Journal of Molecular Sciences (Basel). 2023,24:17391.

OP-014

Novel CAIX radioligands for molecular imaging of clear cell renal cell carcinoma

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Aim/Introduction: Carbonic Anhydrase IX (CAIX) is selectively overexpressed in the cell membrane of over 95% of aggressive Clear Cell Renal Cell Carcinomas (ccRCC), making it an attractive tumor-specific antigen for diagnosis and therapy. Despite the striking homology between CAIX and other CA isoforms, we identified several novel chemotypes showing high CAIX potency and selectivity to develop as radiopharmaceuticals for ccRCC imaging. ***Materials and Methods:*** Sulfonamide-based CAIX binders were synthesized, and CAIX binding affinity, kinetics, and half-life were characterized by surface plasmon resonance (SPR). Cellular potency was corroborated by a competitive binding assay in CAIX-expressing SK-RC-52 ccRCC cells. For binders showing high affinity (Kd<0.1 nM) and selectivity (>100X), 111In or 68Ga radioligands were synthesized, and in vivo distribution was assessed by SPECT/CT or PET/CT imaging. Mice bearing subcutaneous SK-RC-52 xenografts or patient-derived xenografts (PDX) derived from ccRCC tumors were intravenously injected 7.0±3.0 MBq of radiotracer and images acquired at 1h and 24h post-injection (p.i.). Region of interest analyses of the images and ex vivo biodistribution, following the last imaging time point, quantified tumor, and normal tissue uptake as injected activity per gram of tissue (%IA/g; mean±SD). ***Results:*** We synthesized and screened over 700 compounds in 3 general structural classes. SPR identified over 50 promising binders and tracer candidates with high affinity, CAIX selectivity (>100x selective against CAIV, CAXII and CAXIV), and a broad range of receptor occupancy half-lives. Further screening using an in vitro competitive cell-binding assay identified about a dozen binders and tracers exhibiting exquisite potency (<5 nM) in CAIX-expressing SK-RC-52 cells. Longitudinal in vivo SPECT/CT imaging showed elevated tumor accumulation (20-40 %IA/g at 1 h p.i.) for several radiotracers. The 111In-labeled lead tracer candidate WT-735-0626, [111In]In-626, showed rapid tumor uptake kinetics (30.3±1.0 %IA/g at 1 h p.i.) and elevated peak uptake as 45.3±1.8 %IA/g at 24 h p.i. Mice bearing ccRCC PDXs displayed rapid tumor uptake and fast clearance of [111In]In-626. [68Ga]Ga-626 PET/CT imaging of SK-RC-52 tumors showed excellent uptake as 15.0±4.0 %IA/g and fast renal clearance, leading to tumor/normal kidney contrast of 1.3 at 1 h p.i. Except for the kidneys and CAIX-expressing stomach, overall normal tissue uptake was low. ***Conclusion:*** We successfully synthesized several exquisitely potent and CAIX-selective radioligands displaying unprecedented imaging properties, such as fast and elevated tumor uptake and rapid normal tissue clearance. [68Ga]Ga-626 showed promising properties as a PET/CT imaging radiotracer, warranting our efforts toward its clinical translation in ccRCC.

OP-015

Dansylated Amino Acid Derived $^{68}Ga/^{177}Lu$-LNC1011 as Prostate Cancer Theranostics

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Aim/Introduction: Targeting prostate-specific membrane antigen (PSMA) with radioligands has demonstrated promising potential in the treatment of metastatic castration-resistant prostate cancer (mCRPC). This study aims to develop PSMA-targeted radioligands by incorporating dansylated amino acids as weak albumin binders to significantly increase tumor accumulation while preserving diagnostic efficiency. This approach allows for a comprehensive investigation that combines diagnosis and therapy within a single molecular framework. ***Materials and Methods:*** The binding affinities of dansylated amino acids (Dan-Gly,Dan-Nva, and Dan-Phe) with human serum albumin (HSA) were determined using biolayer interferometry by interaction with biotinylated HSA. Binding affinity and PSMA targeting specificity were investigated using saturation binding assay and cell uptake in PSMA-positive PC-3 PIP cell. PET imaging in PC-3 PIP tumor-bearing mice were performed to evaluate preclinical pharmacokinetics and diagnostic efficiency of 68Ga-labelled PSMA ligands to select optimum radioligand. Tumor uptake of 177Lu-LNC1011 were evaluated through SPECT/CT imaging and biodistribution studies. Radioligand therapy studies were conducted to systematically assess the therapeutic effect of 177Lu-LNC1011. Additionally, 68Ga-LNC1011 PET imaging demonstrated the distribution in human organs and tumor at various time points. ***Results:*** 68Ga-Dan-Gly-PSMA, 68Ga-Dan-Nva-PSMA and 68Ga-Dan-Phe-PSMA (denoted as 68Ga-LNC1011) were successfully synthesized with >97% radiochemical yield (Figure A). The HSA binding affinity of Dan-Phe (3.21 ± 0.18 μM) was substantially higher than that of Dan-Gly (10.44 ± 2.31 μM, $P < 0.001$) and Dan-Nva (10.88 ± 1.17 μM, $P < 0.001$) (Figure B). Saturation binding assay demonstrated a high binding affinity of 68Ga-LNC1011 (Kd = 15.91 ± 4.26 nM) for PSMA (Figure C). PET and SPECT imaging of 68Ga-LNC1011 and 177Lu-LNC1011 revealed favorable pharmacokinetics and distinguished prominent tumor-to-nontarget ratios (Figure D-H). Biodistribution studies confirmed the significantly higher tumor uptake of 177Lu-LNC1011 (127.36 ± 16.95 %ID/g) over 177Lu-PSMA-617 (17.44 ± 6.29 %ID/g) at 4 h post-injection. Furthermore, there was no notable decrease in the tumor uptake of 177Lu-LNC1011 within 72 h (Figure I). Radioligand therapy results demonstrated a noteworthy inhibition of tumor growth after administration of a single dose of 18.5 MBq 177Lu-LNC1011 (Figure J). Compared to 68Ga-PSMA-11, which detected 35 lesions in three patients, 68Ga-LNC1011 detected an equivalent number of lesions. The SUVmax values were 17.23, 24.97, 34.10, 37.23, and 45.40 at 10, 30, 60, 90, and 150 min, respectively (Figure K). ***Conclusion:*** 68Ga/177Lu-LNC1011, characterized by high tumor uptake and timely clearance from background organs, emerges as a promising candidate for a single-molecule theranostic radioligand in preclinical and clinical.

OP-016

PET Evaluation of Oligonucleotide Structural Effects on Tumor Targeting in HCC1954 Breast Cancer Xenografts

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Aim/Introduction: Positron emission tomography (PET) is a valuable tool for developing novel therapeutics. It enables quick scanning of various structures to identify one with the most beneficial properties. However, PET requires straightforward and reproducible radiolabeling methods. Click chemistry between tetrazine and trans-cyclooctene (TCO) in this context is a great approach. Here, we utilized 2-[18F]fluoro-2-deoxy-d-glucose conjugated tetrazine ([18F]FDG-Tz)1 to demonstrate the beneficial properties of molecular spherical nucleic acids (MSNAs), highly oriented nanostructures, over linear oligonucleotides (ONs). Additionally, we aimed to evaluate the structural properties affecting their biodistribution. For these purposes, six 18F-labeled MSNA structures were evaluated in HCC1954 tumor-bearing mice and compared to ONs. Influence of folate as a targeting moiety, the effect of phosphodiester (PO) vs. phosphorothioate (PS) backbones, and the percentage of TCO-load were evaluated. ***Materials and Methods:*** [18F]FDG-Tz was synthesized via oxime formation between glucose-free [18F]FDG and aminooxy-derived phenyltetrazine.1 MSNAs were prepared via strain-promoted azide-alkyne cycloaddition between an azide-modified [60] fullerene core and bicyclo[6.1.0]nonyne-modified ONs.2 TCO-PEG4-NHS was used for TCO functionalization, while N-hydroxysuccinimidyl ester was utilized for folate decoration. Dynamic 60-minute PET/CT imaging was conducted in 8-10 weeks old female Rj:Athymic-FOXN1nu/nu mice bearing subcutaneous HER2-expressing HCC1954 tumors after intravenous tracer administration. After imaging animals were euthanized, organs of interest were harvested and measured, and tumors were collected for cryosectioning and in vitro studies. ***Results:*** The biological evaluation revealed notable advantages of MSNAs over linear ON in significantly lower kidney uptake and higher tumor-to-muscle ratios observed across most MSNA structures. Introducing a PS backbone decreased nuclease degradation, prolonging blood circulation and consequently enhancing tumor uptake for [18F]MSNA-PS compared to [18F]MSNA-PO. In addition, the backbone determined the elimination route, with PO backbone structures primarily undergoing urinary excretion, while PS backbone structures tended to accumulate in the liver. Furthermore, folate decoration resulted in increased tumor-to-muscle ratio compared to non-folate structures, suggesting FRs binding, which was confirmed through in vitro binding and blocking study. Additionally, increasing the TCO-load altered the hydrophilicity of the molecules' surface, influencing its biodistribution. ***Conclusion:*** The developed radiolabeled method allowed us to successfully demonstrate the beneficial properties of MSNAs over linear ON and to study the structural effects on biodistribution. ***References:*** 1. T. Auchynnikava et al., ACS Omega. 8, 45326-45336 (2023). 2. A. Äärelä et al., Mol. Pharm. 20, 5043-5051 (2023).

OP-017

Annotating the distribution of stem cell-derived macrophages in non-human primates by PET/CT.

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Aim/Introduction: Cell therapies, such as therapeutic macrophages (Mφ), are hampered by the limited availability of these cells at scale. Deriving macrophages from induced pluripotent stem cells (iPSC) addresses supply concerns, but whether iPSC-derived macrophages (iMφ) cells traffic similarly to autologous cells in vivo remains unknown. Herein, using innovative radiochemistry, we tracked iMφ biodistribution in mice and non-human primates (NHP) by PET/CT. ***Materials and Methods:*** Monocyte radiolabeling with 89Zr involved direct Deferoxamine (DFO) conjugation to oxidized cell-surface glycans using NaIO4. The process was optimized using immortalized U937 monocytes. Oxidized cells (1-5x106) were incubated with aminooxy-DFO (AOD: 200 µM) in aniline (10 mM), then radiolabeled with 89Zr (33-37 MBq). Cell viability was measured at each step via trypan blue staining, and radiochemical yield and purity were determined via iTLC. For imaging studies, human peripheral blood CD14+ Mφ (HPB-Mφ) or NHP iPSCs (NHP-iMφ) were radiolabeled, and [89Zr]Zr-HPB-Mφ (4.6x105 cells, 3.3 MBq) or [89Zr]Zr-NHP-Mφ (1.3-1.5x106 cells, 4.6-5.6 MBq) were injected IV in NSG mice (N=6) and serial PET/CT imaging was performed at 2, 24, 72, 144 and 192 h p.i. Mauritius macaques (N=2) were given [89Zr]Zr-NHP-Mφ 11.1 MBq (~2x106) IV and scanned in a clinical PET/CT scanner at 0.5, 24, 72, and 168 h p.i. Region-of-interest (ROI) analysis data was reported as percent injected activity per gram (%IA/g) or standardized uptake values (SUVmean). ***Results:*** Mφ were efficiently radiolabeled with 89Zr (4.3-7.1 MBq per 1x106 cells) with excellent purity (93-95%) and viability (>75%). Mice administered [89Zr]Zr-HPB-Mφ or [89Zr]Zr-NHP-iMφ showed similar in vivo biodistribution with initial cell accumulation in the lungs (25.6±5.1 vs. 21.9±10.2 %IA/g) and liver (39.7±2.8 vs. 42.5±6.5 %IA/g) at 2h followed by redistribution to the liver (41.5±3.8 %IA/g) and spleen (6.85±0.5 vs. 10.7±0.96 %IA/g) at 168h. Similarly, [89Zr]Zr-NHP-iMφ distribution in NHP displayed initially elevated lung (10.5±3.3 SUVmean), liver (25.2±1.1 SUVmean), and spleen (18.3±5.0 SUVmean) accumulation at 30 min p.i. Later time points revealed a steady decline in lung activity and stable signal in the liver and spleen at day 7. Overall, negligible normal tissue uptake and minimal whole-body radioactivity excretion in both mice and NHP indicated cell persistence and excellent radiolabel stability in vivo. ***Conclusion:*** Our 89Zr radiolabeling protocol showed unprecedented efficiency and biocompatibility, allowing in vivo tracking of multiple macrophage subtypes. PET/CT studies in Mauritius macaques evidenced the clinical utility of our tracking methodology and the potential of iPSC-derived therapeutic Mφ.

OP-018

Population Pharmacokinetic Model to Assess Bone Marrow Absorbed Dose after ^{177}Lu-DOTATATE Administration

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Aim/Introduction: Lutetium-177 (177Lu)-Dotatate (Lutathera®) is a peptide receptor radionuclide therapy (PRRT) used to treat unresectable or metastatic somatostatin-receptor-positive (SSTR) gastroenteropancreatic neuroendocrine tumors (GEP-NET). PRRT may induce early and late hematological toxicity. The aim of our monocentric study is to determine bone marrow absorbed dose by simultaneously analysing plasma and imaging data with PKPOP modeling and to compare them with results obtained by standard practices using image-based dosimetry in our institution. ***Materials and Methods:*** Patients with GEP-NET were treated with PRRT between May 2015 and December 2021. Nine blood samples (5 mL) were collected at each cycle: at the end of 177Lu-Dotatate infusion and 1, 2, 4, 8, 16, 24, 72, and 144 h post-dose. Radioactivity was measured using a WIZARD 2 2480-0010 Gamma Counter. These data were used to calculate area-under-the-curve of 177Lu-Dotatate plasma (AUCBL) and bone marrow (AUCRM) concentrations by PKPOP approach using Nonlinear mixed-effects modeling with NONMEM®. The medullary absorbed dose (ADref) was calculated by dosimetric approach using PlanetDose®. AUCBL and AUCRM were converted to absorbed dose using Medical Internal Radiation Dose (MIRD) formalism to resp. ADBL and ADRM. Generated plots were observed (OBS) versus population (PRED) and individual (IPRED) predicted concentrations ***Results:*** 111 patients of which 71 were included with bone marrow data. For the 15 patients with imaging dosimetry, 14 AUC were available at cycle 1 and 6 AUC at cycle 4, corresponding to a total of 20 cycles. 2139 plasma concentrations are included in the PKPOP model. Goodness-of-fit plots show that the PRED and IPRED concentrations concurred with OBS data for plasma and bone marrow concentrations. The mean [range] at cycle 1 was : AUCBL = 4547 MBq/L.h [1987 - 7036] and AUCRM = 4362 MBq/L.h [1907 - 6389]. The mean [range] of ADref = 0.044 Gy [0.021 - 0.087] at cycle 1 and 0.048 Gy [0.031 - 0.067] at cycle 4. The mean [range] of ADBL = 0.030 Gy [0.013 - 0.044] and of ADRM = 0.029 Gy [0.012- 0.042]. The mean [range] percentage of difference between absorbed dose as determined by PkPOP vs dosimetry was -31.8 % [-75 ; 19]. ***Conclusion:*** These results suggest that the population pharmacokinetic approach can be used to determine bone marrow absorbed dose. Moreover, this model can be based on plasma data only, and does not require imaging data. This new approach can allow for more robust and practical monitoring of bone marrow exposure.

OP-019

Real-time characterization of ^{177}Lu-DOTATATE binding, internalization and excretion

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Aim/Introduction: The efficacy of molecular radiotherapy is influenced by the cellular binding and retention of the compounds. Methods to determine these characteristics are cumbersome, therefore this study aimed to develop a new methodology to deepen the knowledge of 177Lu-Tyr3-DOTA-octreotate (177Lu-DOTATATE) binding, internalization, and excretion on cancer cells in vitro. ***Materials and Methods:*** The interaction between 177Lu-DOTATATE and U2OS-SSTR cells was studied in real-time at 37oC with varying concentrations and incubation times. Non-internalizing controls were performed at 8oC, or by addition of 0.5M sucrose. The obtained real-time interaction curves were analysed with kinetic binding models to evaluate binding rate constants

as well as internalization. The distribution between internalized and membrane-bound 177Lu-DOTATATE was quantified using a manual acid wash assay and an acid wash step was also implemented into the real-time binding assay. Furthermore, additional inhibitors of receptor trafficking were applied to investigate intracellular sorting of the ligand-receptor complex. ***Results:*** The kinetic modelling of 177Lu-DOTATATE interacting with U2OS-SSTR cells revealed two main interactions with differing dissociation rates, representing binding and internalization. Different modelling approaches gave similar binding kinetics with an association rate of 3.1-8.8*104 M-1s-1 and dissociation rate of 2.8-15*10-4 s-1 resulting in an affinity of 6.8-50.9 nM. The internalized fraction at 4 hours was predicted to be 75-88% which was in good agreement with manual acid wash data. Inhibition of internalization resulted in a drastic reduction of ligand uptake, supporting the results for the binding rate constants and internalized fraction. However, kinetic modelling seemed to over-estimate the amount of internalized 177Lu-DOTATATE for early time points, presumably due to re-binding effects. Negating re-binding by addition of unlabelled DOTATATE decreased the amount of cell-associated 177Lu-DOTATATE more than expected, implying excretion of the internalized fraction. Removing surface-bound receptors by acid wash reversed this effect, suggesting that 177Lu-DOTATATE excretion is depended on the presence of cell-surface bound ligand. ***Conclusion:*** This data exemplifies how combining real-time binding assays with kinetic modelling and acid wash procedures allows quantification of cellular binding, internalization as well as excretion of radiopharmaceuticals. Deepening the understanding of sub-cellular localization and dynamics of radiopharmaceuticals can improve several aspects of radionuclide therapy, including decision-making in drug development and dosimetry calculations.***References:*** Nonnekens J, et. al. Potentiation of Peptide Receptor Radionuclide Therapy by the PARP Inhibitor Olaparib. Theranostics. 2016 Jul 18;6(11):1821-32.Lundsten S, et. al. p53-Mediated Radiosensitization of 177Lu-DOTATATE in Neuroblastoma Tumor Spheroids. Biomolecules. 2021 Nov 15;11(11):1695.

OP-020

Impact of molar activity on [^{203}Pb]Pb-VMT-α-NET biodistribution profile in mice bearing neuroendocrine tumor xenograft

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Aim/Introduction: Hematotoxicity limits radiopharmaceutical therapy (RPT) targeting SSTR2. Somatostatin agonists and antagonists bind to bone marrow cells and lymphocytes in humans and mice. Therefore, these radiotherapeutics have the potential to induce hematoxicity. The molar activity (MA) of a given RPT impacts radioactivity absorbed dose to normal tissues and tumors by changing the "hot" to "cold" stoichiometry. Here, we aimed to develop understanding of how the MA of SSTR2 agonist [203Pb] VMT-α-NET (an imaging surrogate for [212Pb]VMT-α-NET) impacts its biodistribution in tumor-free and SSTR2+ tumor bearing mice. These studies provide insights into how MA can be modified to change bone marrow radiation dose and potentially limit the risk of hematotoxicity. ***Materials and Methods:*** [203Pb]Pb-VMT-α-NET was radiolabeled according to established methods and adjusted to MA of 0.148 -155.4 MBq/nmol. 74 kBq of [203Pb]Pb-VMT-α-NET was administered to CD1 Elite mice, or athymic nude mice bearing AR42J tumor xenografts. 1.85 MBq of [203Pb]VMT-α-NET was administered for sequential planar gamma-eye imaging. Organs and tissues were collected at different time points and normalized to %ID/g. ***Results:*** In CD-1 mice (at 14.8 MBq/nmol) [203Pb]Pb-VMT-α-NET accumulated in kidneys, but was excreted rapidly (13.127 %ID/g at 1 hour and 0.175% ID/g at 24 hours). There was moderate uptake in lung, adrenal glands, pancreas, and bones. When [203Pb]Pb-VMT-α-NET was administered at 18.5 MBq/nmol in AR42J-bearing mice, a similar biodistribution profile was observed, with high accumulation in kidneys (37.268 %ID/g and 1.678 ID/g), and tumor (13.469 %ID/g and 8.249 %ID/g at 1 hour and 24 hours, respectively. [203Pb]Pb-VMT-α-NET administered at 155.4, 18.5, 0.74 or 0.148 MBq/nmol revealed that lower MA resulted in significant lower bone marrow uptake, but comparable tumor uptake at 1,3,6 hours, except at 24 hours where the tumor uptake dropped 40% for the 0.148 MBq/nmol group. When tumor-bearing mice were administered 1.2 nmol of [203Pb]Pb-VMT-α-NET as compared to 12 pmol, tumor uptake of 1.38%ID/g and 4.85 %ID/g, and bone uptake of 0.022 %ID/g and 0.138 %ID/g, respectively at 27-hour post-injection were observed. ***Conclusion:*** The MA of [203Pb]VMT-α-NET impacts the uptake in low-SSTR2 expressing organs. Results suggest that a "sweet spot" of total injected mass of [203Pb]VMT-α-NET (<0.5 nmol) can be found in which tumor to normal ratio can be optimized. These findings provide a potential new strategy that could be used to optimize this aspect of RPT.

OP-021

2-$^{[18F]}$FDG µPET/CT reveals the direction of glucose distribution in mice receiving peritoneal dialysis fluids

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Aim/Introduction: Peritoneal dialysis (PD) as renal replacement therapy is a cost-effective and patient-friendly alternative to hemodialysis (1). However, instilled PD fluids are generally hypertonic glucose-based solutions that, over time, can lead to reduced ultrafiltration capacity, and treatment failure due to peritoneal inflammation and fibrosis (2). Although PD has been applied since the 1960s, the distribution and kinetics of glucose upon PD fluid instillation are unclear. Understanding these mechanisms could help to optimize PD and reduce treatment failure. ***Materials and Methods:*** Approximately12 week old female, healthy C57BL/6 mice (fasted for 4 hours) were injected intraperitoneally with around 10 MBq 2-$^{[18F]}$FDG in either 2 mL ELO-MEL (vehicle group) or PD fluid containing 3.86% glucose (PD group) (n=3 each). Subsequently, 60 min dynamic µPET and anatomical CT data were acquired. At the end of the procedure, mice were euthanized and organs of interest were harvested for gamma counter measurements. Dynamic tracer uptake data was evaluated using a dedicated image quantification software. ***Results:*** In the liver of vehicle group animals, 2-$^{[18F]}$FDG uptake started earlier, reaching a low plateau already after approximately 4 min post injection, whereas a higher plateau was reached after 16 min in the PD group. The summed liver SUVaver of the last 7 time frames (9-55 min) of the PET scan was significantly higher in the PD group (1.08 ± 0.17 vs. 0.76 ± 0.06 in the vehicle group, $p = 0.038$). In gamma counter measurements, a trend towards increased 2-$^{[18F]}$FDG uptake was observed in the PD group for liver and kidneys. Conversely, there was a trend towards decreased 2-$^{[18F]}$FDG uptake in the other organs (stomach, spleen, pancreas, ileum, colon, brain, heart) when compared to the vehicle group.

Conclusion: Although 2-[18F]FDG was administered in a solution containing 77.2 mg glucose in the PD group, tracer uptake was boosted rather than reduced specifically in the liver. The dynamic 2-[18F]FDG uptake data from the liver and heart suggest that glucose from PD fluids may be reabsorbed from the peritoneum by an early and fast phase via the peritoneum viscerale, followed by a much slower resorption via the peritoneum parietale. Interestingly, this clearance pattern differed in time between the PD and vehicle group. Follow-up studies using a uremic PD mouse model and µPET/MR are planned to further characterize the observed effects. ***References:*** (1) P.K. Li, et al. (2017). Nat Rev Nephrol, 13. (2) R. Mehrotra, et al. (2016). J Am Soc Nephrol, 27.

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Sunday, October 20, 2024, 08:00 - 09:30
Hall Y4-Y9

Cutting Edge Science Track - TROP Session: Dosimetry Committee: Preclinic and Radiobiology

OP-022

Unravelling radiobiological and immunological mechanisms driving effective CAIX-TRT and ICI combination therapy

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Aim/Introduction: Preclinical studies have demonstrated the potential of combining targeted radionuclide therapy (TRT) and immune checkpoint inhibition (ICI). Understanding which factors determine treatment outcome is crucial for effective clinical translation. In our previous work we demonstrated complete therapeutic responses in a murine Renca-hCAIX tumour model using TRT with CAIX-targeting antibody hG250 combined with aPD-1/aCTLA4 ICI. Here, we aim to deepen our understanding of the underlying mechanisms driving this effective combination treatment by assessing 1) tumour RNA expression and 2) growth inhibition and survival after various combination strategies. ***Materials and Methods:*** Renca-hCAIX tumour-bearing mice were injected with 4 MBq [177Lu]Lu-DOTA-hG250 with or without aPD1/aCTLA4 ICI. Subgroups of mice were followed to monitor tumour growth and survival (n=10 mice per group), while other mice were sacrificed at pre-defined timepoints to assess the biodistribution and determine the tumour radiation absorbed dose (n=3 mice per group), and to perform profiling of tumours using bulk RNA expression analysis (murine PanCancer IO 360 Gene Expression Panel, NanoString Technologies, Inc.) (n=5-6 mice per group). ***Results:*** Biodistribution studies revealed high tumour uptake of [177Lu]Lu-DOTA-hG250 (66±7 %IA/g at 24h post-injection) with relatively low uptake in healthy organs, with the exception of the liver (11±0.3 %IA/g at 24h post-injection). Estimated tumour-absorbed radiation dose was 27±15 Gy. RNA pathway analysis in TRT-treated tumours indicated DNA damage repair induction. Other pathways represented overlapping effects of TRT and ICI, including IFN signalling, cytotoxicity, lymphoid compartment, and antigen presentation. Furthermore, dynamic changes in Ctla4, Pdcd1 (PD-1), and Cd274 (PD-L1) expression within the tumour were observed following ICI and combination treatment. Notably, the changing expression patterns of Ctla4 and Pdcd1 largely corresponded to patterns observed for T-cell infiltration using flow cytometry analysis. Ongoing experiments are focused on combining CAIX-TRT with distinct ICI dosing regimens. Mice are currently in the follow-up phase of the study, and so far data indicates the ICI dosing regimen influences outcomes. ***Conclusion:*** These findings provide valuable insights into the temporal dynamics and immune responses within the tumour microenvironment following TRT and ICI combination therapy. Based on these results, future research should prioritize investigating the role of specific immune cell subsets and optimizing treatment application, particularly focusing on dosing and timing strategies.

OP-023

The dose-reponse effects of the additional Auger and IC electrons of ^{161}Tb- compared to ^{177}Lu- labelled agonists and antagonists

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Aim/Introduction: Preclinical data have shown that 161Tb-labelled peptides targeting the somatostatin receptor (SSTR) are therapeutically more effective for peptide receptor radionuclide therapy (PRRT) compared to their 177Lu-labelled counterparts. To further substantiate this enhanced therapeutic effect, we performed cellular dosimetry to quantify the absorbed dose to the cell nucleus and compared dose-response curves to evaluate differences in relative biological effectiveness (RBE) in vitro. ***Materials and Methods:*** CA20948 cell survival was assessed after treatment with [161Tb]Tb- and [177Lu]Lu-DOTA-TATE (agonist) and with [161Tb]Tb- and [177Lu]Lu-DOTA-LM3 (antagonist) via a clonogenic assay. Cell binding, internalization and dissociation assays were performed up to 7 days to acquire time-integrated activity coefficients. Separate S-values for each type of particle emission (Auger/Internal Conversion (IC) electrons and β-particles) were computed via Monte Carlo simulations, while considering a concentric sphere model to mimic the CA20948 cell geometry. The implementation of more realistic cell geometries is ongoing. Once the absorbed dose to the cell nucleus was calculated, survival curves were fitted to the appropriate linear or linear-quadratic model and corresponding RBE were evaluated. ***Results:*** While the radiopeptides had an equal cellular uptake independent of the radionuclide, [161Tb]Tb-DOTA-TATE and [161Tb]Tb-DOTA-LM3 delivered a 3.6 and 3.8 times higher dose to the cell nucleus, respectively, compared to their 177Lu-labelled counterparts. This increased absorbed dose was mainly due to the additional emission of IC and not Auger electrons by 161Tb. When considering activity concentrations, cell survival curves showed a lower survival fraction for both [161Tb]Tb-DOTA-TATE and [161Tb]Tb-DOTA-LM3 compared to a labelling with 177Lu. After conversion to absorbed dose, no significant difference could be observed between the dose-response curves of 161Tb- and 177Lu-labelled DOTA-TATE, in line with corresponding RBE values. [161Tb]Tb-DOTA-LM3 showed a linear-quadratic dose-response, while [161Tb]Tb-DOTA-TATE showed only a linear dose-response, suggesting additional cell membrane damage by Auger electrons when using a SSTR-antagonist. ***Conclusion:*** The IC, rather than Auger electrons, emitted by 161Tb resulted in a higher absorbed dose to the cell nucleus and lower clonogenic survival for 161Tb-labelled DOTA-TATE and DOTA-LM3 compared to the 177Lu-

labelled analogues. In contrast, 161Tb- instead of 177Lu-labelling, did not result in a higher dose-response for DOTA-TATE while for [161Tb]Tb-DOTA-LM3 an additional quadratic response was observed. Due to this quadratic response, potentially caused by cell membrane damage, DOTA-LM3 is a more effective peptide compared to DOTA-TATE for labelling with 161Tb.

OP-024

Transcriptional repression of double-strand DNA damage repair potentiates targeted alpha therapy efficacy in advanced prostate cancer.

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Aim/Introduction: A significant proportion of metastatic castration-resistant prostate cancer (mCRPC) patients do not respond or relapse following 225Ac-PSMA targeted alpha therapy (TAT). Unfortunately, injected activity escalation is limited by severe xerostomia. Therefore, we investigated the ability of Bromodomain and Extraterminal protein inhibitors (BETi) to reduce the transcription of a network of double-strand DNA damage repair (DDR) genes and amplify the genomic instability driven by 225Ac radiation, thus enhancing the lethality of 225Ac-PSMA TATs in CRPC cells. ***Materials and Methods:*** We developed ART-101, a longer-acting PSMA-targeting molecule with protracted pharmacology, and employed 225Ac-ART-101 for our in vivo studies. In vitro, cytotoxicity was determined in PC3-PIP, LNCaP, and 22Rv1 cells treated with BETi (JQ1 or next-generation inhibitor ABBV-075: 0.3 nM-1 mM). Expression of the DDR genes BRCA1/2 and RAD51 were measured by qPCR 24 h-post treatment with JQ1/ABBV-075. In vitro Monte Carlo-based 225Ac dosimetry estimates enabled viability and clonogenic survival measurements in cells treated with 225Ac (0.03-1 Gy) or the combination 225Ac+JQ1/ABBV-075. γH2AX immunofluorescence staining was performed to confirm enhanced DNA damage by 225Ac+BETi. Therapy studies employed groups of 8-week-old nude male mice (n=5-10) bearing PC3-PIP xenografts treated with daily oral JQ1 (50mg/kg) or ABBV-075 (1 mg/kg) for 14 days, a single 225Ac-ART-101 (18.5 or 37 kBq) IV injection, or combined 225Ac-ART-101 + JQ1/ABBV-075. Tumor growth, overall survival, and toxicity events were recorded thrice weekly for up to 120 days. ***Results:*** 225Ac+JQ1 treatment showed marked ($p<0.02$) antiproliferative effects compared to 225Ac or JQ1 alone in all cell lines. The enhanced cytotoxicity of the 225Ac+JQ1 combination was corroborated in clonogenic survival assays using either JQ1 or ABBV-075. qPCR revealed significant repression of BRCA1/2, and RAD51 in JQ1 and 225Ac+JQ1 treatments, but not 225Ac alone. Increased γH2AX foci in 225Ac+JQ1-treated cells suggest that this treatment increases genomic instability, buttressing the rationale for the 225Ac and BETi combination. In vivo, 225Ac-ART-101 + JQ1 and 225Ac-ART-101 + ABBV-075 elicited a stronger tumor growth inhibition ($p<0.01$) compared to single treatments 225Ac-ART-101, JQ1/ABBV-075, or control, evidencing a potential synergism between 225Ac-ART-101 and BETi. Consequently, overall survival was significantly extended in the combination treatment arms. None of the therapeutic interventions resulted in attributable severe toxicities or death. ***Conclusion:*** DDR disruption through BETi proved a promising strategy to boost 225Ac's lethality in CRPC cells. Combining BETi with 225Ac-ART-101 or other TAT agents is mechanistically justified and merits further therapeutic optimization and toxicological evaluations toward its potential clinical implementation.

OP-025

Quantitative assessment of Relative Biological Effectiveness for^{177}Lu-DOTATATE versus External Beam Radiotherapy: Unveiling critical gaps in the current models?

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Aim/Introduction: This work aims to model the dose-response and dose-dependent relative biological effectiveness (RBE) of 177Lu-DOTATATE in comparison to external beam radiotherapy (EBRT) for cell survival in 3 cell lines. ***Materials and Methods:*** Geant4 was used to model 3 cell-lines, with different proliferation speeds and geometrical properties: GOT1 (spherical cells -2D bilayer clusters), NCI-H69 (spherical cells - 3D floating randomly shaped clusters) and U2OS (polygonal mesh shaped cells - isolated plated cells).177Lu-DOTATATE uptake (4h in medium) and subsequent excretion was assessed by performing cellular uptake assays. The MIRD formalism was adopted to determine the absorbed dose rate to cell nuclei. Cell death was assessed at day 7 of exposure for 0.1-1 MBq/ml of 177Lu-DOTATATE using cell survival assays. For comparison, response to 0.5-2Gy x-ray irradiation was measured. The linear (L), linear-quadratic (LQ), repairable-conditionally repairable (RCR) model were employed to fit the data. ***Results:*** The absorbed dose ranges for 0.1-1 MBq/mL of added activity were 0.2-1.3Gy (5-31 mGy/h), 0.98-1.78Gy (26-39 mGy/h) and 2.55-4.89Gy (30-53 mGy/h) for U2OS, NCI-H69 and GOT1, respectively. The dose rate heterogeneity due to cellular placement and cluster sizes caused a variation in maximum dose rate up to -43% and +66% for GOT1. The best fitting dose-response models ($R2 > 0.85$) following 177Lu-DOTATATE treatment were: RCR for U2OS ($a=3.5\pm0.8$/Gy, $b=0.98\pm0.26$/Gy, $c= 0.70\pm0.14$/Gy), LQ for NCI-H69 ($\alpha=0.03\pm0.10$/Gy, $\beta=0.09\pm0.07$/Gy2) and L for GOT1 ($\alpha=0.05\pm0.02$/Gy). In contrast, the EBRT dose-response was similar across all cell-lines ($\alpha = 0.24$-0.27 1/Gy), with significant additional sublethal damage for U2OS only ($\beta=0.22\pm0.06$ /Gy2).The RBE for U2OS followed an exponential decay behavior ($R2=0.99$), with RBE = 5.1 ± 1.7 at 0.1 MBq/mL and 60% survival and 0.5 ± 0.2 at 2.5 MBq/mL and 40% survival. Fitting linear dose-response models, the RBEmax was 0.43 ± 0.07 (range: 0.35-0.72) and 0.22 ± 0.02 (range: 0.18-0.29) for NCI-H69 and GOT1, respectively. However, the absorbed dose-RBE relationship was characterized by a non-linear, in first approximation quadratic, behavior for both cell-lines. ***Conclusion:*** We challenge the use of a constant, cell-line independent value to explain the radiobiological differences between 177Lu-DOTATATE and EBRT. Our results indicate an overkill effect at low dose rates, which might be obscured by biological and physical heterogeneity in the response. Establishing a novel mechanistic model, rather than empirical linear-quadratic dose-responses, is imperative to elucidate the cell-dependent interplay between maximum dose-rate levels and activation of repair mechanisms during 177Lu-DOTATATE therapy.

OP-026

In vitro comparative analysis of the neuroendocrine tumor response to peptide receptor radionuclide therapy and external beam radiotherap

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Aim/Introduction: Peptide receptor radionuclide therapy (PRRT) with [177Lu]Lu-DOTA-TATE shows promise in treating neuroendocrine tumors (NETs). However, enhancing clinical outcomes may be achieved by incorporating radiosensitizers. Understanding PRRT radiobiology is crucial for developing effective combination therapies. Currently, this knowledge is generally extrapolated from conventional external beam radiotherapy (EBRT), however this is probably not accurate due to the physical differences between these radiation types (e.g. timing, dose rate, absorbed dose). Here, we compared the NET cellular response to EBRT and PRRT and verified the potential effect of this response on the efficacy of several radiosensitizers between both radiation types. ***Materials and Methods:*** A direct comparative transcriptomic analysis was carried out between EBRT and PRRT in the NET cell line GOT1 using bulk mRNA-sequencing. Considering the central role of the DNA damage response (DDR) in the radiation response, we then performed a high throughput screen with DDR-/cell cycle-targeted compounds as potential radiosensitizers in the context of PRRT in GOT1 and NCI-H69 cells. Subsequently, the radiosensitizing potential of hit compounds was directly compared between EBRT and PRRT in both cell lines using cellular survival assays and dosimetric modeling with GEANT4. ***Results:*** EBRT and PRRT shared a large part of the induced transcriptomic radiation response, primarily involving DNA- and cell cycle-based pathways. However, PRRT exhibited a delayed peak response compared to EBRT. Identified targets for PRRT-based radiosensitization included DNA-PK, ATM, ATR, HSP90, PARP, and CDK2, with variable efficacy between cell lines. The radiosensitization potential of these inhibitors was comparable between EBRT and PRRT. ***Conclusion:*** Early transcriptomic responses and radiosensitizing potential were akin between EBRT and PRRT, with larger magnitude differences appearing at a later timepoint as could be expected by the type of radiation source. Variations in radiosensitization efficacy among cell lines underscore the need for further research into factors influencing radiosensitization in combination with PRRT for NETs.

OP-027

Enhancing [^{177}Lu]Lu-DOTA-TATE therapeutic efficacy in vitro by combining it with chemotherapy

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Aim/Introduction: Peptide receptor radionuclide therapy (PRRT) uses [177Lu]Lu-[DOTA0-Tyr3]octreotate ([177Lu]Lu-DOTA-TATE) to treat patients with neuroendocrine tumors (NETs) overexpressing the somatostatin receptor 2A (SSTR2A). It has shown significant short-term improvements in survival and symptom alleviation, but there remains room for improvement. Here, we investigated whether combining [177Lu]Lu-DOTA-TATE with chemotherapeutics enhanced the in vitro therapeutic efficacy of [177Lu]Lu-DOTA-TATE. ***Materials and Methods:*** Transfected human bone osteosarcoma (U2OS+SSTR2A, high SSTR2A expression) and pancreatic NET (BON1+STTR2A, medium SSTR2A expression) cells were subjected to hydroxyurea, gemcitabine or triapine for 24 hours at 37oC and 5% CO2. Cells then recovered for 4 hours prior to a 24-hour incubation with 0.7-0.9 MBq [177Lu]Lu-DOTA-TATE (25 nM) for uptake and metabolic viability studies. Controls included untreated SSTR2A-expressing cells and cells incubated with 177Lu or unlabelled DOTA-TATE, or treated with X-ray radiation. Non-SSTR2A-expressing cells were also incubated with [177Lu]Lu-DOTA-TATE. Finally, cells were harvested to assess cell cycle progression, SSTR2A expression, and cell size by flow cytometry. ***Results:*** Uptake of [177Lu]Lu-DOTA-TATE was SSTR2A-mediated and incubation of U2OS+SSTR2A cells with hydroxyurea, gemcitabine, and triapine enhanced uptake of [177Lu]Lu-DOTA-TATE from 0.2 ± 0.1 in untreated cells to 0.4 ± 0.1, 1.1 ± 0.2, and 0.9 ± 0.2 Bq/cell in U2OS+SSTR2A cells, respectively. Subcellular localisation remained mostly cytoplasmic. Cell viability post treatment with [177Lu]Lu-DOTA-TATE in cells pre-treated with chemotherapeutics was decreased compared to cells treated with [177Lu]Lu-DOTA-TATE monotherapy. For example, the viability of U2OS+SSTR2A cells incubated with [177Lu]Lu-DOTA-TATE decreased from 59.5 ± 22.3% to 18.8 ± 5.2% when pre-treated with hydroxyurea. Control conditions showed no reduced metabolic viability. Hydroxyurea, gemcitabine, and triapine increased SSTR2A expression and cell size in U2OS+SSTR2A and BON1+STTR2A cells. The S-phase sub-population of asynchronous U2OS+SSTR2A cell cultures was increased from 45.5 ± 3.3% to 84.8 ± 2.5%, 85.9 ± 1.9%, and 86.6 ± 2.2% when treated with hydroxyurea, gemcitabine, and triapine, respectively. ***Conclusion:*** Hydroxyurea, gemcitabine and triapine all increased cell size, SSTR2A expression, and [177Lu]Lu-DOTA-TATE uptake, whilst further reducing cell metabolic viability in U2OS+SSTR2A cells when compared to [177Lu]Lu-DOTA-TATE monotherapy. Further investigations could transform patient care and positively increase outcomes for patients treated with [177Lu]Lu-DOTA-TATE.

OP-028

Biodistribution of free francium-221 and bismuth-213 in tumour-bearing SCID mice after successful establishment of actinium-225/francium-221 radionuclide generator set-ups

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Aim/Introduction: Despite the success of first targeted alpha therapies in the management of highly resistant cancer diseases, optimised treatment regimens are nevertheless needed to improve overall survival rates and combat side-effects such as xerostomia or renal dysfunction. The factors accounting for the undesired non-targeted uptake to organs remain elusive and under investigation. The nuclear recoil effect of actinium-225 has been hypothesised to contribute to the non-targeted uptake, and francium-221 is a striking example of an unevaluated recoiling daughter radionuclide, mainly due to a lack of generator concepts for direct in vivo applications and its short half-life (4.8 min). Here, we report on the first successful application of an actinium-225/francium-221 generator concept using HDEHP-based LN2 resin. The biodistribution of successfully acquired francium-221 and its

daughter bismuth-213 were further evaluated in vivo. ***Materials and Methods:*** The elution of francium-221 was performed on a LN2-resin column. 225Ac(NO3)3 was loaded onto a column pre-conditioned with 0.1M HNO3. After a series of washes, multiple francium-221 elutions were performed with 0.1M NaOAc (pH 6.5) after sufficient francium-221 in-growth time of 25-30 minutes. The biodistribution of francium-221 and bismuth-213 was investigated in male SCID mice with LNCaP tumours. The mice were injected with single doses of francium-221 and bismuth-213 and sacrificed 5, 10, or 15 minutes post-injection. Uptake to organs was examined by gamma spectrometry measurements (high-purity germanium detector) and a gamma detector. ***Results:*** Our results indicate that LN2 is a highly potent resin for selective and consecutive francium-221 elutions. The application of 0.1M NaOAc facilitated a continuous pH equilibrium leaving additional pH adjustments for in vivo application unnecessary. The 25-minute intervals between elutions were ideal for obtaining high activity francium-221 with only minimal bismuth-213 contaminations. The biodistribution study revealed a very fast distribution of francium-221 and bismuth-213 with almost complete clearance in blood already after 5 minutes. We observed a strong accumulation of francium-221 to the kidneys (30-40% ID/g), salivary glands (20-30% ID/g) and small intestine (~10% ID/g), and accumulation of bismuth-213 to the kidneys and liver (10-20% ID/g). Other organs including tumours showed little to no accumulation. ***Conclusion:*** We present an unprecedented concept utilising LN2 resin in actinium-225/francium-221 generator applications. Successfully eluted francium-221 fractions were deployed in a biodistribution study, showing strong accumulation of francium-221 and bismuth-213 into key organs. Our data provide preliminary evidence of the potential contribution of recoiled (grand)daughter radionuclides to side-effects in non-targeted organs.

OP-029

Single Time point Dosimetry of ^{64}Cu-DOTA-rituximab using mean effective half-life

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Aim/Introduction: Dosimetry for radionuclide therapy often involves multiple scans points (Tsc) to determine the time-integrated activity (TIA). However, this traditional dosimetry procedure causes additional data collection effort. The aim of this study was to investigate the feasibility of 64Cu-DOTA-rituximab dosimetry by using single time point (STP) scan. ***Materials and Methods:*** Four mice were intravenously injected with 50 µCi/100µl of 64Cu-DOTA-rituximab. Kinetics were assessed via gamma camera scans of heart, liver, lungs, spleen and kidney at 1, 2, 6, 24, 48 and 72 hours. The Effective half-life was calculated by fitting a mono-exponential function to the data measured in each organ. S-values were calculated using Monte Carlo approach. Two STP approaches (STP1 and STP2) that eliminate the patient-specific effective half-life (Teff) were utilized to calculate organ's absorbed doses. STP1 proposes that TIA can be calculated as $\tilde{A} = (A(Tsc)/\ln(2))\times 2Tsc$ indicating that if the Tsc remains within 0.75-2.5 times the Teff, errors in dose estimates would be below 10%. STP2 suggests that utilizing the population mean effective half-life (Teff-p) $\tilde{A} = (A(Tsc)/\ln(2))\times\exp(\ln(2)\times Tsc/Teff\text{-}p)\times Teff\text{-}p$ would improve the accuracy. The accuracy of each approach was evaluated in terms of error resulting from comparison with Multiple Time Point (MTP) dosimetry approach. ***Results:*** Effective half-lives of heart, liver, lungs, spleen and kidney have ranged from 22 to 33.8 (mean: 27.2), 22.5 to 36.7 (mean: 31.2), 22.8 to 39.8 (mean: 34.3), 26.2 to 41.3 (mean: 31) and 23.1 to 30.8 (mean: 26.1) hours, respectively. Absorbed dose showed significant errors at early and 72 hours for both approaches as compared to MTP. STP1 showed a maximum error of -95%, -90%, -73%, -22% and -32% at 1, 2, 6, 24 and 72 hours, respectively. The errors of STP2 were 48%, 47%, 41%, 17%, and -27% at 1, 2, 6, 24 and 72 hours, respectively. However, absorbed dose calculated from data collected at time point of 48 hours have an excellent agreement with MTP for both approaches, with error ranges of -0.51% to 6.1% in STP1 and 0.21% to -8% in STP2. Furthermore, the use of Teff-p notably enhanced the absorbed dose estimates by 3% to 6%. ***Conclusion:*** In this study, we investigated the feasibility of 64Cu-DOTA-rituximab STP dosimetry using two distinct STP approaches. Our results indicate that STP dosimetry for 64Cu-DOTA-rituximab is achievable at 48 hours scan time point. While both approaches exhibited low dose estimation errors at 48 hours, STP2 was superior with up to 6% improvement.

OP-030

Repair of DNA damage in PBMCs after mixed ex vivo irradiation with different mixtures of α- and β-emitters

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Aim/Introduction: The aim of this study was to investigate DNA damage and its repair in peripheral blood mononuclear cells (PBMCs) after ex vivo internal irradiation of whole blood with different mixtures of an α- and a β-emitter. ***Materials and Methods:*** Blood samples of 10 healthy volunteers were collected and divided in four aliquots each, of which one served as non-irradiated baseline. The remaining blood samples were incubated for 1 h with varying [223Ra]RaCl2 and [177Lu]LuCl3 activities to achieve total absorbed doses to the blood of 100mGy (ratio α-dose:β-dose 3:1, 1:1, 1:3). The PBMCs were then isolated and divided into 3 subsamples. These were fixed with ethanol either directly, or after culture in RPMI for 4 h or 24 h to analyse the time course of DNA repair. Immunostaining of DNA double-strand break (DSB) markers γ-H2AX and 53BP1 revealed co-localised DSB foci and γ-H2AX-positive α-tracks in the PBMCs' nuclei that were counted microscopically in 100 nuclei per sample. The repair was described by a monoexponential model: $(N(t)=N0\cdot((1-Q)\cdot\exp(-R\cdot t))+Q)$ (N0: max. number of induced tracks in 100 cells/RIF per cell, R: repair rate, Q: unrepaired fraction)[1]. ***Results:*** Mean β-doses of (26.7±1.2)mGy, (51.3±2.7)mGy, (75.7±3.1)mGy and the corresponding mean α-doses of (76.5±2.5)mGy, (50.6±1.8) mGy and (25.3±0.7)mGy were achieved. Directly after 1 h internal irradiation, the mean of the average number of radiation-induced foci (RIF) per cell were 0.65±0.18 (β-dose: 25mGy), 0.81±0.32 (β-dose: 50mGy) and 0.98±0.25 (β-dose: 75mGy). The mean of the number of α-tracks in 100 cells directly after internal irradiation were 5.9±2.2 (α-dose: 25mGy), 8.1±2.2 (α-dose: 50mGy), 13.1±3.1 (α-dose: 75mGy).The results showed comparable repair rates between mixed (Rβ: (0.25±0.12)h-1 (25 mGy), r2=0.49; (0.29±0.13) h-1(50 mGy), r2=0.53; (0.31±0.09)h-1 (75mGy), r2=0.75 and Rα: (0.22±0.07)h-1 (25mGy), r2=0.69; (0.16±0.05)h-1 (50mGy), r2=0.73; (0.26±0.05)h-1 (75mGy), r2=0.82) and single irradiation (Rβ,pure: (0.28±0.03)h-1 (50mGy)[1] and Rα,pure: (0.24±0.05)h-1 (25mGy),

(0.16±0.04)h-1(50mGy) [2]), for both RIF and α-tracks. However, mixed irradiation resulted in a higher proportion of unrepaired RIF per cell at 24 h (Qβ: 0.35±0.10 (25mGy), 0.23±0.10 (50mGy), 0.14±0.07 (75mGy)) compared to pure β-irradiation (Qβ,pure: (0.06±0.02) (50mGy)[1]). ***Conclusion:*** Mixed internal irradiation seems not to affect the repair rate of focal DNA damage. For the α-tracks, there is no difference between mixed and pure irradiation. However, a higher proportion of unrepaired RIF/cell at late time points was observed relative to pure β-irradiation, most likely caused by incomplete repair of α-induced DSB damage. ***References:*** [1] Schumann et al, EJNMMI, 2022 [2] Göring et al, EJNMMI, 2022

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Sunday, October 20, 2024, 08:00 - 09:30

Hall Z

Clinical Oncology Track - TROP Session: Oncology & Theranostics Committee: Breast

OP-031

A Preliminary Study on the Clinical Utility of ^{18}F-FES and ^{68}Ga-HER2-affibody in Patients with Metastatic Breast Cancer

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Aim/Introduction: The heterogeneity of breast cancer as a malignant tumor is characterized by significant variations in the expression of ER or HER2, posing a substantial challenge for the determination of their expression through biopsy. The purpose of this study was to investigate the utility of 18F-FES and 68Ga-HER2-affibody PET imaging for noninvasive assessment of ER and HER2 status in patients with metastatic breast cancer, aiming to enhance their clinical applicability. ***Materials and Methods:*** A total of 19 patients with metastatic breast cancer were enrolled. 18F-FES and 68Ga-HER2-affibody PET/CT were performed, and the interval between the two scans was not more than 1 month. A positive PET result is defined as a lesion showing higher uptake compared to the surrounding normal tissue. The identification and localization of all lesions need to be confirmed through 18F-FDG PET/CT or traditional imaging examinations. The SUVmax values of two tracers are measured to compare the relationship between PET uptake levels and receptor status using non-parametric testing, specifically the Mann Whitney U test. Additionally, this study aims to investigate the potential utility of 18F-FES and 68Ga-HER2-affibody PET/CT in guiding subsequent treatment. ***Results:*** A total of 226 lesions were found in 19 patients with metastatic breast cancer, of which 15 were liver metastases, and 18F-FES and 68Ga-HER2-affibody PET could not be evaluated (high biological uptake of liver). In total, 211 lesions were included in the analysis, with 92 (43.6%) lesions showing positive results in 18F-FES PET and 144 (68.2%) lesions showing positive results in 68Ga-HER2-affibody PET. The 18F-FES SUVmax of ER-positive patients was significantly higher than that of ER-negative patients among the 14 patients with metastatic biopsy pathology (median SUVmax: 4.1 vs. 1.0, P<0.001). However, there was no significant difference in the 68Ga-HER2-affibody SUVmax between HER2-positive and HER2-negative patients (median SUVmax: 3.6 vs. 3.4, P=0.901). It is noteworthy that among patients with 18F-FES positivity, 81.8% received endocrine therapy, while among those with 68Ga-HER2-affibody positivity, 61.5% received anti-HER2 therapy; the proportion was even higher in patients with 100% 18F-FES or 68Ga-HER2-affibody positive lesions at 88.9% and 80.0%, respectively. However, patients lacking 18F-FES or 68Ga-HER2-affibody positive lesions were not administered endocrine or anti HER2 therapy. ***Conclusion:*** The use of 18F-FES and 68Ga-HER2-affibody PET imaging enables the assessment of ER and HER2 status in patients with metastatic breast cancer, thereby providing valuable insights into the heterogeneity of receptor expression and potentially guiding subsequent treatment strategies.

OP-032

Prognostic Role and Importance of ^{18}F-FDG PET/CT in Patients with Breast Cancer:12-Year Experience

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Aim/Introduction: The use of Fluorine-18 fluorodeoxyglucose positron emission tomography/computed tomography (18F-FDG PET/CT) in oncology is of increasing importance. The aim of this study is to investigate the role of parameters obtained from 18F-FDG PET/CT for staging in predicting the prognosis of patients with breast cancer. ***Materials and Methods:*** Totally 1250 patients 18-90 years who diagnosed with BC and underwent 18F-FDG PET/CT imaging between April 2009-June 2021 screened, and 333 patients (mean age: 54.7±14.03) complete data could accessed, retrospectively included in study. ^{18}F-FDG PET/CT images re-evaluated, and metabolic parameters SUVmax, SUVmean for primary lesions, axillary lymph nodes, and distant metastases were calculated. The relationship between parameters and clinicopathological features; histopathological-molecular subtypes, sizes, lymph node (LN) positivity, presence of distant organ metastasis, and progression-free survival (PFS), overall survival (OS) was evaluated. ***Results:*** 333 patients; 259 (77%) IDC, and 74 (23%) other invasive histopathological subtypes. Axillary LN metastasis was detected in 193, while distant nodal metastasis found in 67 cases. 140 patients had distant organ metastasis, while 193 patients were in a local or locally advanced stage. SUVmax of primary lesions calculated mean±SD: 12.20±8.73. Median follow-up period; 45.57±36.54 months (minimum: 0.33-maximum: 157.24 months), during which progression was observed in 115 (34%) and 151 patients died. Total OS calculated 51.75±36.54 months. PFS and OS were significantly shorter in axillary LN metastatic patients (p=0.04). There was no statistically significant relationship between primary lesion size and metabolic parameters with overall survival. A statistically significant relationship found between tumor size and SUVmax, axillary LN SUVmax, and PFS with p-values calculated as (<0.001, 0.01, 0.002) respectively. Correlations and p-values between tumor and axillary LN SUVmax, tumor size, OS, and PFS are given in Table 1. ***Conclusion:*** 18F-FDG PET/CT recommended in current guidelines for stage 3a (T3, N1, and M0) and more advanced cases. Although there are many parameters available to predict tumor prognosis, in our study, the role of PET metabolic parameters in predicting BC prognosis, especially PFS, has clearly defined with long follow-up period. In our study that PET parameters obtained from 18F-FDG PET/CT imaging at the staging phase can contribute to prognosis determination by revealing their importance in long-term patient follow-up.

OP-033

Comparison of Ga-68 FAPI PET/CT and F^{18}-FDG PET/CT in primary staging of breast cancer

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Aim/Introduction: To evaluate the role of Ga-68 FAPI PET/CT in breast cancer staging in comparison with F^{18}-FDG PET/CT. ***Materials and Methods:*** This prospective study was supported by Scientificand Technological ResearchCouncil of Turkey(TUBITAK) under the Grant Number 221N370.The authors thank TUBITAK for their supports. Following ethics committe approval, 29 breast cancer patients (28F,1M,mean age:54) were included. F-18F-FDG and Ga-68 FAPI PET/CT were performed for staging. Patient based sensitivity,specificity,PPV,NPV and accuracy is calculated for each modality. Uptake intensity of the primary breast lesions, axillary lymph nodes and other metastatic sites were compared between two imaging modalities. Correlation between SUVmax of the lesions and histopathological parameters and significance of difference of medians between different histpothological groups were analyzed. ***Results:*** The sensitivity,PPV and accuracy for detection of primary breast lesions of Ga-68 FAPI were slightly higher than F^{18}-FDG (96%,100% and 96% vs 93%,100% and 93% respectively). There were no false positive cases in both modalities. For axillary LN metastasis, sensitivity,specificity,PPV, NPV and accuracy of Ga-68 FAPI PET/CT were higher than F18-FDG PET/CT (88%, 100%,100%,87% and 93% vs 87%,86%,87%,86%,86% respectively). Median SUVmax of Ga-68 FAPI uptake of primary breast lesions were significantly higher than F^{18}-FDG uptake ($p<0.001$). For axillary lymph nodes, no significant difference was detected. Among histopatholohical variables, Ki-67 proliferation index of the primary tumors was significantly correlated with SUVmax of axillary LN on Ga-68 FAPI PET/CT. No other correlation was found between Ki-67 and other SUVparameters. Medians of SUVmax of the primary breast and metastatic lesions did not differ among groups with or without lymphovascular invasion, perineural invasion, lymphocytic infiltration, Her2 positivity, invasive ductal or lobular cancer. Ga-68 FAPI PET/CT changed management in 5/29 patients(17%) (axillary dissection was performed for Ga-68 FAPI positive, F^{18}-FDG negative metastatic LN in 3 patients, shift from surgery to neoadjuvant therapy due to Ga-68 FAPI positive, F^{18}-FDG negative metastatic parasternal lymph node in 1 patient, bilateral mastectomy due to Ga-68 FAPI positivity in the contralateral breast in 1 patient). There was only 1 patient with distant organ metastasis. Brain metastasis was both F^{18}-FDG and Ga-68 FAPI negative and skeletal metastasis were both F18-FDG and Ga-68 FAPI avid. ***Conclusion:*** Accuracy and specificity of Ga-68 FAPI PET/CT is higher than F18-FDG PET/CT for detection of primary breast lesions and axillary lymph node metastasis in primary staging of breast cancer. Ga-68 FAPI changes management in a significant number of cases and can be used complementary to F^{18}-FDG PET/CT

OP-034

Association between PET-based features reflecting intensity and heterogeneity of [^{18F}]FDG uptake and immunohistochemical markers in breast cancer of no special type and lobular type

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Aim/Introduction: In breast cancer (BC), a higher [^{18F}]FDG uptake has been associated with hormone receptor-negative status, HER2 overexpression, high Nottingham Grade and high Ki67 index. We aimed to analyze the association between standardized uptake value (SUV)-based features reflecting the intensity and heterogeneity of [^{18F}]FDG uptake in BC and immunohistochemical (IHC) markers. ***Materials and Methods:*** This retrospective study included 200 histologically confirmed invasive breast carcinomas [170 of no special type (NST) and 30 of the lobular type] from patients staged with [^{18F}]FDG-PET/CT. The primary tumour was delineated through a robust semiautomatic method using a Bayesian classifier (Constantino et al, J Digit Imaging, 2023). SUVmax, SUVmean, SUVpeak, metabolic tumour volume (MTV), total lesion glycolysis (TLG), entropy, kurtosis, skewness, uniformity, range, standard deviation (SD) and coefficient of variation (CoV) were extracted from the delineated tumours. In NST tumours, these variables were compared in subgroups defined by the estrogen receptors (ER) and progesterone receptors (PgR) status, HER2 IHC and in situ hybridization (ISH) expression [score 0, 1+ and 2+ non-amplified by ISH vs score 2+ amplified by ISH or score 3+] and Nottingham Grade (1-2 vs 3) using Mann-Whitney U test. In both NST and lobular carcinomas, the same features were correlated with Ki67 index using the Spearman coefficient. Uncorrected $p<0.05$ was considered statistically significant. ***Results:*** In NST BC, SUVmax, SUVmean, SUVmedian, SUVpeak, entropy, range, skewness, SD and CoV were higher and uniformity was lower in ER/PgR-negative than in ER/PgR-positive tumours ($p<0.05$). TLG was also higher in ER-negative than in ER-positive tumours ($p<0.05$). SUVmax, SUVmean, SUVmedian, SUVpeak, TLG, entropy, range, SD and CoV were higher and uniformity was lower in grade 3 than in grade 1-2 tumours ($p<0.05$). The higher the Ki67 index, the higher the SUVmax ($r=0.391$), SUVmean ($r=0.335$), SUVmedian ($r=0.309$), MTV ($r=0.220$), TLG ($r=0.295$), entropy ($r=0.395$), range ($r=0.409$), SD ($r=0.403$), CoV ($r=0.427$) and SUVpeak ($r=0.363$) and the lower the uniformity ($r=-0.386$) ($p<0.05$). None of the measured features was significantly associated with HER2 expression. In lobular BC, the higher the Ki67 index, the higher the entropy ($r=0.413$) and SD ($r=0.415$) and the lower the uniformity ($r=-0.412$) ($p<0.05$). ***Conclusion:*** Higher intensity and heterogeneity of [^{18F}]FDG uptake in NST BC were associated with poorer prognostic biomarkers, namely ER- and PgR-negative status, higher Nottingham Grade and higher Ki67 index. None of the [^{18F}]FDG-based features was associated with HER2 expression. In lobular BC, higher heterogeneity of [^{18F}]FDG uptake was also associated with higher Ki67 index.

OP-035

The Role of [^{68}Ga]Ga FAPi PET/CT in Staging and Restaging in Breast Cancer with Low FDG Uptake

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Aim/Introduction: The aim of this study is to assess the potential efficacy of [68Ga]Ga FAPi PET/CT in staging and restaging in breast cancer patients with FDG-negative or low FDG uptake lesions. ***Materials and Methods:*** Between October 2020 and February

2024, 25 female patients with pathologically confirmed breast cancer were prospectively enrolled. These patients underwent [68Ga]Ga FAPi and [18F]-FDG PET/CT imaging within one week for staging or restaging. All imaging was reviewed in consensus by three experienced nuclear medicine physicians. The maximum standard uptake values (SUVmax) of the primary tumor areas and metastases in the [68Ga]Ga FAPi and [18F]-FDG PET/CT images were recorded and statistically compared using the paired t-test. A p-value of <0.05 was considered statistically significant. ***Results:*** 25 female patients with suspicious primary malignancy recurrence or metastases but low FDG affinity on [18F]-FDG PET/CT were imaged with [68Ga]Ga FAPi PET/CT. The mean age was 57.1±11.7 years. Histopathologic examination from previous surgeries/biopsies available for 20 patients revealed lobular carcinoma in 10 cases, ductal carcinoma in 8 cases, signet ring cell carcinoma in one patient and squamous cell carcinoma in one patient. In six patients (24%), neither the [18F]-FDG PET/CT nor the [68Ga]Ga FAPi PET/CT revealed any findings indicating recurrence or metastasis. Disease stage increased in 36% (n=9) of patients after [68Ga]Ga FAPi PET/CT imaging, with 8 of them showing no pathologic findings on [18F]-FDG PET/CT; after [68Ga]Ga FAPi PET/CT imaging, 7 patients progressed to stage 4 and 1 to stage 3. One patient progressed from stage 2 to stage 3 according to AJCC 8. edition. 60% (n=6) of the lobular carcinomas were upstaged after [68Ga]Ga FAPi PET/CT. The detection of lymph nodes and distant metastases in lobular carcinoma was higher with [68Ga]Ga FAPi PET/CT than with [18F]-FDG PET/CT (Table 1). Only one patient had a primary lesion that was negative on both [18F]-FDG and [68Ga]Ga FAPi PET/CT. Furthermore, [68Ga]Ga FAPi PET/CT showed a higher SUVmax in primary tumor foci and metastases (Table 2) (p<0.05). ***Conclusion:*** [68Ga]Ga FAPi PET/CT has been shown to be superior for staging and restaging indications in breast cancer, especially for tumors such as lobular carcinoma with low FDG affinity. It is anticipated that [68Ga]Ga FAPi PET/CT will be included in future guidelines for primary diagnosis and staging in breast cancer patients, especially in patients with the lobular histopathologic subtype. Further multicenter prospective studies are needed in this area.

OP-036

Contribution of Ga-68 DOTA-Bombesin PET/CT to Staging and Restaging in Breast Cancer: Preliminary Findings

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Aim/Introduction: Bombesin (BBN) is 14-amino acid peptide selectively binds to gastrin-releasing peptide receptor (GRPR). GRPR has detected in prostate, lung, central nervous system, colon, pancreatic cancers, and also highly expressed in breast cancer .These tumors synthesize BBN-associated peptides and function as autocrine growth factors by excessively expressing BBN receptors. Study aims to evaluate the diagnostic, staging-restaging role and significance of GRPR imaging in breast cancer using GRPR analogue 68Ga-DOTA-Bombesin PET/CT. ***Materials and Methods:*** Our prospective study has local ethical board approval. Total 23 patients histopathologically confirmed breast carcinoma, 22 women [(mean ± STD: 54.26 ± 13.21 years), (21/22 staging, 1/22 restaging)] ,1 man (71 years), underwent staging 68Ga-DOTA-Bombesin PET/CT and 18F-FDG PET/CT within same 2week. In vivo tumor uptake obtained from 68Ga-DOTA-Bombesin, axillary lymph node uptake, and uptake values for distant metastasis, as well as metabolic parameters from ^{18}F-FDG PET/CT, estrogen (ER) and progesterone (PR) receptor and HER2/neu status, and Ki-67 index in biopsy samples, tumor, and axillary lymph node sizes evaluated comparatively. ***Results:*** Histopathologically, 15 patients had invasive ductal, 6 invasive lobular, 2 tubulolobular breast carcinoma diagnoses. Regarding hormone receptor status, 8 Luminal A, 14 Luminal B and 1 Triple Negative. Normal breast tissue showed moderate GRPR binding (SUVmax: 1.2 ± 1.0), while physiological uptake in other organs was minimal, except for pancreas and kidneys. Mean FDG SUVmax of primary tumor was 10.39 ± 8.79, and the mean Bombesin SUVmax was 5.52 ± 2.16, with a statistically significant difference betweenprimary tumor SUVmax (p = 0.01). When comparing axillary LN FDG SUVmax (mean ± STD: 10.65 ± 9.67) and Bombesin SUVmax (mean ± STD: 7.02 ± 2.61), no statistically significant difference was observed, but a negatively low correlation was observed (r: -0.35) (Table 1). In the assessment of distant organ metastasis, when compared with 18F-FDG PET/CT, 68Ga-DOTA-Bombesin PET/CT showed additional lesions in one patient with a total of 3 liver metastases (Figure 1). Additionally, in one out of a total of 4 patients with bone metastasis, additional bone metastases were observed with 68Ga-DOTA-Bombesin PET/CT compared to 18F-FDG PET/CT. ***Conclusion:*** Preliminary findings of ongoing study demonstrate that 68Ga-DOTA-Bombesin PET/CT is a promising imaging method in breast cancer. However, further studies with larger patient cohorts are needed to determine whether radiolabeled GRPR analogues can be used in the diagnosis and staging of breast cancer. Additionally, Lu-177-conjugated GRPR analogues may also be considered for the treatment of metastatic breast cancer.

OP-037

Head-to-Head Comparison of [18F]PSMA-1007 and [18F] FDG PET/CT in Patients with Triple-Negative Breast Cancer

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Aim/Introduction: Triple-negative breast cancer (TNBC) exhibits high aggressiveness and a notably poorer prognosis at advanced stages. Treatment options for TNBC patients are limited, often leading to recurrence and therapy resistance. Nuclear medicine offers new possibilities, not only diagnostically but also potentially promising therapeutic strategies. Prostate-specific membrane antigen (PSMA) expression primarily associated with prostate cancer, has also been identified in breast cancer, showing a positive correlation with its aggressiveness. The aim of our study was to assess the expression of PSMA in vivo in TNBC patients by means of PET/CT using 18F-PSMA-1007. Additionally, we performed a head-to-head comparison of 18F-PSMA-1007 versus standard-of-care 18F-FDG-PET/CT in TNBC patients. ***Materials and Methods:*** This prospective study involved ten patients diagnosed with advanced-stage TNBC. Each patient underwent both 18F-FDG PET/CT and 18F-PSMA-1007 PET/CT examinations, with no more

than one month between the scans. All visible lesions displaying radionuclide uptakewere evaluated and compared. ***Results:*** A total of 10 patients were included: 5 post-mastectomy and chemotherapy, 4 undergoing chemotherapy (CTH): 1 neoadjuvant, 3 palliative CTH, and 1 untreated patient. The uptake of 18F-PSMA in primary and metastatic cancer lesions was comparable to 18F-FDG. 18F-PSMA indicated one additional primary lesion not detected in 18F-FDG PET/CT. Lymph nodes with positive uptake, typical for nodal metastases were found in 8 patients, showing similar SUV max values in both modalities. Two patients had uncountable lung metastases positive inboth 18F-FDG and 18F-PSMA scans. PET-positive osteolytic lesions characteristic for bone metastases were identified in the 18F-PSMA PET/CT in 4 patients, while elevated 18F-FDG uptake in bone metastases was found only in 3 of them. Distant metastases to the liver and adrenals displayed higher SUV max values in the 18F-PSMA PET/CT. Approximately ten small brain metastases (ranging from 4 to 7 mm in diameter) were exclusively detected using 18F-PSMA PET/CT. ***Conclusion:*** The study confirms the expression of PSMA in TNBC. To the best of our knowledge, this is the first prospective study directly comparing 18F-PSMA and 18F-FDG PET/CT in TNBC. The comparison suggests the potential superiority of 18F-PSMA PET/CT particularly in case of brain metastases. The documented expression of PSMA not only offers a novel diagnostic pathway but also implies potential therapeutic applications by means of targeted radionuclide therapy (theranostic approach).

OP-038

Contribution of ^{18}F-FDG MAMMI-PET Imaging in Breast Cancer Staging

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Aim/Introduction: 18F-FDG PET/CT has limited role in T staging of breast cancer. Dedicated breast PET (MAMMI-PET) imaging has improved spatial resolution and sensitivity which may contribute T staging of breast cancer. In present study, we evaluate the diagnostic performance of additional 18F-FDG MAMMI-PET imaging in breast cancer patients. ***Materials and Methods:*** Biopsy-confirmed breast cancer patients were performed skull base to mid-thigh 18F-FDG PET/CT and MAMMI-PET for staging. Lesions were categorized as invasive tumor, insitu tumor or benign based on PET findings. Lesion location and number, skin/nipple involvement were interpreted with clinical and histopathological data. PET findings were correlated either with histopathological results or MRI/USG/mammography findings. Sensitivity, specificity, accuracy, PPV, and NPV were calculated for each imaging modality, excluding multicentric cases. ***Results:*** All PET images of 80 female patients (Table 1) were interpreted retrospectively. In 40 patients, only one tumor was detected, while tumors were multifocal in 40 patients, and multicentric in 13 patients. After the exclusion of multicentric cases, a total of 168 lesions were determined in 67 patients. Of these, 92 were invasive tumors, 34 were in situ tumors, and 42 were benign lesions. Skin/nipple involvement was detected in 25 patients. Final diagnosis was confirmed by histopathological in %48 of patients, while remaining lesions were concluded by radiologically. 18F-FDG PET/CT detected 73/92(79%) invasive carcinoma and 9/34 (26%) in situ tumors, while MAMMI-PET detected 82/92 (89.1%) invasive carcinoma and 31/34(91%) in situ tumors. MAMMI-PET could not detect 5/126 lesions (%4) located adjacent to pectoralis muscle which were outside the FOV, and 4 of them were shown by 18F-FDG PET/CT. 18F-FDG PET/CT defined skin/nipple involvement in 19/25 (76%) patients, while MAMMI-PET identified 23 (92%) of them. Lesion-based sensitivity, specificity, accuracy, PPV and NPV were 65%, 93%,72%, 96%, 47% for 18F-FDG PET/CT; 88%, 90%, 88%, 96%, 71% for MAMMI PET, and 92%, 90%, 91%, 96%, 79% for combination of 18F-FDG PET/CT and MAMMI PET, respectively. ***Conclusion:*** Our study findings demonstrate that, 18F-FDG MAMMI-PET has high level accuracy in determining invasive/in situ tumors and skin/nipple involvement in breast cancer, in correlate with previous studies (1). Combination of MAMMI-PET and 18F-FDG PET/CT seems contribute T staging of breast cancer, and may reduce the need of additional breast MRI in clinical practice. ***References:*** 1)Nishimatsu, K., Nakamoto, Y., Miyake, K. K., Ishimori, T., Kanao, S., Toi, M., & Togashi, K. (2017). Higher breast cancer conspicuity on dbPET compared to WB-PET/CT. European Journal of Radiology, 90, 138-145.

OP-039

The prognostic role of baseline and post neoadjuvant chemotherapy $^{[18F]}$FDG PET/CT in triple-negative breast cancer: preliminary results of the TRINE-PET trial

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Aim/Introduction: triple-negative (TN) is recognized as the most aggressive breast cancer (BC) subtype and is still associated to short life expectancy. Although TNBC is a well-established $^{[18F]}$-FDG (FDG)-avid tumor at Positron Emission Tomography/Computed tomography (PET/CT), literature lacks of evidence regarding the prognostic value of FDG PET in these patients. The objective of TRINE-PET, a retrospective multicenter Italian study, aims to correlate FDG PET/CT results and survival outcomes in TNBC patients across various clinical settings of the disease. ***Materials and Methods:*** 23 Italian centers retrospectively collected data relative to FDG PET/CT scans performed in TNBC patients, either at baseline or after neoadjuvant chemotherapy (NAC), with a minimum of 2 years of follow-up. In patients who underwent NAC, pathological complete response (pCR) and response according to PERCIST criteria at FDG PET/CT were collected. A per-site PET based analysis was conducted and the survival outcomes (progression

and death) were compared in each category by using log-rank test. The correlation between categorial variables was assessed using the chi-squared test. ***Results:*** FDG PET/CT scans from 130 patients at baseline and 66 patients post-NAC were considered. Overall, lymph node and distant metastases were detected in 69 (53%) and 11 (8.5%) patients at baseline, and in 19 (28.8%) and 9 (13.6%) patients post NAC. In the baseline group (median follow-up of 3.5 years), 34 (26.2%) patients had disease progression, and 20 (15.4%) passed away. In the post-NAC group (median follow-up of 3.7 years), 21 (31.8%) patients had disease progression, and 17 (25.8%) passed away. The presence of N+ and M+ disease on FDG PET strongly correlated with both progression (all $p<0.05$) and death (al $p<0.01$) in both clinical settings. pCR after NAC was achieved in 29 (56.9%) out of 51 patients with available data. According to PERCIST criteria, a complete metabolic response was observed in 34 (51.5%) patients. PERCIST response on FDG PET/CT significantly correlated with pCR ($p <0.0001$) and with both progression ($p<0.0001$) and death ($p<0.0001$). ***Conclusion:*** a strong correlation was observed between N+ or M+ disease at baseline or post-NAC FDG PET/CT and survival outcomes in TNBC patients. Response to NAC assessed according to PERCIST criteria at FDG PET/CT was significantly correlated with both pCR and survival outcomes.

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Sunday, October 20, 2024, 08:00 - 09:30
Hall Y10-Y12

Featured Session: Paediatrics Committee: Paediatric Oncology

OP-040

Theranostic Application in Neuroblastoma

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OP-041

Disialoganglioside GD2 targeted PET imaging of high-risk children neuroblastoma with newly synthesized 68Ga labeling bicyclic peptide

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Aim/Introduction: Disialoganglioside GD2 has limited expression in normal tissues but is overexpressed in children neuroblastoma. It is considered a tumor-associated antigen and used successfully as a target for cancer immunotherapy. Anti-GD2 monoclonal antibodies target GD2-expressing tumor cells, leading to phagocytosis and destruction by means of antibody-dependent cell-mediated cytotoxicity, lysis by complement-dependent cytotoxicity. The aim of this study was to synthesize GD2 targeted 68Ga labeling bicyclic peptide (68Ga-GD2BP) and evaluate the value of 68Ga-GD2BP PET-CT imaging for GD2 expression quantification in neuroblastoma. ***Materials and Methods:*** GD2BP were designed based on the structure of GD2 targeted antibody and prepared via solid phase peptide synthesis, mixed with TATA for cyclization and radiolabeled with 68Gallium. In vitro cell binding affinity and specificity experiments of 68Ga-GD2BP were performed in neuroblastoma tumor cells with varying levels of GD2 expression. Ex vivo biodistribution and Animal PET/CT imaging of 68Ga-GD2BP were performed in mice bearing Neuroblastoma, breast cancer and osteoblastoma xenografts. Tumor uptake of 68Ga-GD2BP (percentage of injected dose, %ID/g) was compared with GD2 expression based on IHC results from tumor xenografts. ***Results:*** 68Ga-GD2BP was synthesized with high radiochemical purity. It was stable in PBS for 3 hours with radiochemical purity ranging from 96% to 98%. Cell binding specificity was confirmed by GD2 blockage. Positive correlation was found between tumor cell uptake of 68Ga-GD2BP and GD2 expression with R2 being 0.86. 68Ga-GD2BP was excreted rapidly via kidney and its retention in blood circulation was short. Tumor uptake of 68Ga-GD2BP (%ID/g) at 1h, 2h, 3h was (2.9±0.25), (3.8±0.7) (2.6±0.1) and (0.65±0.1 on 2h) at the block group. Tumor uptake of 68Ga-GD2BP at 2h post tail vein injection was positively corelated with GD2 expression revealed on IHC with R2 being 0.85. ***Conclusion:*** 68Ga-GD2BP, as one newly prepared GD2 targeted radiolabeled peptide, maybe promising for GD2 expression evaluation and patient screen for Anti-GD2 immunotherapy. ***References:*** 1.Marjolein C Stip, Mitchell Evers , Maaike Nederend , et al. IgA antibody immunotherapy targeting GD2 is effective in preclinical neuroblastoma models. J Immunother Cancer. 2023 Jul;11(7):e006948. 2.Stephan D Voss 1, Suzanne V Smith, Nadine DiBartolo, et al. Positron emission tomography (PET) imaging of neuroblastoma and melanoma with 64Cu-SarAr immunoconjugates. Proc Natl Acad Sci U S A. 2007 Oct 30;104(44):17489-93. 3.Irena Horwacik, Przemyslaw Golik, Przemyslaw Grudnik, et al. Structural Basis of GD2 Ganglioside and Mimetic Peptide Recognition by 14G2a Antibody.Mol Cell Proteomics.2015 Oct;14(10):2577-90.

OP-042

The value of ^{18}F-FDG PET/MR radiomic features in predicting MYCN amplification, 1p and 11q aberrations in pediatric neuroblastoma

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Aim/Introduction: The aim of this study is to evaluate the predictive ability of ^{18}F-FDG PET/MR radiomics features in MYCN amplification, 1p and 11q aberrations in pediatric neuroblastoma(NB). ***Materials and Methods:*** 139 pediatric patients (median age 3.5 years, range from 0.3 to 13.5 years) with NB were retrospectively enrolled. Preserve significant features through multivariate logistic regression and establish a clinical model (C_model) that included clinical features.^{18}F-FDG PET/MR radiomic features were extracted by Computational Environment for Radiological Research. Use the Least Absolute Shrinkage and Selection Operator (LASSO) regression to select radiomic features and establish a model (R model). Compare the predictive performance of models constructed from clinical features (C_ model), radiomics features (R_model), and their combination (CR_model) using receiver operating curve (ROC). A nomogram was developed based on radiomics score (rad score) and clinical parameters. ***Results:*** The patients were divided into a training set (n = 97) and a testing set (n = 42). Accordingly, 5, 7, and 6 radiomic features were selected to establish R_models for predicting MYCN, 1p and 11q status. The R_ model demonstrated a strong ability to recognize these aberrations, with ROC area under the curve (AUC) of 0.89, 0.91, and 0.90 in the training set, and 0.91, 0.90, and 0.89 in the testing set, respectively. When combining clinical and radiomics features, the AUCs in the training set increased to 0.97, 0.95, and 0.98, while the AUCs in the test set increased to 0.97, 0.90,

and 0.92. The CR_models had the highest predictive performance for MYCN, 1p and 11q predictions ($P < 0.05$). ***Conclusion:*** The pre-therapy ^{18}F-FDG PET/MR radiomics features can predict MYCN amplification and 1p and 11q aberrations in pediatric NB, thereby aiding in tumor staging, risk stratification, and disease management in clinical practice.

OP-043

Significant Dose Reduction employing Dual-Low-Dose Total-Body PET/CT in Pediatric Lymphoma while Maintaining Diagnostic, Staging and Response-assessing Efficacy

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Aim/Introduction: To explore a clinical dual-low-dose total-body (TB) PET/CT strategy on pediatric lymphoma patients by using low-dose PET and two different low-dose CT protocols, and estimate the corresponding clinical efficacy. ***Materials and Methods:*** Total 246 pediatric patients were retrospectively enrolled and divided into low-dose PET/low-dose CT group (LDCT, n=127), and low-dose PET/ultra-low-dose CT group (ULDCT, n=119). Image quality was evaluated based on subjective and objective metrics. The sensitivity, specificity and area under curve (AUC) for detecting involvements of lymph node, spleen, bone marrow and other extranodal organs were compared. The accuracies of staging, treatment response assessment and effective dose (ED) were calculated and compared. ***Results:*** ULDCT had comparable CT objective scores relative to LDCT in terms of liver, blood pool and muscle. Both protocols had good or high diagnosing efficiency in all patterns of lymphoma involvement, with AUCs ranging from 0.883 to 1.00. The staging and response assessment accuracy were 93.2% and 94.0% for LDCT group, and 94.0% and 97.6% for ULDCT group, with no significance (p=0.221). The total ED was 9.7±3.2 mSv for LDCT and 5.6±1.9 mSv for ULDCT (p<0.001). ***Conclusion:*** Dual-low-dose TB PET/CT has demonstrated sufficient image quality and performed well in diagnosing, staging and response assessing in pediatric lymphoma patients. The ULDCT protocol can significantly reduce total ED relative to LDCT without compromising the performance in diagnostic, staging and treatment response assessment.

OP-044

^{18}F-FDG PET/MR in pediatric Langerhans cell histiocytosis

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Aim/Introduction: Langerhans cell histiocytosis (LCH) in pediatric patients is a disease that can affect single or multiple systems. Accurate staging is crucial for selecting a precise treatment plan ranging from local surgery to chemotherapy. ***Materials and Methods:*** A retrospective review was undertaken of reported ^{18}F-Fludeoxyglucose (FDG) PET/MR scans performed in pediatric LCH from June 2017 to June 2023. Research results were compared with a reference standard of biopsy or informed clinical follow-up. ***Results:*** 134 scans were performed in 44 patients (age 9 weeks to 14 years). 28 patients had single-system, bone unifocal disease; 8 patients had single-system, bone multifocal disease; 5 patients had single-system, skin unifocal disease; 1 patients had multisystem disease; and 2 patient had single-system, lymph node disease. 35 scans were performed to stage biopsy-proven LCH, and 99 scans were performed during follow-up to assess treatment response or recurrence after therapy completion. At staging, PET/MR detected all sites of biopsy-proven LCH. The per-patient false-positive rate of PET/MR at staging was 5.7% (2/35). During follow-up, 6 LCH recurrences and 2 case of progressive disease on therapy occurred, all positive on PETMR. During follow-up 3 patients had PET/MR scans with false-positive findings and 2 patient with a magnetic resonance imaging false-positive finding. The per-scan false-positive rate of PET/MR during follow-up was 3% (3/99). ***Conclusion:*** ^{18}F-FDG PET/MR is highly sensitive for the staging and follow-up of pediatric patients with LCH, and has a very low false-positive rate.

OP-045

The value of ^{18}F-FDG PET/MR radiomics nomogram in predicting bone marrow involvement in pediatric neuroblastoma

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Aim/Introduction: To develop and validate a radiomics nomogram based on ^{18}F-fluorodeoxyglucose (FDG) PET/MR for non-invasive prediction of bone marrow involvement (BMI) in pediatric neuroblastoma. ***Materials and Methods:*** A total of 120 patients with neuroblastoma were retrospectively included and randomized into the training set (n = 84) and test set (n = 36). Radiomics features were extracted from both T2WI and PET images. The radiomics signature was developed. Independent clinical risk factors were identified using the univariate and multivariate logistic regression analyses to construct the clinical model. The clinical-radiomics model, which integrated the radiomics signature and the independent clinical risk factors, was constructed using multivariate logistic regression analysis and finally presented as a radiomics nomogram. The predictive performance of the clinical-radiomics model was evaluated by receiver operating characteristic curves, calibration curves and decision curve analysis (DCA). ***Results:*** Ten radiomics features were selected to construct the radiomics signature. Neuron-specific enolase and vanillylmandelic acid were identified as independent predictors to establish the clinical model. In the training set, the clinical-radiomics model outperformed the radiomics model or clinical model (AUC: 0.939 vs. 0.911, 0.899) in predicting the BMI, which was then confirmed in the test set (AUC: 0.931 vs. 0.900, 0.909). The calibration curve and DCA demonstrated that the radiomics nomogram had a good consistency and clinical utility. ***Conclusion:*** The ^{18}F-FDG PET/MR-based radiomics nomogram which incorporates radiomics signature and independent clinical risk factors could non-invasively predict BMI in pediatric neuroblastoma.

OP-046

The value of radiomic features and quantitative parameters based on PET/MRI in predicting MYCN gene amplification in pediatric neuroblastoma

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Aim/Introduction: To explore the value of radiomics features and quantitative parameters based on 18F-FDG PET/MRI in predicting MYCN gene amplification in pediatric neuroblastoma (NB).

Materials and Methods: A retrospective analysis was conducted on the PET/MRI imaging data of 125 pediatric patients (56 males and 69 females, aged 0.5 to 13.5 years) who were pathologically confirmed by pathology as NB in our hospital from April 2017 to December 2023. According to the copy number of the target gene, the children were divided into amplification group and non amplification group. Preserve salient features through multiple logistic regression and establish a parameter model (Q_model) that includes quantitative parameters. Extract radiomics features from PET and T2WI images separately and perform feature screening.Using logistic regression to construct an R_model based on radiomics features, and calculating the radiomics score (Rad_score). Based on R_ Model, Q_ Model construction joint model (RQ_model). Evaluate the predictive performance of the model using Receiver Operating Characteristic (ROC) curves. ***Results:*** The training set includes 87 children with NB (53 in the MYCN amplification group and 34 in the non amplification group), and the validation set includes 38 children with NB (25 in the MYCN amplification group and 13 in the non amplification group). Four radiomics features were obtained through screening, two of which were based on T2WI images and the other two were based on PET images. In the training set, the ROC area under the curve (AUC) of the R_ Model, Q_ Model, RQ_Model predicting the MYCN gene amplification status in NB were 0.92, 0.87, and 0.96, respectively;In the validation set, the AUCs of the R_ Model, Q_ Model, RQ_Model predicting the MYCN gene amplification status in NB were 0.91, 0.83, and 0.98, respectively. RQ_ model has the highest predictive performance for MYCN gene amplification. ***Conclusion:*** The radiomics features of PET/MRI can accurately predict the MYCN gene amplification status in NB. By combining metabolic parameters, the accuracy of predicting MYCN gene amplification can be further improved, providing assistance for the development of personalized and precise treatment plans for NB.

OP-047

Interim PET in Pediatric High Grade B Lymphomas; Future is Predictable

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Aim/Introduction: Pediatric Non-Hodgkin Lymphomas (NHL) are highly heterogenous and it is hard to determine residual disease on interim PET-CT. High-grade B-cell lymphoma (HGBCL) is the most common type of NHL that differs from other types. It has been shown that, the use of metabolic parameters such as metabolic tumor volume (MTV) and total lesion glycolysis (TLG) can be more advantageous than Deauville-Score (DS), especially in terms of predicting prognosis. The aim of the study is to compare the performance of DS and MTV&TLG in predicting disease recurrence in pediatric HGBCL. ***Materials and Methods:*** HGBCL patients under 18 years of age with interim PET-CT images were included. In this retrospective-single-center study; DS, whole-body TLG of the pediatric patients were evaluated. SUVmax-2.5 threshold was used for TLG. Patients with DS3-4 and TLG values higher than median were considered having residual disease. Follow-up data of the patients was obtained. The performance of interim imaging about predicting early recurrence after completion of treatment was investigated. Disease recurrence and disease-related-death are defined as events; survival analyses were performed. ***Results:*** A total of 56 patients (39 male) were included to the study. The mean age was 9.9 years (± 4.5 years). The mean follow-up period was 88 months (± 5.3 months). Recurrence was observed in 6 (%11) patients. The median DS, MTV and TLG in interim PET-CT were 1 (min-max: 1-5), 0 cm3 (min-max: 0-216) and 0 (min-max: 0-3163), respectively. The number of patients considered positive for residual disease in DS3, DSTLG was 18, 12 and 11, respectively. All patients considered positive on TLG were also positive for DS. Kaplan-Meier survival-analyses showed no statistically-significant difference between the survival curves according to the DS3-4 prediction values. The median survival was not reached for all assessment type. Best mean-survival-difference obtained from the TLG-positivity (147 vs 100 months), and event-free survival was the worst in the TLG-positive group (p= 0.01). ***Conclusion:*** This study, in a larger cohort; metabolic markers obtained from interim PET-CT showed a better performance on prediction for the recurrence than DS. This high prediction performance can change the treatment plan and follow-up process with contribution to the clinical-judgement. Metabolic parameters can be helpful, especially in cases with DS3 and DS4. Studies on accurate TLG threshold values can be determined by ongoing studies in the future.

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Sunday, October 20, 2024, 08:00 - 09:30
Hall G2

TROP Session: Cardiovascular Committee: From Flow to Myocardium the Unsuspected Virtues of Molecular Cardiology

OP-049

Preliminary Study on the Feasibility of Fast Low-dose (FLow) One-day Dynamic CZT-SPECT Protocol Acquisition

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Aim/Introduction: Non-invasive assessment of myocardial blood flow (MBF) and perfusion reserve (MPR) by low-dose dynamic cadmium-zinc-telluride single-photon emission computed tomography (CZT-SPECT) is a well-known tool evaluating coronary artery disease (CAD). Standard acquisition protocols require waiting time between rest and stress dynamic and perfusion scans, with consequent patient motion. Residual Activity Correction (RAC) is a recommended tool evaluating quantitative data obtained by SPECT with 99mTc-labeled tracers performing one-day studies. Thus, we aimed to evaluate the feasibility of a Fast Low-dose (FLow) one-day dynamic CZT-SPECT protocol acquisition, with and without RAC, compared to 82Rb-PET/CT, in a selected cohort. ***Materials and Methods:*** We evaluated 20 patients with suspected or known CAD. All patients underwent fast low-dose one-day dynamic rest/stress CZT-SPECT: dynamic rest and stress scans were immediately followed by standard rest and stress myocardial perfusion imaging (MPI), with no waiting time between rest and stress. All patients underwent 82Rb-PET/CT within 3 weeks after dynamic CZT-SPECT imaging, according to clinical decision. For both PET and CZT-SPECT, MBF for each of the three vascular territories were computed from dynamic rest and stress scans. Global and regional MPR were defined as the ratio of hyperemic to baseline MBF. Moreover, RAC was applied to

stress MBF and MPR by CZT-SPECT, and the results were compared to both PET and CZT-SPECT without RAC. ***Results:*** The mean scan duration by CZT-SPECT FLow protocol was 29±3 minutes. MPI by both PET and CZT-SPECT resulted concordant in each patient. Comparison of hyperemic MBF and MPR values by CZT-SPECT, with and without RAC, showed no significant differences in the mean values (2.51±0.79 vs 2.33±0.77, p=0.303; 2.68±0.79 vs 2.56±1.13, p=0.622). When compared to PET, absolute baseline and hyperemic MBF by CZT-SPECT resulted significantly lower, both without (0.97±0.30 vs 1.30±0.32, p=0.002; 2.51±0.79 vs 3.52±0.79, p<0.001, respectively) and with RAC (2.33±0.77 vs 3.52±0.79, p<0.001). Meanwhile, no significant difference emerged between CZT-SPECT and PET MPR, both without (2.68±0.79 vs 2.81±0.74, p=0.466) and with RAC (2.56±1.13 vs 2.81±0.74, p=0.350). Similar results were obtained for regional baseline and hyperemic MBF and MPR. Moreover, at univariate Cox's logistic regression analysis only CZT-SPECT MPR with RAC resulted significant predictor of reduced MPR obtained by PET (p<0.05). ***Conclusion:*** These preliminary results show that fast low-dose one-day dynamic CZT-SPECT may be a feasible and useful tool to evaluate coronary vascular function, providing results comparable to 82Rb-PET/CT, and shortening dramatically acquisition time, with less motion and waiting time for the patient.

OP-050

Radiomics Nomogram Derived from Gated Myocardial Perfusion Imaging for Identifying Ischemic Cardiomyopathy

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Aim/Introduction: Personalized management involving heart failure (HF) etiology is crucial for better prognoses. We aim to evaluate the utility of a radiomics nomogram based on gated myocardial perfusion imaging (GMPI) in distinguishing ischemic from non-ischemic origins of HF. ***Materials and Methods:*** A total of 172 heart failure patients with reduced left ventricular ejection fraction (HFrEF) who underwent GMPI scan were divided into a training (n=122) and validation set (n=50) based on chronological order of scans. Radiomics features extracted from the resting GMPI were calculated for the Radscore. A radiomics nomogram was constructed based on the Radscore and independent clinical factors. Finally, the model performance was validated using operating characteristic curves, calibration curve, decision curve analysis, integrated discrimination improvement values (IDI) and the net reclassification index (NRI). ***Results:*** Three optimal radiomics features were used to build a radiomics model. Total perfusion deficit (TPD) was identified as the independent factors of conventional GMPI metrics for building the GMPI model. In the validation set, the radiomics nomogram integrating the Radscore, age, systolic blood pressure, and TPD significantly outperformed the GMPI model in distinguishing ischemic cardiomyopathy (ICM) from non-ischemic cardiomyopathy (NICM) (AUC 0.853 vs. 0.707, p=0.038). IDI analysis indicated that the nomogram improved diagnostic accuracy by 28.3% compared to the GMPI model in the validation set. ***Conclusion:*** By combining radiomics signatures with clinical indicators, we developed a GMPI-based radiomics nomogram that helps to identify the ischemic etiology of HFrEF.

OP-051

The relationship between left ventricle mechanical dyssynchrony and increased clearance of ^{99m}Tc-MIBI in chronic heart failure patients

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Aim/Introduction: The radiopharmaceutical 99mTc-methoxy-isobutyl-isonitrile (99mTc-MIBI) is a widely used perfusion radiotracer, which accumulated and store in the mitochondria of cardiomyocytes for a long time without further redistribution. It is known that increased washout of 99mTc-MIBI from cardiomyocytes, according to myocardial perfusion imaging (MPI), may reflect mitochondrial dysfunction. There are limited studies that have examined 99mTc-MIBI clearance from the myocardium in chronic heart failure (CHF) patients. Currently, it remains unclear, whether there is a relationship between the mitochondrial dysfunction in CHF patients, impaired contractility and LV dyssynchrony. The aim of this study was to evaluate the 99mTc-MIBI washout rate (WR) from the myocardium and its relationship with left ventricle (LV) contractility and mechanical dyssynchrony indices in non-ischemic CHF patients. ***Materials and Methods:*** The study included 20 non-ischemic CHF patients who had indications for cardiac resynchronization therapy (CRT). Ten patients without CHF were included in the control group. All patients underwent rest gated MPI with 99mTc-MIBI, according to the early (1 hour) and delayed (3 hours) acquisition protocol for evaluating 99mTc-MIBI WR, contractility, and mechanical dyssynchrony. Follow LV contractility indices were evaluated: wall motion, wall thickening. Follow LV mechanical dyssynchrony indices were evaluated by phase analysis: phase standard deviation (PSD), phase histogram bandwidth (HBW), skewness, and kurtosis. Six months after CRT, 15 patients underwent MPI to assess the changes of 99mTc-MIBI clearance. ***Results:*** According to MPI data, CHF patients had a higher 99mTc-MIBI WR from the myocardium compared to the control group (10.9 (8.49-13.8)% versus 3.98 (0.9-9.8)%, p=0.0001), as well as higher LV mechanical dyssynchrony (PSD: 66 (55.11-73.24) degrees versus 13.1 (10.1-19.6) degrees, p<0.0001; HBW: 207 (165-246) degrees versus 40 (33-66) degrees, p<0.0001). The 99mTc-MIBI WR was positively correlated with LV end-diastolic (r=0.46, p<0.001) and LV end-systolic (r=0.44, p<0.001) volumes and negatively correlated with LV ejection fraction (r=0.41, p<0.001). A moderate correlation was found between 99mTc-MIBI WR and indices of LV mechanical dyssynchrony and contractility: HBW (r=0.412, p<0.001), skewness (r=-0.41, p<0.001), kurtosis (r=-0 .44, p<0.001), wall motion (r=-0.45, p=0.001), wall thickening (r=-0.54, p<0.001). Six months after CRT, 99mTc-MIBI WR significantly decreased from 12.4 (10.3-14.9)% to 8.14 (3.37-8.88)%, p = 0.0006. ***Conclusion:*** In non-ischemic CHF patients, an increase of 99mTc-MIBI WR from the LV myocardium is associated with the severity of impaired contractility and heart mechanical dyssynchrony. MPI with 99mTc-MIBI can be used as non-invasive method for assessing mitochondrial dysfunction of cardiomyocytes.

OP-052

A study for prediction of CRT super response using left ventricle mechanical dyssynchrony parameters in short-term period

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Aim/Introduction: The left bundle branch block, nonischemic heart failure (HF) and female gender are the most powerful predictors of a super response to cardiac resynchronization therapy (CRT). It is important to identify super responders who can derive most benefits from CRT. It is known that a serious impact to the HF progression is made by mechanical dyssynchrony (MD), which is characterized by temporary heterogeneity of activation and contractility in various ventricular segments of the heart. The predictive values of MD assessed by nuclear medicine techniques in CRT candidates have been reported in a number of studies. We aimed to establish a predicting model that could be used for prognosis of a super response to CRT in short-term period. ***Materials and Methods:*** Patients with QRS ≥ 130 ms, New York Heart Association (NYHA) II-III class of HF, left ventricle ejection fraction (LVEF) ≤ 35% and indications for CRT were included in the study. Before and 6 month after CRT the electrocardiography, transthoracic echocardiography and cardiac scintigraphy were performed. The study's primary endpoint was the NYHA class improvement ≥ 1 and left ventricle end systolic volume decrease > 30% or LVEF improvement > 15% after 6 month CRT. Based on collected data, we developed a predictive model regarding a super response to CRT. ***Results:*** In overall 49 (100.0%) patients, 32 (65.3%) had a super response to CRT. Patients with a super response were likelier to have a lower cardiac index (p=0.007), higher rates of interventricular delay (IVD) (p=0.003), phase standard deviation of left ventricle anterior wall (PSD LVAW) (p=0.009) and ΔQRS (p=0.02). Only left ventricle MD parameters (IVD and PSD LVAW) were independently associated with a super response to CRT in univariate and multivariate logistic regression (odds ratio [OR] 1.02, 95% confidence interval [CI] 1.00-1.04, p<0.001 and OR 1.06; 95% CI 1.00-1.13; p<0.001, respectively). We created a predictive model of super response to CRT using these MD indicators in logistic equation and calculated a cut-off value. The model demonstrated discrimination ability evidenced by an AUC of 0.812 (sensitivity 90.62%; specificity 70.59%). The developed predictive model resulted in an accuracy of 81.6% in correctly diagnosing the CRT super response in our study cohort. ***Conclusion:*** We have developed a predictive model using left ventricle MD indicators, which could be applied for the prediction of a super response to CRT in short-term period and selection of most suitable patients in clinical practices.

OP-053

A study for risk stratification of sustained ventricular tachycardia with cardiac ^{123}I-MIBG scintigraphy parameters in patients with CAD and ICD

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Aim/Introduction: Multiple lines of evidence point to a pivotal role of the cardiac autonomic nervous system (CANS) in the development and maintenance of ventricular tachycardia (VT). The impaired heart sympathetic innervation and increased sensitivity of the myocardium to catecholamines can serve as VT trigger factors. Most of the trials devoted to the CANS activity assessment show the importance of one of various methods such as cardiac scintigraphy, heart rate variability (HRV) or erythrocyte membranes β-adrenoreactivity (EMA) assessment. This prospective study aimed to investigate the ability of CANS activity assessment in stratifying for sustained VT in patients with coronary artery disease (CAD) and implanted cardioverter-defibrillator (ICD) during mid-term follow-up period. ***Materials and Methods:*** We enrolled patients with CAD and ICD implantation indications. Before ICD implantation CANS was assessed by using HRV, myocardium scintigraphy with 123I-meta-iodobenzylguanidine (123I-MIBG) and EMA. The study's primary endpoint was the documentation of sustained VT according to ICD endogram recordings. Based on collected data, we developed a risk model regarding a sustained VT. ***Results:*** In overall 45 (100.0%) patients with ICD, 15 (33.3%) had sustained VT event during 30.0 [28.0; 52.0] months follow-up period. Patients with sustained VT were likelier to have a higher summed 123I-MIBG score delayed (p<0.001) and lower 123I-MIBG washout rate (p=0.008) indicators. These parameters were independently associated with endpoint in univariate and multivariate logistic regression (odds ratio [OR] 1.234, 1.079-1.412, p<0.001 and OR 0.665, 0.501-0.883, p<0.001, respectively). We created a logistic equation and calculated a cut-off value. The resulting ROC curve revealed a discriminative ability with AUC of 0.933 (sensitivity 100.00% and specificity 93.33%). The developed risk stratification model resulted in an accuracy of 95.56% in correctly diagnosing sustained VT in our study cohort. ***Conclusion:*** In patients with CAD and ICD occurrence of sustained VT associated with the CANS activity dysfunction. Our risk model including cardiac 123I-MIBG scintigraphy parameters is able to predict sustained VT in patients with CAD during mid-term follow-up period after ICD implantation. Independent prospective cohort studies should further validate our risk stratification model.

OP-054

Transient ischemic dilatation evaluated using non-gated ^{15}O-water PET

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Aim/Introduction: Left ventricular (LV) transient ischemic dilatation (TID) during myocardial perfusion imaging is a known cardiac risk marker. TID can be assessed by measuring the ratio of LV end-diastolic volume (EDV) during rest and stress. 15O-water PET allows simultaneous assessment of myocardial blood flow (MBF) and LV-volumes, and thus, it should be possible to evaluate both perfusion and TID during routine PET-scanning. Blood-pool gated 15O-water has been shown a feasible alternative to assess LV-volumes but requires extra post-processing. It would therefore relevant to assess the possibility to quantify TID without ECG-gating. The aim of this study was to assess the prognostic value of TID calculated with non-gated 15O-water PET. ***Materials and Methods:*** We retrospectively evaluated 783 consecutive patients with suspected CAD who performed rest/adenosine-stress 15O-water PET. Additionally, 44 patients with primary mitral regurgitation (MiR) with same-day PET and CMR and 15 subjects with same-day test-retest PET were included. LV EDV was automatically quantified using non-gated parametric blood volume images (1) and compared to

CMR measurements. Repeatability was assessed in the test-retest group. EDV ratio was defined as EDV stress/EDV rest*100. Patients in the CAD cohort were followed and major adverse cardiac events (MACE) were defined as cardiovascular death or hospitalization for myocardial infarction, unstable angina pectoris and acute heart failure. The prognostic value of EDV ratio was evaluated using Cox hazard ratios (HR[95% confidence interval]) and compared to stress MBF and myocardial flow reserve (MFR). ***Results:*** In the MiR patients, EDV from PET and CMR correlated well (r=0.88, p<0.001) with small bias (-10±26 ml, p=0.02). In the test-retest group, EDV was highly repeatable (172±67 vs 169±71 mL, p=0.4; repeatability coefficient 29 mL (17%)). In the CAD cohort, MACE was registered in 102 patients (median follow-up 3.6 years). Patients with MACE had significantly higher EDV ratio (95.3±14.3% vs 89.3±12.5%, p<0.001). EDV ratio was negatively correlated to stress MBF and MFR (r=-0.22 and -0.29, p<0.001). Correcting for age and sex, the EDV ratio was prognostic (HR 1.02[1.01-1.04]), but lost independent significance when adding stress MBF or MFR to the model. ***Conclusion:*** LV EDV and TID can be evaluated with non-gated 15O-water PET. EDV ratio was associated with reduced perfusion and adverse outcomes in patients with suspected CAD, but stress MBF and MFR remained stronger predictors of cardiac events. ***References:*** 1.Harms H J et al. J Nucl Med. 2016

OP-055

Stress myocardial blood flow would predict all-cause, cardiovascular and non-cardiovascular mortality in hemodialysis population.

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Aim/Introduction: N13-ammonia positron emission tomography (PET) is an established diagnostic test for IHD. We have reported that stress myocardial blood flow (MBF) and coronary flow reserve (CFR) derived from N13-ammonia PET would predict all-cause mortality in hemodialysis (HD) population in previous studies. We investigated their cardiovascular (CV) and non-CV mortality in HD population in this study. ***Materials and Methods:*** 1,020 HD patients who undergone N13-ammonia PET for suspected IHD from May 2013 to May 2022 were enrolled. They were divided into two groups according to median value of stress MBF; the lower stress MBF group (stress MBF<1.96, n=504) and the higher stress MBF group (stress MBF>= 1.96, n=516). We have followed them in 1282 days (median, 1st-3rd quartile was 510-2116). We collected their prognosis; all-cause, cardiovascular and non-cardiovascular mortality. Cardiovascular mortality included sudden death. ***Results:*** Kaplan-Meyer and cox univariate analysis showed intergroup difference in all-cause mortality (log rank p<0.001, hazard ratio (HR): 1.967, 95% confident interval (CI); 1.549-2.500), CV mortality (log rank p<0.001, HR: 2.016, 95%CI 1.395-2.914) and non-CV mortality (log rank p< 0.001, HR: 1.932, 95%CI 1.411-2.644). Multivariate cox analysis showed that stress MBF (continuous value) was an independent predictor for all-cause (p<0.001, HR: 0.4822, 95%CI 0.384-0.604), CV mortality (p<0.001, HR: 0.426, 95%CI 0.298-0.603) and non-CV mortality (p<0.01, HR: 0.529, 95%CI 0.393-0.711). ***Conclusion:*** In HD population, stress MBF would be an important predictor for all-cause, CV and non-CV mortality.

OP-056

Incremental prognostic value of ^{18}F-FDG myocardial ischemic memory imaging for major adverse cardiovascular events in patients with suspected unstable angina

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Aim/Introduction: ^{18}F-FDG PET myocardial ischemia memory imaging can be used for diagnosing myocardial ischemia. It may potentially enhance risk stratification. However, its incremental prognostic value for suspected unstable angina (UA) patients remains unclear. This study aimed to evaluate whether ^{18}F-FDG PET myocardial ischemic memory imaging provides additional prognostic value for major adverse cardiac events (MACE) compared to clinical risk factors, GRACE score, and coronary artery calcium score (CACS) in suspected UA patients. ***Materials and Methods:*** This study conducted a post-hoc analysis based on a prospective study, including 265 suspected UA patients (62.3% male, mean age 65.0 ± 9.4 years). All patients underwent rest ^{18}F-FDG PET myocardial ischemic memory imaging and coronary angiography. ^{18}F-FDG positive was defined as focal or focal on diffuse uptake patterns. MACE was defined as a composite of cardiovascular death, acute myocardial infarction, heart failure, rehospitalization for unstable angina, unplanned coronary revascularization, and stroke. Multivariable Cox regression analysis was used to identify risk factors for MACE in suspected UA patients. The incremental prognostic value of ^{18}F-FDG PET myocardial ischemic memory imaging relative to clinical risk factors, GRACE score, and CACS was evaluated using C-index, net reclassification improvement (NRI) and integrated discrimination improvement (IDI). ***Results:*** During a median follow-up of 25 months, 51 (19.2%) patients experienced MACE. Multivariable Cox regression analysis showed that after adjusting for coronary revascularization and other confounding variables, ^{18}F-FDG positive was an independent predictor of MACE in suspected UA patients (HR=3.220, 95% CI: 1.630-6.360, P<0.001). ^{18}F-FDG PET myocardial ischemic memory imaging significantly improved risk stratification for suspected UA patients compared to clinical risk factors, GRACE score, and CACS (C index, 0.769 vs 0.688, P=0.045; NRI, 0.324, P=0.020; IDI, 0.055, P=0.027). ***Conclusion:*** Compared to clinical risk factors, GRACE score, and CACS, ^{18}F-FDG PET myocardial ischemic memory imaging has significantly increased prognostic value in predicting MACE in suspected UA patients. Submitting patients with suspected UA to ^{18}F-FDG PET myocardial ischemic memory imaging can help to improve their risk stratification.

OP-057

Utility of myocardial angiogenesis imaging with 99mTc HYNIC Cyclo(RGDfk)2 (RGD) SPECT/CT for myocardial viability assessment

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Aim/Introduction: Obstructive coronary artery disease is treated by revascularization. The benefits of revascularization are most notable when hibernating myocardium is present. Myocardial viability is assessed with MIBI and FDG scans, which have shortcomings1. Radiolabelled RGD-peptide is used to image areas of neoangiogenesis. We compared RGD and FDG scans for myocardial viability assessment. ***Materials and Methods:*** In this

prospective study, CAD patients considered for revascularization underwent 99mTc-HYNIC-Cyclo(RGDfk)2 SPECT/CT in addition to the routine myocardial viability imaging. Patterns of RGD distribution were visually analysed. Segmental scores from 0 to 4 were assigned based on the degree of RGD uptake (0 = no uptake and 4 = intense uptake). Viability was defined as reduced perfusion with increased RGD or FDG uptake. Per-segment myocardial viability was compared between MIBI/RGD and MIBI/FDG pairs. Summed rest scores (SRS) and summed RGD scores (SRGS) were also analysed alongside cardiac MRI parameters. ***Results:*** Scans of 33 patients were included for analysis (30 males and 3 females). 22/33 patients had perfusion defects in a total of 150 segments. RGD uptake was noted in 31/33 (94%) patients and 93/150 (62%) perfusion defects. In 37 (24.7%) segments, RGD uptake was more than FDG; in 27 (18%) segments, FDG uptake was more than RGD. The two viability assessment methods were concordant in 57.3% and discordant in 42.7% of segments (Cohen's κ = 0.124). 23 patients had a previous history of MI, and 22 (96%) of them showed focal RGD uptake. 10 patients had no history of MI, and 7 (70%) of them showed diffuse RGD uptake (7/10). A negative correlation was observed between SRS (mean = 19.47, SD = 13.26) and SRGS (mean = 49.5, SD = 14.07), with r= -0.57 ($p < 0.001$). SRGS showed positive correlations with LVEF (r = 0.43, p=0.032) and LV Global function index (r = 0.49, p=0.01). ***Conclusion:*** RGD uptake was higher than FDG uptake in rest perfusion defects. In 43% of the patients, there was discordance in viability assessments made with RGD and FDG scans. RGD uptake was noted in areas with no FDG uptake and, therefore, may not represent viable myocardium. A higher RGD uptake was noted in patients with no severe LV dysfunction.

References: 1.Beanlands RSB, Nichol G, Huszti E, et al. F^{18}-fluorodeoxyglucose positron emission tomography imaging-assisted management of patients with severe left ventricular dysfunction and suspected coronary disease: a randomized, controlled trial (PARR-2). J Am Coll Cardiol. 2007;50(20):2002-2012. doi:10.1016/j.jacc.2007.09.006

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Sunday, October 20, 2024, 08:00 - 09:30
Hall F

e-Poster Presentations Session 1: Neuroimaging Committee: Neuroendocrine and Gastro Intestinal Cancers

EPS-001

Evaluation of the Diagnostic Utility of Amyloid PET/MRI in Cerebral Amyloid Angiopathy

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Aim/Introduction: Cerebral amyloid angiopathy (CAA) is an age-related degenerative condition caused by deposition of beta-amyloid in the walls of cerebral small vessels. The gold standard for diagnosis remains histopathological examination, although the Boston criteria provide clinicians with a probabilistic approach for diagnosis based on MRI imaging characteristics. This study aimed to evaluate the efficacy of amyloid PET (A-PET) in detecting CAA among individuals with mild cognitive impairment (MCI) and to understand associated uptake patterns. ***Materials and Methods:*** This prospective study enrolled 144 patients (76 women; median age: 71 years [range: 51-88]) previously diagnosed with mild cognitive impairment. All participants underwent PET/MRI using $^{[18F]}$Flutemetamol (GE Signa), with imaging conducted 90 minutes after the injection of 5 mCi. Image interpretation was carried out by radiologists and nuclear medicine physicians. A-PET images underwent both visual and quantitative assessments to detect the presence and localization of amyloid deposits. In the quantitative analysis, the pons served as a reference region, with average SUVR values up to 0.6 considered normal. Additionally, the deposition pattern of patients with CAA and those not meeting CAA criteria were analyzed visually (anterior or posterior deposition pattern) and quantitatively (comparing Z-scores of the occipital lobe with the prefrontal and global regions using Mann-Whitney statistical analysis). MRI sequences were evaluated using the Boston 2.0 criteria for cerebral amyloid angiopathy (CAA) diagnosis. ***Results:*** A-PET yielded positive results in 79 patients (55%), negative in 59 (41%), and uncertain in 6 (4%). MRI identified CAA in 11 patients; among them, 9 exhibited A-PET positivity while 2 were A-PET negative in both visual and quantitative analysis. Two out of eleven patients with CAA showed a predominantly posterior deposition pattern visually, while quantitative analysis comparing CAA with the rest of the patients yielded non-significant results when compared with the prefrontal lobe (p=0.82588) as well as globally (p=0.77182). A-PET demonstrated a sensitivity of 82% in detecting CAA when considering MRI as the gold standard for diagnosis of this disease. ***Conclusion:*** Our study revealed a limited sensitivity of A-PET in diagnosing CAA within our patient cohort, with 100% concordance between visual and quantitative analysis. Notably, among A-PET positive CAA patients, no distinct pattern emerged compared to other positive cases. While PET/MRI evaluations proved beneficial in this cohort, further research is necessary to delineate the precise role of A-PET in patients with cognitive impairment suspected of having Alzheimer's disease, particularly given the notable percentage presenting with angiopathy.

EPS-002

Imaging Amyloid in motor regions in Alzheimer's disease

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Aim/Introduction: Alzheimer's disease is characterized by abnormal deposits of ß-amyloid and accumulation of phosphorylated tau-protein. Amyloid deposition has been described in AD not only in brain regions associated with cognitive functions but also in motor-regions such as the

basal ganglia. These depositions have rarely been the focus of pathomechanistic studies, and it is not well studied whether they develop similarly to amyloid-deposits in other regions of the brain. Thus, the aim of this study was to investigate the development of amyloid-deposition in motor-relevant regions of the brain with advancing symptomatic disease. ***Materials and Methods:*** We included 1300 amyloid PET scans using [F^{18}]FBB or [F^{18}] AV-45 from the Alzheimer's Disease Neuroimaging Initiative (ADNI) cohort, including 502 cognitively unimpaired individuals (CU), 600 patients with mild cognitive impairment (MCI) and 198 patients with Alzheimer's Dementia (AD). SUVRs were calculated for cortical and subcortical motor-related brain regions (primary motor cortex, supplementary motor area, putamen, globus-pallidus). For comparison, a standard ROI was used which includes four large cortical regions (frontal, cingulate, parietal, temporal cortices). A repeated measurement ANOVA was performed to assess the group-related differences in amyloid pathology in each region. A partial correlation analysis was conducted in the clinical groups (MCI, AD) to assess the association between cognitive impairment (ADAS 13) and amyloid-deposits. ***Results:*** All examined brain regions, including cortical and subcortical motor-regions as well as AD-typical non-motor cortical regions showed a statistically significant increase in amyloid pathology with advancing disease stage. A significant correlation between cognitive impairment and amyloid burden was detected in non-motor and motor regions of MCI patients. In AD, a significant correlation between cognitive dysfunction and amyloid-burden was observed exclusively in the primary motor cortex and the SMA, whereas no correlation was found between amyloid-load in AD-typical non-motor regions and cognitive impairment. ***Conclusion:*** Amyloid burden increases with disease stage in cortical and subcortical motor-regions of the brain. Whereas amyloid levels in AD-typical as well as in motor-regions correlate with cognitive impairment in MCI, in AD the degree of cognitive impairment is no longer linked to amyloid-levels in AD-typical cortical regions but remains correlated to amyloid-levels in the SMA and the primary motor cortex. The maintained correlation of amyloid-levels in certain motor areas with disease severity even in manifest AD may indicate that these regions could be suitable for staging, in contrast to other brain regions for which a plateau of amyloid-deposition in early stages of dementia has been demonstrated.

EPS-003

MRI-based deep learning 3D Synthesis Amyloid-β PET for Assessment of Alzheimer's Disease

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Aim/Introduction: Amyloid-β (Aβ) is a core biomarker of Alzheimer's disease (AD), and Aβ PET is significant for early diagnosis and staging. However, the high cost of examination and exposure to radioactive radiation have limited the promotion of Aβ PET in early screening. With the development of deep learning algorithms, it has become possible to synthesize PET images based on MRI. Nevertheless, the current synthesis Aβ PET studies have focused on 2D image without considering meaningful information in other planes. The aim of this study was to generate 3D synthetic Aβ PET from MRI via image-to-image deep learning algorithm as important complement to early screening for AD. ***Materials and Methods:*** The high-resolution T1-weighted image (3D T1WI) and 18F-florbetapir (18F-AV45) PET data were retrospectively collected in pairs from Alzheimer's Disease Imaging Initiative (ADNI) and Xuanwu Hospital, Capital Medical University. Enrolled subjects included healthy control, mild cognitive impairment, AD, and other dementia. 18F-AV45 PET was aligned to paired 3D T1WI and then both were normalized to Montreal Neurologic Institute space. Standardized uptake value ratio map was calculated relative to the cerebellum. The share generative adversarial network (Share-GAN) model was trained on ADNI data and tested on hospital data. Two discriminators were designed based on Patch GAN, using conv3D instead conv2D for 3D image input. Synthetic PET image quality was evaluated using quantitative metrics, including the structural similarity index measure (SSIM), peak signal-to-noise ratio (PSNR), and mean absolute error (MAE). Two senior radiologists assessed Aβ deposition status by synthetic PET. ***Results:*** 676 patients (age, 76.0 ± 7.6 years; 386 female patients; 18F-AV45 = 364.6 ± 27.7 MBq) from ADNI were included in the training set, 163 patients (age, 64.7 ± 7.8 years; 103 female patients; 18F-AV45 = 383.0 ± 14.5 MBq) from Xuanwu Hospital were included in the testing set. A high degree of likeness across the testing set, which had a mean SSIM = 0.909, PSNR = 37.569 and MAE = 0.030. 3D Synthetic Aβ PET showed reliable diagnostic accuracy for Aβ deposition status, with accuracy = 83.4%, sensitivity = 83.2%, specificity = 60.4%, and F1 score = 88.5% in the testing set. ***Conclusion:*** We propose a Share-GAN model to generate 3D synthesize Aβ PET images with comparable image quality to real Aβ PET and excellent discrimination of Aβ deposition status. This may provide a low-cost Aβ PET-like auxiliary imaging method for AD patients to screen those who require real PET.

EPS-004

Amyloid deposition and glymphatic system dysfunction in early Alzheimer's disease

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Aim/Introduction: The glymphatic system is assumed to play an important role in the clearance of disease proteins in neurodegenerative diseases. A new index using MR-DTI was used to evaluate glymphatic system function in early Alzheimer's disease (eAD) and compared to brain amyloid deposition measured by [^{11}C]Pittsburgh compound-B (PiB) PET/MRI. ***Materials and Methods:*** Sixty patients with mild cognitive impairment (MCI) and eAD (70±11 years) underwent [^{11}C]PiB PET/MRI to assess amyloid deposition and were compared with 30 age-matched cognitive normal subjects (CN: 69±10 years). All subjects were evaluated for cognitive abilities using the Mini Mental State Examination (MMSE) before PET/MRI. Multiple MRI sequences were also acquired during the PET scan including 3D-T1WI, diffusion tensor imaging (DTI), etc. The centiloid scale was obtained using standardized uptake value ratio (SUVR) images calculated from static PiB PET data at 50-70 min post-injection with the reference region of the whole cerebellum. To assess the functional activity of the glymphatic system in the brain, the DTI analysis along the perivascular space (DTI-ALPS) index was calculated. Regional parametric values and other biomarkers were compared using ANOVA and Pearson's regression analysis. ***Results:*** All patients in the eAD group had positive brain [^{11}C]PiB accumulation, while those in the CN group had negative accumulation. There was a significant difference in MMSE scores between eAD (24±4) and CN (28±4) groups. Mean PiB centiloid scales for the two groups were 78.5 ± 33.4 and 0.4 ±

6.7 (P<0.0001), respectively. The ALPS-indexes were significantly lower in the eAD group compared to the CN group for both DTI b=1000 (1.43±0.08 vs. 1.28±0.11, P<0.00001) and DTI b=2000 (1.38±0.11 vs. 1.27±0.12, P<0.005). Correlations between ALPS-index, MMSE and VSRAD Z-score were significant for all pairs of biomarkers. In correlation with PiB centiloid, the ALPS-index for b=1000 showed a better correlation coefficient (r=0.66) than b=2000 (r=0.48), and the variance observed in the confidence interval was smaller for b=1000. When PiB centiloid was compared with other biomarkers after normalization, ALPS-index had a greater slope and better correlation coefficient (0.31, r=0.65) than the other correlations. ***Conclusion:*** Glymphatic system function measured by DTI-ALPS correlates closely with amyloid deposition in eAD. PiB centiloid correlated better with DTI-ALPS than other biomarkers, suggesting that glymphatic system function and disease protein deposition would cause neurodegenerative changes and cognitive dysfunction. ***References:*** [1] Okazawa H, et al. EJNMMI Res, 2020. [2] Taoka T, et al. Jpn J Radiol 2017. [3] Matsuda H, Yamao T. Brain Behav. 2022.

EPS-005

Positivity Thresholds using a Commercial Tau Quantification Tool in a Clinical Population

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Aim/Introduction: 18F-Flortaucipir PET has received approval to estimate density and distribution of neurofibrillary tau tangles in Alzheimer's disease patients based on a set of visual interpretation guidelines. This visual assessment differs from SUVR-based semi-quantification often used in research and clinical trials. The aim of this study was to determine regional 18F-flortaucipir SUVR positivity thresholds calculated using a dedicated commercially available application and compare them with visual interpretation. ***Materials and Methods:*** A cohort of 244 subjects (average age 71±9 years) with tau PET scans acquired 75 minutes post-injection of 197±39MBq of 18F-flortaucipir for 30 minutes, at the Geneva University Hospitals was selected. All images were visually assessed for tau positivity (based on the manufacturer's reading guidelines) and for Braak stage estimation, by an experienced reader (6 years). Images were additionally assessed for tau positivity using the same guidelines by two other nuclear medicine specialists with intermediate (1 year) or low (3 months) experience. Volume-weighted SUVR values were estimated in a meta-temporal VOI for global tau assessment, and in different Braak regions. SUVR-based global tau positivity threshold were calculated using visual ratings as gold standard and Youden's index. For each Braak region, tau positivity was defined as mean+2*SD SUVR within the considered region across 110 subjects visually classified as Braak 0 (i.e., visually tau negative for all Braak regions). ***Results:*** The tau SUVR positivity threshold for the meta-temporal VOI was 1.34 (specificity=0.79, sensitivity=0.95). There were 11.5% (28/244) mismatches between classifications based on meta-temporal SUVR and visual reads, with most cases being classified as tau negative based on SUVR, while positive on visual assessment. SUVR thresholds for Braak regions were: 1.41 (Braak I-II), 1.32 (Braak III), 1.34 (Braak IV), 1.28 (Braak V), and 1.23 (Braak VI). This resulted in a fair agreement compared to visual reads (Cohen's kappa=0.31). In general, subjects were classified with a lower Braak stage in comparison to visual assessment, and 65.6% (160/244) of cases were classified as Braak 0 based on SUVR thresholding. The agreement between the predicted tau status using the semi-quantitative threshold and visual inspection was similar across all raters (0.75 for the experienced, 0.72 for the intermediate, and 0.73 for the low experience reader, p<0.01). ***Conclusion:*** Commercial tau semi-quantification tools might be of aid to determine tau positivity. Thresholds identified in this cohort are comparable with values reported in the literature and resulted in a good agreement between quantitative and visual interpretations.

EPS-006

Diagnostic Yield of [123I]FP-CIT SPECT and [18F]DOPA-PET-CT in Parkinsonian Syndromes

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Aim/Introduction: Neurodegenerative pathologies with dopaminergic deficits reach a prevalence of 2% in individuals over 60 years old (1). Their diagnosis is exclusively clinical and constantly requires revisions for confirmation. In this context, dopamine transporter imaging tests are crucial tools to confirm the presence of Parkinsonian Syndromes (PS). Objectives: To compare parallel results of diagnostic yields for Parkinsonian syndromes using [123I]FP-CIT SPECT and [18F]DOPA-PET-CT against the final clinical diagnosis as the reference standard. ***Materials and Methods:*** A retrospective observational study was conducted on a sample of 67 patients with suspected parkinsonian syndromes who underwent diagnostic tests between January and December 2023. The results of each test were compared with the final clinical diagnosis as the reference standard. Sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), overall accuracy, Cohen's kappa index, and other relevant statistical data were calculated using R-studio version 4.3.3 for Windows. ***Results:*** Of the studied sample, 32 (47.8%) subjects underwent [123I]FP-CIT SPECT and 35 (52.2%) [18F]DOPA-PET-CT. The mean age observed was 69 ± 10.3 years, with 53.73% being women. The specificity of [18F]DOPA-PET-CT was 0.9523 (95% CI: 0.86-1.04), compared to 0.73 (95% CI: 0.50-0.95) for [123I]FP-CIT SPECT, with similar sensitivity of 0.92 (95% CI: 0.79-1.06) and 0.94 (95% CI: 0.82-1.05) respectively. The overall accuracy was 0.94 (95% CI: 0.86-1.01) for [18F]DOPA-PET-CT and 0.84 (95% CI: 0.71-0.96) for [123I] FP-CIT SPECT. The unweighted Kappa index was found to be 0.7544 (Z=10.382, p < 0.001), and the weighted Kappa index was 0.6513 (Z=6.434, p < 0.001), indicating substantial and moderate agreement between observers. ***Conclusion:*** The results show, in our population, good diagnostic performance of [18F]DOPA-PET-CT and acceptable performance in [123I]FP-CIT SPECT. Both tests effectively rule out the disease; however, only [18F]DOPA-PET-CT is suitable for confirming it. This is a parallel study where there is no direct comparison between imaging tests, so it is recommended to conduct prospective cross-comparative studies evaluating both tests in the same group of patients. ***References:*** Official clinical recommendations guide for Parkinson's disease. 2019, Spanish Society of Neurology.

EPS-007

The need of age-adjusted cut-offs for Z-score of DaT SPECT striatal binding ratio (SBR) to support the differential diagnosis between Parkinson's Disease (PD) and Essential Tremor (ET)

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Aim/Introduction: A cut-off of -2 z-score for DaT SPECT SBR has been arbitrarily proposed to define abnormal scans in patients with suspected neurodegenerative parkinsonism. We previously demonstrated that different and less conservative semiquantitative cut-offs increase sensitivity without decreasing test's specificity in the diagnosis of either PD or Dementia with Lewy Bodies. Aging is a further source of heterogeneity linked to the expected progressive loss of dopaminergic neurons. Here, we tested the accuracy of DaT SPECT parameters and z-score cut-offs in distinguishing PD from essential tremor (ET) in patients grouped by age. ***Materials and Methods:*** We retrospectively enrolled 275 patients (175 PD and 100 ET; age 68.7±8.7 vs. 70.5±7.7; females 40% vs. 57%) who underwent DaT SPECT in two centers (Genoa and Prague). The gold-standard was final clinical diagnosis after at least 2 years, irrespective from DaT SPECT result. Images were flipped obtaining the most affected hemisphere (MAH) on the same side and were analyzed with Datquant® version 2 to compute z-scores of striatum, substriatal regions and putamen/caudate (P/C) ratio. Patients were tested all together and binarized by median age (90 PD and 44 ET, range: 50-69 vs. 85 PD and 56 ET, range: 70-84). ROC curves, with a 5-fold cross-validation approach, were used to compute AUCs, sensitivity (Se), specificity (Sp) and Youden's index (YI) of Datquant-derived parameters and z-scores. AUCs were compared with the Hanley-McNeil method. ***Results:*** Clinical characteristics between the two subgroups of PD patients were not significantly different. The posterior putamen of the MAH was confirmed as the most accurate parameter for discriminating between PD and ET in the whole sample (AUC=0.99), with -1.1 as the most accurate z-score (Se=0.98, Sp=0.99, YI=0.97). Most accurate z-scores were -1.4 (Se=0.98, Sp=1, YI=0.98) for younger patients and -0.8 (Se=0.99, Sp=0.98, YI=0.97) for older patients. In all cases, -2 resulted less accurate compared to experimentally-identified age-tailored cut-offs (YI=0.90, 0.95, and 0.82), showing lower sensitivities (0.90, 0.95, and 0.82) with small or absent gains in specificity. The accuracy of the P/C ratio (AUC=0.88 in the whole sample) resulted significantly lower in the older subgroup when compared to younger patients (AUC=0.84 vs. 0.94; p=0.005). ***Conclusion:*** Age affects value and accuracy of z-score cut-offs for SBR. Regardless of aging, less conservative cut-offs are more sensitive but not less specific than -2. The added value of the P/C ratio is more pronounced in younger patients. These results have practical repercussions for the clinical settings.

EPS-008

Disease-tailored parameters and cut-offs for the diagnosis of Progressive Supranuclear Palsy (PSP): a semiquantitative approach to Dopamine Transporter (DaT) imaging in the memory clinic setting

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Aim/Introduction: DaT-SPECT is a valuable tool to support the diagnosis of PSP. Peculiar alterations (a more prominent involvement of the caudatus) have been suggested as potential features to identify PSP at visual-analysis. By contrast, semiquantitative approaches to DaT-SPECT has been tuned to define abnormal scans in Parkinson's Disease and Dementia with Lewy Bodies (DLB), but there's lack of studies tailoring semiquantification to support the suspect of PSP. We targeted most accurate z-score cut-offs for striatal binding ratio (SBR) to identify PSP with a specific focus on the memory clinic setting, when a differential diagnosis is needed with respect to patients presenting cognitive impairment with parkinsonism and/or frontal features. ***Materials and Methods:*** One-hundred nineteen consecutive patients (35 PSP, 20 Alzheimer's Disease (AD), 14 Fronto-temporal Dementia (FTD), and 50 DLB) referred to our memory clinic and submitted to DaT-SPECT were included. Cortico-basal syndrome/degeneration was not included given the low-accuracy of clinical diagnosis. Patients' clinical diagnosis after a 2-years follow-up was the gold-standard (regardless of DaT-SPECT results). For all patients' subgroups, striatal/substriatal regions' SBR were computed and z-scores were obtained with Datquant® in comparison with 118 healthy volunteers belonging to the Parkinson›s Progression Markers Initiative. ROC analysis was used to calculate accuracy (AUC), sensitivity (Se), specificity (Sp), and Youden's index (YI) to identify the most accurate z-score cut-offs in PSP compared to all other subgroups. ***Results:*** Severity of cognitive impairment (MMSE score 23.42±4.35 for the entire population) and mean age (76.35±6.33) were superimposable between PSP and other subgroups (p=ns). The most accurate parameter to discriminate between PSP and all other patients was the posterior-putamen in both hemispheres (AUC=0.71). The same substriatal region distinguished PSP from AD (highest accuracy -0.7 z-score; AUC=0.95, Se=0.87, Sp=0.90, YI=0.77) as well as PSP from FTD patients, although a more conservative cut-off was needed (-1.6 z-score; AUC=0.80, Se=0.74, Sp=0.71, YI=0.46). Only when comparing PSP and DLB, the bilateral caudatus resulted the most accurate parameter, but its diagnostic value was poor (AUC=0.59). ***Conclusion:*** The posterior-putamen was confirmed as the most accurate semiquantitative parameter also to support the diagnosis of PSP even in the memory clinic setting. A more pronounced alteration is needed to tell apart PSP with respect to FTD. The present semiquantitative approach confirmed a more prominent involvement of the caudatus nucleus in PSP compared to DLB, although the added diagnostic value was

low and this feature might only represent a red-flag to increase sensitivity for PSP.

EPS-009

Measurement of extrastriatal ^{18}F-FDOPA uptake in idiopathic Parkinson disease

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Aim/Introduction: Extrastriatal (ES) 18F-FDOPA uptake sites have been investigated previously with dynamic imaging and dedicated brain PET cameras. Visualization of midbrain "Mickey mouse" shape uptake is one of the visual landmark of 18F-FDOPA in current static imaging of idiopathic Parkinson disease (IPD) (1). We investigated the feasibility of semi-quantitative analysis of 18F-FDOPA midbrain and other ES structures on routine static 18F-FDOPA PET imaging. ***Materials and Methods:*** 40 IPD patients (mean age 70±9) H&Y 1 and 2 and 31 patients with essential tremor (ET) (mean age 69±12) were retrospectively analysed. One hour after Carbidopa premedication, patients were injected with 3 MBq/kg of 18F-FDOPA and scanned 90 minutes later. A SiPM PET/CT camera was used (Siemens Biograph Vision 600®). Static acquisition lasted 6 minutes; images were reconstructed including PSF correction. For each ES region, a 3D VOI was manually centered on maximal uptake and an isocontour adjusted to the volume of the corresponding structure: 0.5 cm3 for the substantia nigra pars compacta (SN); 1.5 cm3 for the periaqueductal gray (PAG) around the mesencephalic aqueduct. Beside these midbrain structures pineal gland (PG), anterior cingulate (AC) and entorhinal cortex (EC) uptake were measured as well as striatal to occipital uptake ratios (SOR using automatical VOI positioning; Siemens Striatal Analysis®). Striatal anteroposterior gradient was calculated. ***Results:*** As expected SORs were significantly decreased and posteroanterior gradient significantly increased in IPD vs ET ($p<0.001$) and were more severely reduced on the side contralateral to the dominant symptoms ($p< 0.001$) in IPD. SN contralateral SUVs were lower than on the ipsilateral side in IPD but no significant difference was found with ET. Original findings were higher PAG and EC SUVs in IPD than in ET ($p<0.01$). There was no other significant difference. ***Conclusion:*** PAG and EC increased uptake in IPD most likely reflects increased amino-acid decarboxylase activity in serotoninergic neurons, DOPA acting as a "false transmitter". These results show the feasibility of midbrain structure analysis using routine fast static imaging with a SiPM modern camera and open the way to serotonin-related PAG imaging with 18F-FDOPA PET. ***References:*** 1- Morbelli S et al. EANM practice guideline/SNMMI procedure standard for dopaminergic imaging in Parkinsonian syndromes 1.0. EJNMMI (2020) 47: 1885-1912.

EPS-010

A combined PET/MRI study on the interplay between dopamine D_1 receptor availability and iron levels in Gilles de la Tourette syndrome (GTS)

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Aim/Introduction: Gilles de la Tourette syndrome (GTS) is a neuropsychiatric disorder characterized mainly by motor and vocal tics. Literature suggests a dysregulated dopaminergic system, with a selective dopamine D1 receptor (D1R) antagonist providing promising treatment results. Recently, we reported D1R changes in patients with GTS in relation to the clinical disease severity. We now expand the investigations on our multimodal data to better understand the role of iron in dopamine neurotransmission in GTS. ***Materials and Methods:*** We performed D1R PET using [^{11}C]SCH23390 on a Siemens Biograph hybrid PET/3T MRI system in 20 patients with GTS and 20 age- and sex-matched healthy controls (HCs). After injection of 474 ± 31 MBq, participants underwent a 90 min. dynamic PET scan, whose data was motion-corrected and co-registered to individual T1-MP2RAGE MRI data. We performed kinetic modeling (MRTM2) to generate parametric binding potential (BPND) maps. As a surrogate for iron, Multi-Echo Gradient recalled Echo (ME-GRE) MRI sequence on a 7T MRI (Siemens Magnetom Terra) was used to model quantitative susceptibility mapping (QSM), R2* and paramagnetic component maps. Additionally, we took blood serum to assess ferritin, transferrin and iron levels. Group comparisons were conducted using two sampled t test, correlations were assessed using Spearman. ***Results:*** We found significant QSM signal reductions in patients with GTS compared to HCs in several subcortical brain regions such as pallidum (4.1 ± 2.3 vs. 5.6 ± 2.4, $p = 0.01$), caudate (2.9 ± 1.1 vs. 3.7 ± 1.6, $p = 0.03$) and thalamus (0.3 ± 0.2 vs. 0.5 ± 0.3, $p = 0.002$). This echoes the differences we found in D1R availability (E.g. caudate: 2.0 ± 0.2 vs. 2.2 ± 0.3, $p = 0.02$; thalamus: 0.3 ± 0.04 vs. 0.4 ± 0.1, $p = 0.03$). Iron-related serum markers showed reduced levels in patients for ferritin (95 ± 54 vs. 130 ± 88, $p = 0.04$) and transferrin (2.4 ± 0.2 vs. 2.6 ± 0.3, $p = 0.001$). ***Conclusion:*** These results indicate a potential link between iron brain accumulation and dopaminergic neurotransmission in patients with GTS and controls. Serum results support the hypothesis of disturbed hemic iron homeostasis in GTS.

EPS-011

^{18}F-FDG PET can effectively rule out conversion to dementia and the presence of CSF biomarker of neurodegeneration: a real-world data analysis

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Aim/Introduction: Precisely defining the delay in onset of dementia is a particular challenge for early diagnosis. Brain [18F] fluoro-2-deoxy-2-D-glucose (18F-FDG) Positron Emission Tomography (PET) is a particularly interesting tool for the early diagnosis of neurodegenerative diseases, through the measurement of the cerebral glucose metabolic rate. There is currently a lack of longitudinal studies under real-life conditions,

with sufficient patients, to accurately evaluate the predictive values of brain 18F-FDG PET scans. Here, we aimed to estimate the value of brain 18F-FDG PET for predicting the risk of dementia conversion and the risk of occurrence of a neurodegenerative pathology. ***Materials and Methods:*** Longitudinal data for a cohort of patients with no diagnosis of dementia at the time of recruitment referred by a tertiary memory clinic for brain 18F-FDG PET were matched with (1) data from the French National Health Data System (NHDS), (2) data from the National Alzheimer Bank (NAB), and (3) lumbar puncture (LP) biomarker data. The criteria for dementia conversion were the designation, within the three years after the brain 18F-FDG PET scan, of a long-term condition for dementia in the NHDS and a dementia stage of cognitive impairment in the NAB. The criterion for the identification of a neurodegenerative disease in the medical records was the determination of LP biomarker levels. ***Results:*** Among the 403 patients (69.9±11.4 years old, 177 women) from the initial cohort with data matched with the NHDS data, 137 were matched with the NAB data, and 61 were matched with LP biomarker data. Within three years of the scan, a 18F-FDG PET had negative predictive values of 85% for dementia conversion (according to the NHDS and NAB datasets) and 95% for the presence of LP neurodegeneration biomarkers. It was also shown that a normal brain 18F-FDG PET had an NPV of 96% for the risk of death at 3 years. In addition, the visual and semi-quantitative analyses of brain 18F-FDG PET showed an accuracy of 70% in the diagnosis of neurodegenerative pathologies and 87% in the diagnosis of Alzheimer's disease. ***Conclusion:*** A normal brain 18F-FDG PET scan can help rule out the risk of dementia conversion and the presence of cerebrospinal fluid (CSF) biomarker of neurodegeneration early with high certainty, allowing modifications to patient management regimens in the short term. Brain 18F-FDG PET could thus be utilized in routine first-line complementary investigations for assessing cognitive complaints.

EPS-012

[18F]FDG PET for Differential Diagnosis of Cognitive Impairment in Depression: Incremental Value Compared to Clinical Diagnosis

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Aim/Introduction: Assessment of regional glucose metabolism by [18F]FDG positron emission tomography (PET) is used as a diagnostic biomarker for differential diagnosis of dementia. In contrast, psychiatric disorders like depression with cognitive impairment often referred to as pseudo-dementia show no overt abnormalities on cerebral [18F]FDG PET. The present study validates the incremental diagnostic value of [18F]FDG PET in addition to clinical diagnosis in a real-life geriatric mental health clinical population. ***Materials and Methods:*** Ninety-eight consecutive patients with clinically verified depression and cognitive impairment were included. Baseline clinical diagnoses were independently established before and after disclosure of [18F]FDG PET and dichotomized into cases with neurodegenerative or non-neurodegenerative diseases (ND or NND; level 1). In an additional step, ND cases were allocated to diagnostic subgroups (AD, LBD, FTLD, ND other; level 2). An interdisciplinary, biomarker-supported consensus diagnosis after a median follow-up of 6.6 month after PET served as reference. Changes of clinical diagnoses and diagnostic accuracy were assessed. ***Results:*** After disclosure of [18F]FDG PET, level-1 clinical diagnoses changed in 23% of cases, improving the diagnostic accuracy from 72% to 92% ($p<0.001$). Similar fractions of cases with a final diagnosis of ND (3/50; mostly early AD with pathological AD biomarkers) and NND (3/48) in clinically suspected NND and ND, respectively, were missed by the clinical diagnosis also after [18F]FDG PET disclosure. Still, [18F]FDG PET was of particular value for exclusion of ND. Concerning level-2 decisions, the clinical diagnoses changed in 30% of cases, increasing its accuracy from 64% to 85% ($p<0.001$). A major fraction of cases with incorrect level-2 diagnoses comprised patients with AD that were misdiagnosed with LBD. Stratification by MMSE score, MADRS score and patient age did not significantly affect the results. ***Conclusion:*** [18F]FDG PET has a high impact on the clinical diagnosis and provides a significant incremental diagnostic value beyond the clinical diagnosis in depressive cognitive impairment. Thus, [18F]FDG PET should be considered as an essential part in the diagnostic work-up of patients with psychiatric disorders and cognitive impairment.

EPS-013

Feasibility and initial examination of chemokine receptor-4 (CXCR4) expression using 68Ga-Pentixafor (Pars-Cixafor™) PET-MR image fusion in high-grade gliomas (HGG)

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Aim/Introduction: The treatment of brain tumors relies heavily on imaging techniques. While magnetic resonance imaging (MRI) is considered the gold standard, its ability to differentiate between tumor areas and treatment-related changes is limited. Glioma cells, especially in glioblastoma multiforme (GBM), show overexpression of amino acid agents and chemokine receptor-4 (CXCR4). This study aims to assess the feasibility of non-invasive 68Ga-Cixafor™ PET/CT in improving diagnostic accuracy in glioma. ***Materials and Methods:*** Our retrospective analysis used a database of histopathology-proven glioma patients with positive MRI. The patients underwent 68Ga-Cixafor™ PET/CT scans to evaluate CXCR4 expression. Visual and semi-quantitative scores were calculated, including maximum standardized uptake value (SUVmax) and tumor-to-background ratios (TBR). ***Results:*** We enrolled 29 cases in our cohort, including 13 female patients (44.8%) and 16 male patients (55.2%), with a median age of 56

years (range: 11-73). Visual assessment of 68Ga-Cixafor™ PET imaging showed that 27 out of 29 cases were positive, with a median SUVmax of 2.31 (range: 0.49-9.96) and TBR of 20 (range: 6.12-124.5). Among the 29 patients, 17.24% (5/29) had World Health Organization (WHO) grade III and 82.75% (24/29) had grade IV pathologies. The median SUVmax of grade IV lesions was significantly higher than that of grade III lesions (P=0.02). There was no significant difference in median TBR between grade IV (20, range: 8.36-124.5) and grade III (22.37, range: 6.12-51.25). ***Conclusion:*** This study demonstrates that 68Ga-Cixafor™ PET exhibits a high TBR with low background activity in the cortex, suggesting its potential to enhance tumor detection in gliomas. The combination of imaging and therapeutic capabilities further highlights the potential of 68Ga-Cixafor™ as a valuable tool for improved detection and management of gliomas.

EPS-014

FET PET uptake characteristics in IDH-mutant glioma

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Aim/Introduction: Contrast enhancement in MRI correlates to response to treatment with the IDH inhibitor vorasidenib in IDH-mutant glioma. Tracer uptake on amino acid PET with FET is associated with tumor type and malignancy in gliomas. We investigated the correlation of contrast media and FET uptake in newly diagnosed IDH-mutant glioma as a basis for future biomarker studies for refined prediction of vorasidenib efficacy. ***Materials and Methods:*** Patients with histologically verified IDH-mutant glioma WHO grade 2-4 (WHO 2021 classification) without prior surgery, radio- and / or chemotherapy were included. Static FET PET parameters (maximal and mean tumor-to-background ratios (TBRmax and TBRmean) and PET volume were evaluated and compared to contrast-enhanced MRI as well as neuropathological diagnosis. PET and MRI-based lesions (contrast enhancement; T2 hyperintensity) were compared visually. ***Results:*** Overall, 44/147 (29.9%) cases showed contrast enhancement on MRI. Among the 103 gliomas without contrast enhancement on MRI, 57 (55.3%) presented with [18F]FET uptake. On [18F]FET PET, 98/147 (66.6%) cases were FET-positive, with a higher proportion in oligodendrogliomas compared to astrocytomas (91.2% vs. 44.3%). Among the 49 FET-negative gliomas, only 4 (8.2%) presented with contrast-enhancement on MRI. Both, presence of contrast enhancement as well as FET positivity showed a positive correlation with the WHO grade. [18F]FET uptake intensity showed a correlation with the WHO grade, however, with a high overlap of TBRmax and TBRmean values between WHO grades. Areas of [18F]FET uptake significantly exceeded areas of contrast enhancement in 25/44 (56.8%) cases. In 24/44 (54.5%) of cases, MRI and PET showed divergent hotspots. In 45/103 (43.7%) IDH-mutant gliomas without contrast enhancement, PET revealed a hotspot. ***Conclusion:*** FET PET provides complementary information to contrast-enhanced MRI in IDH-mutant glioma and therefore should be explored as additional biomarker. Future studies should put PET positivity into relation to response to IDH inhibitor therapy.

EPS-015

Correlation between synapse loss and cognitive performance in temporal lobe epilepsy: humans and animals PET imaging study with [18F]SynVesT-1

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Aim/Introduction: Cognitive impairment is a common comorbidity in individuals with temporal lobe epilepsy (TLE), yet the underlying mechanisms remain unknown. This study explored the putative association between in vivo synaptic loss and cognitive outcomes in TLE patients by positron emission tomography (PET) imaging of synaptic vesicle glycoprotein 2A (SV2A). ***Materials and Methods:*** We enrolled 16 TLE patients and 10 cognitively normal controls. All participants underwent SV2A PET imaging using [18F]SynVesT-1 and cognitive assessment. Lithium chloride-pilocarpine-induced rats with status epilepticus (n=20) and controls (n=6) rats received levetiracetam (LEV, specifically binds to SV2A), valproic acid (VPA), or saline for 14 days. Then, synaptic density was quantified by [18F]SynVesT-1 micro-PET/CT. The novel object recognition and Morris water maze tests evaluated TLE-related cognitive function. SV2A expression was examined and confirmed by immunohistochemistry. ***Results:*** TLE patients showed significantly reduced synaptic density in hippocampus, which was associated with cognitive performance. In the rat model of TLE, The expression of SV2A and synaptic density decreased consistently in a wider range of brain regions, including the entorhinal cortex, insula, hippocampus, amygdala, thalamus, and cortex. We treated TLE animal models with LEV or VPA to explore whether synaptic loss contributes to cognitive deficits. It was found that LEV significantly exerted protective effects against brain synaptic deficits and cognitive impairment. ***Conclusion:*** This is the first study to link synaptic loss to cognitive deficits in TLE, suggesting [18F]SynVesT-1 PET could be a promising biomarker for monitoring synaptic loss and cognitive dysfunction. LEV might help reverse synaptic deficits and ameliorate learning and memory impairments in TLE patients.

EPS-016

Synaptic density network dysfunction in temporal lobe epilepsy follows risk gene transcriptional downregulation

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Aim/Introduction: Temporal lobe epilepsy (TLE) is a brain network disorder closely associated with synaptic loss and has a genetic basis. However, the in vivo whole-brain synaptic changes at the network-level and the underlying gene expression patterns in patients with TLE remain unclear. ***Materials and Methods:*** In this study, we utilized a positron emission tomography with the synaptic vesicle glycoprotein 2A radioligand [18F]SynVesT-1 cohort and two independent transcriptome datasets to investigate the network properties of whole-brain synaptic connectivity in TLE and its correlation with significantly dysregulated risk genes. ***Results:*** We observed an overall decrease in synaptic connectivity strength, reduced clustering coefficient, and increased path length in TLE, suggesting a loss of synaptic connectivity, particularly long-distance connections, accompanied by network reorganization. These changes were predominantly distributed in the temporo-limbic circuit and fronto-parietal networks. Moreover, these synaptic network changes were spatially correlated with the brain-wide expression of TLE risk genes. In particular, we identified 183 downregulated genes that contribute to the

transcriptional regulation of synaptic network dysfunction, with GABAergic genes such as SLITRK3 and RBFOX1 playing a critical role in TLE pathogenesis. ***Conclusion:*** Our study provides the first evidence that the spatial expression patterns of downregulated risk genes underlie in vivo synaptic network dysfunction in TLE. These imaging-transcriptomic findings have the potential to guide the development of molecular and genetic network-based therapeutic approaches for TLE.

EPS-017

Clinical evaluation of inflammation in neuromyelitis optica spectrum disorders using $^{[18F]}$-DPA714 TSPO PET/MR Imaging

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Aim/Introduction: Neuromyelitis optica spectrum disorder (NMOSD) is an autoimmune demyelinating disorder of the central nervous system, mediated by antibodies against aquaporin-4 water channel protein (AQP4-Abs). Early effective therapy is crucial to prevent long-term disability and preserve quality of life. It is imperative for clinicians to promptly and accurately identify and assess the severity of the patient's condition. This study aims to explore the potential of $^{[18F]}$-DPA714 TSPO PET/MR imaging in evaluating inflammation in NMOSD for early diagnosis, understanding of disease pathogenesis and optimized treatment strategies. ***Materials and Methods:*** Twenty NMOSD patients and 17 healthy controls underwent $^{[18F]}$-DPA714 PET/MRI scans and were included. All participants were genotyped for TSPO polymorphism. Increased regional $^{[18F]}$DPA-714 retention was detected on a voxel basis using statistical parametric mapping analysis, with multiple correspondence analysis conducted to explore patterns of inflammation distribution. PET images were coregistered, normalized and segmented to standard brain templates using SPM12. Standardized uptake value ratios normalized to the whole brain (SUVR) were calculated for quantitative analysis of TSPO PET/MRI features between NMOSD and healthy controls. ***Results:*** All participants of genotypes of rs6971 encoding amino acids were categorized as high-affinity binders. Based on visual assessment, PETMRI could reliably identify increased focal neuroinflammation in NMOSD while enhanced MRI reported normal. NMOSD patients exhibited significantly higher $^{[18F]}$-DPA714 SUVR compared to healthy controls bilaterally in the optic nerve ($p < 0.05$) and brainstem ($p < 0.05$). The uptake in these regions correlated with the severity of motor symptoms but not with the AQP4 antibody titer in serum. Additionally, subgroup analysis based on Expanded Disability Status Scale (EDSS) revealed distinct inflammatory profiles among NMOSD patients, suggesting a potential influence on disease course and response to treatment. ***Conclusion:*** $^{[18F]}$-DPA714 PET/MR imaging demonstrates excellent sensitivity in confirming astrocyte activation in NMOSD, and the SUVR was positively corrected with the EDSS, providing a comprehensive disease-specific evaluation that guides effective management of NMOSD. Further exploration of inflammation patterns could enhance personalized treatment for individual needs.

EPS-018

Exploring Whole-brain Glucose Metabolic PatterntoDistinguish Minimally Conscious state fromUnresponsive Wakefulness Syndrome: an Important Role of Corticothalamic SystemInteractions

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Aim/Introduction: Detecting conscious awareness poses challenges in accurately identifying unequivocal signs of consciousness, impeding the formulation of individualized rehabilitation strategies. 18F-labeled-fluorodeoxyglucose positron emitting tomography (18F-FDG PET) imaging, which calculated glucose metabolism, emerges as a promising tool for detecting brain function related to residual consciousness. This study aims to explore the glucose metabolic pattern (GMP) detrived from SSM/PCA in patients with minimally conscious state (MCS) and unresponsive wakefulness syndrome (UWS), further assessing the expression of GMP in distinguish MCS from UWS. ***Materials and Methods:*** Fifty-seven patients with disorders of consciousness (21 cases of UWS and 36 cases of MCS) for whom the clinical diagnosis with the repeated standardized Coma Recovery Scale-Revised (CRS-R) were enrolled. All patients and healthy controls (HCs) underwent 18F-labeled-fluorodeoxyglucose positron emitting tomography (18F-FDG-PET) to investigate brain glucose metabolism. Voxel-based scaled subprofile model/principal component analysis (SSM/PCA) was used to generate GMP and the expression score was obtained and compared. The diagnostic accuracy of standard uptake value ratio (SUVR) based on frontoparietal cortex was calcalated. Outcome was assessed after 12 months with the Glasgow Outcome scale-Extended. ***Results:*** Relative to HCs, UWS GMP exhibited widespread hypometabolism in the frontal-parietal cortex and hypermetabolism in subcortical regions including the midbrain, unilateral lentiform nucleus, thalamus, parahippocampal gyrus, anterior cingulate gyrus and bilateral cerebellar hemispheres. In contrast, MCS GMP mainly featured by hypometabolism in the right inferior frontal gyrus. When using the MCS group as the reference, UWS GMP showed hypometabomism in frontal-parietal cortex, including the precuneus, precentral gyrus, postcentral gyrus, paracentral lobule, frontal and parietal lobe, alongside hypermetabolism in the unilateral lentiform nucleus, putamen, and anterior cingulate gyrus. The UWS-MCS-GMP expression score cut-off for distinguishing MCS from UWS was 0.351, yielding an area under the ROC curve of 0.77, which is superior to the SUVR based on frontoparietal cortex. UWS-MCS-GMP expression score demonstrated a correlation with CRS-R score ($r = -0.45$, $P = 0.004$). The GMP accurately predicted 73.7% of patient outcomes and SUVR obtained 50.9%. ***Conclusion:*** Patients with UWS and MCS exhibit specific GMPs, and the application of the SSM/PCA method holds promise for aiding the diagnosis of disorders of consciousness. ***References:*** 1. Giacino JT, Katz DI, Schiff ND, et al. Neurology. 2018; 91:450-460.2. Giacino JT, Fins JJ, Laureys S, et al. Nat Rev Neurol. 2014;10: 99-114. 3. Stender J, Mortensen KN, Thibaut A, et al. Curr Biol. 2016; 26: 1494-1499.

EPS-019

Medulla Oblongata Dominated Synaptic Density Network Degeneration in Amyotrophic Lateral Sclerosis

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Aim/Introduction: The purpose of this study was to investigate the synaptic density network connectivity and the likely sequences of synaptic loss in patients with amyotrophic lateral sclerosis (ALS). ***Materials and Methods:*** We examined data from 21 patients diagnosed with ALS and 25 sex- and age-matched healthy controls (HCs) who underwent PET imaging with the SV2A radioligand 18F-SynVesT-1. The individual synaptic density

connectome was constructed for each patient by calculating the similarity between interregional synaptic density distributions. The synaptic network connectivity changes were investigated, followed by an examination of the local synaptic density in regions that showed significant network alterations. Finally, we constructed the voxel-wise and ROI-wise causal synaptic covariance network (cSCN) to identify the sequence of synaptic loss in these brain regions. ***Results:*** We observed an overall decrease in synaptic density network connectivity in ALS patients compared to controls, with the highest nodal degree in the right medulla oblongata. Specifically, the reduced connections were dominantly between the medulla oblongata and the striatum, frontal lobe, occipital lobe. Patients with ALS displayed significantly synaptic loss in those brain regions. Furthermore, the cSCN analyses showed that as the disease progresses, the cortical synaptic loss sequences of ALS extend from the medulla oblongata to the regions including the striatum, frontal lobe, occipital lobe, and parietal lobe. ***Conclusion:*** These findings suggest that synaptic density network degeneration in ALS may follow a bottom-up transmission pattern, primarily involving in the medulla oblongata-striatum-neocortex network, which have the potential to capture new network-based targets for clinical therapy in the progression of ALS.

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Sunday, October 20, 2024, 08:00 - 09:30
Hall G1

CTE 1 - Technologists Committee / SNMMI: PET Tracers Beyond 18F-FDG - Tech Guide Preview

OP-058
Tech Guide – Introduction & Preview
A. Pietrzak;
Greater Poland Cancer Centre/Poznan University of Medical Sciences, Nuclear Medicine Dep./ Electroradiology Dep, Poznan, POLAND.

OP-059
Exploring ^{18}F-Fluoroestradiol (breast & endometrial cancer applications)
T. Buehner;
University of Arizona, College of Medicine, Department of Medical Imaging Division of Nuclear Medicine, Arizona, UNITED STATES OF AMERICA.

OP-060
Delving into ^{11}C-acetate
V. Mautone;
Istituto Romagnolo per lo Studio dei Tumori "Dino Amadori IRCCS, U.O.s Medicina Nucleare Diagnostica, Meldola (FC), ITALY.

OP-061
Core concepts of FAPI
K. Pabst;
University Hospital Essen, Department of Nuclear Medicine, Essen, GERMANY.

211

Sunday, October 20, 2024, 08:00 - 09:30
Hall Y1-Y3

Theranostics Track - TROP Session: Oncology & Theranostics Committee: Other Oncological Treatments

OP-062
^{90}Y-Fibroblast activation protein inhibitors (FAP) inhibitors-46 radioligand therapy (RLT) for advanced-stage cancer or sarcoma.
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[1]Department of Nuclear Medicine, West German Cancer Center, Essen, GERMANY, [2]German Cancer Consortium (DKTK), Partner site University Hospital Essen, GERMANY, [3]Department of Medical Oncology, West German Cancer Center, Essen, GERMANY, [4]Department of Nuclear Medicine and Radiobiology, Universiy of Sherbrooke, Sherbrooke, QC, CANADA, [5]National Center for Tumor Diseases (NCT), West, Campus Essen, Essen, GERMANY, [6]Department of Nuclear Medicine, University Medical Center, Rostock, GERMANY.

Aim/Introduction: FAP is highly expressed on fibroblasts from several solid malignancies,including various sarcomas entites, representing a promising theranostic target. We present an updated retrospective cohort analysis of 90Y-FAPI-46 treatment in patients with advanced solid tumors. ***Materials and Methods:*** Patients with progressive metastatic cancer or sarcoma were deemed eligible for 90Y-FAPI-46 therapy after exhaustion of approved therapies and confirmation of high FAP-expression, defined as SUVmax ≥ 10 in more than 50% of tumor lesions. After therapy, 90Y-FAPI-46 scintigraphy was performed to confirm systemic distribution and tumor uptake, and several 90Y-FAPI-46 PET/CT to determine absorbed doses. Adverse events (AEs) were graded according to the Common Terminology Criteria for Adverse Events (5.0). Imaging response was defined by RECIST for CT and PERCIST for 18F-FDG PET/CT. ***Results:*** gastric cancer, 1/30 (3%) squamous cell carcinoma, 1/30 (3%) cholangiocarcinoma) received a total of n=77 90Y-FAPI-46 cycles between June 2020 and December 2023 at our clinic. The interval between cycles was 4 to 8 weeks. 11/30 (40%) of patients received 4 cycles or more. Patients received a median (IQR) of 3.7 GBq (3.7-3.8) for the first cycle, and a median of 7.4 GBq (7.2-7.4) for subsequent cycles. The median (IQR) absorbed dose was 0.46 Gy/GBq (2.25-5.75) in the kidneys, and 0.03 Gy/GBq (0.03-0.06) in the bone marrow. Tumor lesions received a median (IQR) dose of 1.5 Gy/GBq (0.99-2.37). After treatment, a new onset of hematological AEs of any grade was observed in 18/30 (60%) patients, among which AEs ≥ grade 3 was reported in 6/30 (20%) patients: thrombocytopenia in 3/30 (10%), anemia in 2/30 (6%), and 1/30 (3%) patient demonstrated leukocytopenia and thrombocytopenia. RECIST (n=25) and PERCIST (n=21) response after treatment were assessed. Disease control according to RECIST was achieved in 12/25(48%) patients (9/25(36%) SD; 3/25(12%) PR), of whom 8/12(67%) had a sarcoma. A PERCIST response was noted in 12/21(57%) patients (11/21(52%) SMD; 1/21 (5%) PMR). The best RECIST response under RLT, i.e., any imaging time-point between baseline and restaging after RLT, was obtained in 15/26 (58%) evaluable patients (10/26(38%) SD;

5/26(19%) PR). According to PERCIST best response, 9/22(41%) demonstrated SMD, 5/22(23%) PMR, and 1/22(5%) CMR. ***Conclusion:*** 90Y-FAPI-46 RLT was tolerated well. Objective disease control was achieved in almost half of evaluable patients, almost exclusively sarcomas. Our findings support the role of FAP-RLT in patients with metastatic sarcoma.

OP-063

Therapeutic Potential of ^{177}Lu-TEFAPI-06 in Metastatic Solid Tumor Patients with Limited Treatment Options: Safety, Biodistribution, Preliminary Dosimetry and Efcacy Assessment

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Aim/Introduction: The primary objective of this study is to assess the safety and efficacy of the albumin-bound conjugate of FAP-targeted radiopharmaceutical 177Lu-TEFAPI-06 in the treatment of diverse metastatic solid tumors. ***Materials and Methods:*** Five patients with metastatic solid tumors refractory to conventional therapy were enrolled in the study, including two cases of bone metastasis from prostate cancer, one case of intra-abdominal leiomyosarcoma, one case of gallbladder carcinoma with liver and multiple lymph node metastases, and one case of rectal carcinoma with liver and multiple lymph node metastases. The metastatic lesions were confirmed to exhibit moderate to high uptake on 18F-FAPI-04 PET/CT imaging. Informed consent was obtained from all patients who received intravenous injection of 177Lu-TEFAPI-06 as treatment, at a dose of 30 mCi (range: 24-30mCi), followed by serial whole-body planar imaging and SPECT/CT scans at 2-120 hours post drug injection. The radiation absorbed doses to target organs and whole-body effective doses were calculated using OLINDA/EXM 2.2 software. Toxicities were graded according to the Common Terminology Criteria for Adverse Events (CTCAE v5.0). Patients underwent 18F-FAPI PET/CT scans one month after treatment, and changes in tumor biomarker levels before and after treatment were compared. ***Results:*** Five patients were included in the study, comprising three males and two females, with a median age of 60 years (range: 59-61years). The kidney demonstrated the highest absorbed dose (4.5731±4.1074 mSv/MBq) following administration of 177Lu-TEFAPI-06, followed by the spleen (0.2412±0.2143 mSv/MBq), liver (0.1477±0.0524 mSv/MBq), myocardium (0.1215±0.0757 mSv/MBq), and relatively lower absorbed dose in the red marrow (0.0393±0.0137 mSv/MBq). The average whole-body absorbed dose was 0.0527±0.0197 mSv/MBq, with an effective dose of 0.0503±0.0187 mSv/MBq. A follow-up at 4 weeks post single administration revealed partial efficacy in one prostate cancer patient, with a decrease of 31.10% and 43.85% in serum TPSA and FPAS levels, respectively. Additionally, a significant decrease in SUVmax of metastatic lesions was observed after treatment (baseline median SUVmax: 20.5 (range: 13.4-27.6), post-treatment median SUVmax: 13.9 (range: 8.85-20.2), p=0.015). Two patients experienced grade 3 adverse events: one with leukopenia and one with lymphopenia, although a definite correlation with the investigational drug could not be established. ***Conclusion:*** Preliminary research data suggests the potential feasibility of utilizing 177Lu-TEFAPI-06 in the treatment of various metastatic solid tumors, with relatively good tolerability and acceptable side effects, yet its efficacy awaits further confirmation.

OP-064

Peptide targeted radioligand therapy (PTRT) using Fibroblast Activation Protein (FAP) labelled with 225Actinium as mono- or TANDEM-therapy: A retrospective analysis of long-term safety and survival in patients with progressive, end-stage malignancies

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Aim/Introduction: Targeting tumour microenvironment through α-emitting 225Actinium PTRT is a promising precision medicine approach for end-stage solid tumours expressing FAP on cancer-associated fibroblasts and, sometimes, on cancer cells. This retrospective study assessed the overall survival (OS) and safety after 225Ac-3BP-3940 PTRT (as monotherapy and as TANDEM with 177Lutetium or 90Yttrium) in patients with advanced-progressive solid tumours. ***Materials and Methods:*** Between May 2021 and February 2024, 50 patients (29 men, 21 women; age range 13-81, mean 57.4) received 225Ac-3BP-3940 PTRT after 68Ga-3BP-3940 PET/CT. Primary tumours: pancreas (n=10), colorectal (n=8), NET (n=7), breast (n=5), gastro-oesophageal (n=4), lung (n=4), prostate (n=3), sarcoma (n=2), ovarian (n=1), ovarian and breast (n=1), pancreas and breast (n=1), urothelial (n=1), peritoneal mesothelioma (n=1), tongue (n=1), choroidal melanoma (n=1). Premedication (antiemetics/dexamethasone) and electrolyte infusions for forced diuresis were administered. CTCAE v.5.0 was used to grade haematological, renal, and hepatic adverse events, considering patients with ≥1 follow-up visit (n=37). ***Results:*** In total, 76 225Ac-3BP-3940 cycles were administered over 33 months (19 225Ac-monotherapies, 44 225Ac/177Lu-TANDEM, 13 225Ac/90Y-TANDEM). At the time of analysis, 31 patients had received one cycle, either monotherapy or TANDEM (range 3-19 MBq 225Ac), 13 patients had received two cycles (9.8-30 MBq 225Ac), 6 patients had received ≥three cycles (22.4-47.5 MBq 225Ac). Acute reactions after PTRT were mild and transient, mostly nausea (n=8), and vomiting (n=5). 34 patients died (OS 3 days-14 months) during follow-up, 16 patients are still alive (follow-up 1.5-25 months). After PTRT (vs. baseline): 37 patients developed anaemia G1/G2 (vs. 30), 2 patients anaemia G3. Baseline leukocytopenia G1/G2 (n=8), thrombocytopenia G1 (n=6), and thrombocytopenia G3 (n=1) were not affected by PTRT; 1 patient developed thrombocytopenia G2. After PTRT (vs. baseline): 6 patients showed renal impairment G1/G2 (vs. 4), one patient experienced IRA on IRC two weeks after injection, 13 patients had liver impairment G1/G2 (vs. 11), 2 patients (with extensive liver involvement) developed hepatotoxicity G3. ***Conclusion:*** This retrospective analysis shows that 225Ac-3BP-3940 PTRT is overall safe in terms of acute and long-term severe (G3) adverse effects. Only two cases of anaemia G3 were reported after therapy. Liver and kidney functions were not considerably affected by PTRT, apart from one case of IRA on IRC in a single-kidney patient and two patients with liver metastases developing hepatic impairment G3. 225Ac-3BP-3940 PTRT offers encouraging survival results in advanced patients failing all previous treatments (follow-up > two years).

OP-065

Initial experience with ^{177}Lu-FAP-2286 peptide targeted radionuclide therapy in advanced solid tumors

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Aim/Introduction: FAP-2286 is a cyclic compound and hence offers better therapeutic properties for radionuclide therapy in FAP-positive tumors. We are reporting our initial experience of 177Lu-labeled FAP-2286 PTRT in 3 patients with advanced solid cancers who had exhausted standard therapeutic options. ***Materials and Methods:*** All these 3 patients had a performance score (PS) of 2-3 and undergone pre-therapeutic work-up with documented good marrow reserve, and preserved hepatic & renal functions. Baseline 18F-FDG and 68Ga-FAP-2286 PET-CT scans were carried out to document metabolically active disease burden and FAP-2286 tumor uptake respectively. ***Results:*** Treatment protocol: Patients were pre-medicated with I.V. ondansetron, pantoprazole & Dexamethasone. All these patients then received a fixed dose of 150 mCi of 177Lu-FAP-2286 infusion diluted with normal saline while taking adequate renal protection using Aminoven (10%) solution. Subsequent post-therapy sequential gamma scans were acquired for 7-10 days to document tracer distribution, tumor uptake, and retention. Case 1: 56-year-old female, a known case of recurrent metastatic adenocarcinoma endometrium (PDL1ve+). She had progressed despite multiple lines of chemotherapy and was intolerant to immunotherapy. As a last resort, the disease was challenged with 177Lu-FAP-2286 PTRT. Till now the patient has received 4 cycles of therapies with good clinical and objective response with improvement in PS and partial response on FDG PET-CT scans. Case 2: A 52-year-old female with metastatic left TNBC with progressive disease. She was a defaulter after receiving adjuvant chemotherapy. She then progressed to immune-hormonal therapy, chemo, and targeted therapy. She had received 2 cycles of 177Lu-FAP-2286 therapy as per protocol and had a good clinical response with pain relief; however, there was a mixed response on the follow-up FDG PET-CT scan. Case 3: A 63-year-old male with a diagnosed case of metastatic NSCLC (PD L1 +); had received whole brain RT for multiple ICSOLs. He had progressed on immuno-chemotherapy and was challenged with 177Lu-FAP-2286 therapy. He had good clinical (improved PS) and objective response (partial response) post 2 cycles. However, his FDG PET-CT scan after 3rd cycle showed progression. A multidisciplinary tumor board decided to re-challenge the disease with immunotherapy. The patient is yet to be evaluated for response. All these patients had no serious adverse effects. ***Conclusion:*** 177Lu-FAP-2286 PTRT seems to be a viable therapeutic option for FAP-positive tumors. However, due to variability in objective response, use in combination with single-agent chemo or immunotherapeutic agent is to be explored for better results.

OP-066

Impact of Total Tumour Absorbed Dose and Total Metabolic Tumour Volume on Progression Free Survival in the Phase 1/2a Study of [^{177}Lu]Lu-Lilotomab Satetraxetan for Treatment of Relapsed Indolent Non-Hodgkin Lymphoma

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Aim/Introduction: [177Lu]Lu-lilotomab satetraxetan targets the CD37 antigen on B-cells and was investigated for relapsed indolent non-Hodgkin lymphoma (NHL) patients in the phase 1/2a LYMRIT-37-01 trial. Total metabolic tumour volume (tMTV) and mean absorbed doses to the total tumour volume (tTAD) were calculated [1]. The aim of this study was to investigate the prognostic value of tTAD and tMTV for progression free survival (PFS). ***Materials and Methods:*** Fifteen patients with three different pre-treatment and pre-dosing regimens were included. [177Lu]177Lu-lilotomab satetraxetan was administered at dosage levels of 10, 15 or 20 MBq/kg body mass (2, 3 and 10 patients, respectively). tTAD were calculated from post-treatment SPECT/CT imaging at day 4 and 7 post injection. tMTVbaseline and after 3 months (tMTV3months) were calculated from [18F]FDG PET/CT scans [1]. PFS was analysed using the Kaplan-Meier method and log-rank test. Patients were stratified based on a previously indicated tTAD threshold of 200cGy[1], the tMTVbaseline and tMTV3months analysis and the population median was used to separate the patients. ***Results:*** Overall median values were 130 cGy, 152 cm3 and 14 cm3 for the tTAD, tMTVbaseline and tMTV3months respectively. Thirteen patients reached the endpoint with two remaining in remission as of April 2024. Median PFS was 881 days for patients with tTAD > 200cGy and 209 days for patients with ≤ 200 cGy (p = 0.26). No significant difference was found between the three different activity dosage groups. PFS was not significantly longer for patients with tMTVbaseline lower than the population median (p = 0.52). A statistically significant shorter PFS (p=0.02) was observed for patients with tMTV3months above the population median (median of 209 days vs 881 days). ***Conclusion:*** While a survival benefit was indicated for patients receiving tumour absorbed doses over 200 cGy, the difference was not significant, and further work will focus on establishing a larger data foundation. tMTVbaseline did not predict PFS, which was not surprising since different treatment regimens were explored. However, a significant difference in PFS was found when separating the population based on tMTV3months median, implicating that this parameter may have a prognostic value for patients treated with [177Lu]Lu-lilotomab satetraxetan. ***References:*** 1. Londalen, A., et al., FDG PET/CT and Dosimetric Studies of (177)Lu-Lilotomab Satetraxetan in a First-in-Human Trial for Relapsed Indolent non-Hodgkin Lymphoma-Are We Hitting the Target? Mol Imaging Biol, 2022.

OP-067

Feasibility and therapeutic potential of the 68Ga/177Lu-DOTATATE theranostic pair in patients with metastatic medullary thyroid carcinoma

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Aim/Introduction: This study assessed: 1) the clinical efficacy of imaging with 68Ga-DOTATATE PET/CT (SSTR (somatostatin receptor)-PET) to detect medullary thyroid carcinoma (MTC); and 2) the therapeutic efficacy of peptide receptor radionuclide therapy (PRRT) with 177Lu-DOTATATE in MTC patients. ***Materials and Methods:*** Normal 0 false false false EN-US X-NONE AR-SA Patients with histologically proven MTC and suspected recurrence following thyroidectomy, based on raised serum calcitonin levels, underwent SSTR-PET. In addition, to evaluate the clinical efficacy and safety of PRRT, the patients with intense uptake on SSTR-PET or 99mTc-octreotide scintigraphy underwent PRRT. The Common Terminology Criteria for Adverse Events (version 4.03) was used to

grade adverse events after PRRT. Treatment response was classified as complete response (CR), partial response (PR), stable disease (SD), and progressive disease (PD). ***Results:*** Twenty MTC patients (10 male, 10 female) with a median age of 48.5 years underwent SSTR-PET. SSTR-PET was positive in 17/20 patients (85%). Four of the 17 patients with positive SSTR-PET were scheduled for PRRT. In addition, 2 patients had positive 99mTc-octreotide scintigraphy results (Krenning score ≥ 2) and were scheduled for PRRT. Two of the 6 patients who underwent PRRT showed PR, 2 SD and 2 PD. Two patients died during the follow-up period. Median overall survival was 19 months (95% CI: 5.52-29.48). There were no cases of significant toxicity. ***Conclusion:*** Radiolabeled somatostatin analogs are contributive for the management of recurrent MTC. 68Ga-DOTATAE PET-CT showed a relatively high detection rate in recurrent MTC. In addition, PRRT with 177Lu-DOTATATE was found to be a safe alternative therapeutic option for MTC.

OP-068

Transcriptomic Analysis of Patients Receiving 177LuPSMA Therapy to Decipher Molecular Drivers of Poor Outcome

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Aim/Introduction: Metastatic castration-resistant prostate cancer (mCRPC) exhibits large heterogeneity resulting in variable treatment outcomes across lesions and individuals. [177Lu] Lutetium-PSMA-617(Lu-PSMA) therapy for mCRPC is promising, however non-responder rate is about 30%. Treatment approaches that combine Lu-PSMA and immune checkpoint inhibition are currently under clinical investigation. Thus, immune-related factors may play a role in the efficacy of Lu-PSMA and other therapies. Our aim was to investigate the immune microenvironment in mCRPC patients treated with Lu-PSMA. ***Materials and Methods:*** We analyzed data from 41 patients referred for Lu-PSMA therapy. Among these, 29 had primary and non-primary tumor samples at initial diagnosis, prior to any treatment - therapy-naïve group. Additionally, we collected 15 primary and non-primary tumor biopsies from patients who received additional therapies (ADT, chemotherapy, ARTA) - under therapy group. Three patients had two biopsies, pre and post additional therapy. Tumor specimens underwent Decipher transcriptomic analysis (Veracyte Inc, San Diego, CA) for gene expression data. Immune cell counts were obtained via MySort Software. The primary outcome was overall survival. We used the Cox Proportional Hazards model to assess the impact of gene expression on survival, applying logarithmic transformation due to non-normal distribution of variables. Spearman's test was used for correlation analysis to explore further gene expression influences. ***Results:*** In the therapy-naïve group, PD-L2 levels were significantly associated with worse survival (HR 1.85x104 [7.30-4.69x107],p=0.014) but PD-L1 levels were not (p=0.535). Under therapy, both PD-L2 and PD-L1 levels were not significant for survival prognosis (p=0.209 and p=0.190 respectively), nor in the combined group (therapy-naïve and under therapy; p=0.825 and p=0.480 respectively). In the therapy-naïve group, in a multivariate cox model with a M1/M0 activated macrophage immune count, PD-L2 and PD-1 levels, all of the previous factors were significant, being PD-L2 and PD-1 levels harmful (HR 3.05x105 [23.03-4.03x109, p=0.009; HR 6.33 [1.01-39.53], p=0.046) and M1/M0 protective (HR 0.91 [0.84-0.99], p=0.034). In the combined group, however, only the macrophage signature was significant and protective (HR 0.91 [0.85-0.98], p=0.017). ***Conclusion:*** PD-L2 levels in therapy-naïve samples are a relevant marker of overall survival after Lu-PSMA. After ADT/chemotherapy/ARTA, there seems to be an influence of M1/M0 macrophages on overall survival, but not of PD-L2 or PD-1. Therefore, the relation between immune escape and pro-inflammatory pathways seems to change by the onset of systemic therapy, suggesting an external regulation. Further studies with bigger sample sizes should study the influence of these therapies in immune microenvironment and Lu-PSMA therapy outcomes.

OP-069

Lutetium-177-Prostate-Specific Membrane Antigen (^{177}Lu-PSMA) Therapy in Patients (Pts) with Prior Radium-223 (^{223}Ra) and Chemotherapy: Safety and Efficacy Outcomes by Treatment Sequence

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Aim/Introduction: 223Ra and 177Lu-PSMA, an alpha and beta emitter, respectively, are each approved for the treatment of patients with metastatic castration-resistant prostate cancer (mCRPC). The clinical feasibility and safety of sequential 223Ra and 177Lu-PSMA use in patients with mCRPC was assessed in RaLu, a real-world multicentre study conducted across Germany and Israel. ***Materials and Methods:*** Clinical data were retrospectively collected at centres in Germany (2021-2022) and Israel (2022-2023) for patients with mCRPC who received ≥1 dose of 177Lu-PSMA who previously received ≥1 dose of 223Ra. Safety and effectiveness of 177Lu-PSMA were evaluated by treatment sequence (223Ra then chemotherapy [Ct] followed by 177Lu-PSMA [RaCt-Lu] or Ct then 223Ra followed by 177Lu-PSMA [CtRa-Lu]), and by time interval (<6 or ≥6 months from last 223Ra dose to first 177Lu-PSMA dose). Data was statistically summarised; overall survival (OS) was estimated using the Kaplan-Meier method. ***Results:*** Overall, 198 patients were evaluated, including

89 and 70 in the Ra-Ct-Lu and Ct-Ra-Lu groups, respectively, and 65 and 132 in the <6 months and ≥6 months groups, respectively. Prior to 177Lu-PSMA, all patients received 223Ra (66% received six 223Ra injections) and 58% received ≥4 life-prolonging therapies. In total, 38% of patients received ≥4 177Lu-PSMA cycles, with a median completion of 3 cycles. During 177Lu-PSMA therapy, any-grade and serious treatment-emergent adverse events occurred in 78% and 26% of patients, respectively. Grade 3-4 haematologic laboratory abnormalities included anaemia (32%), thrombocytopenia (17%) and neutropenia (4%). Grade 3-4 anaemia/thrombocytopenia/neutropenia occurred with an incidence of 30%/21%/3% and 38%/23%/2% in the Ra-Ct-Lu and Ct-Ra-Lu groups respectively, and 34%/17%/5% and 31%/18%/4% in the <6 months or ≥6 months groups, respectively. Median OS from starting 177Lu-PMSA was 12.0 months (95% CI, 10.5-15.1) in the overall population, 10.0 (8.2-14.0) and 12.0 (9.1-16.9) months in the Ra-Ct-Lu and Ct-Ra-Lu groups, respectively, and 12.0 (8.9-19.6) and 12.6 (10.7-15.9) months in the <6 months or ≥6 months groups, respectively. PSA response ≥50% occurred in 37% of patients in the overall population and 35-40% across subgroups; an ALP response ≥50% occurred in 8% of patients in the overall population and 6-11% across subgroups. ***Conclusion:*** These findings further support the clinical feasibility of treating patients with mCRPC with 177Lu-PSMA after being treated with the alpha therapeutic 223Ra, irrespective of the length of time between the two treatments and the positioning of chemotherapy within the treatment sequence (before or after 223Ra).

OP-070

French national Survey on supply and demand of RadioLigand Therapy.

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Aim/Introduction: Facing an increasing demand for targeted radioligand therapy (RLT), specifically PSMA-targeted (PRLT), the French Society of Nuclear Medicine (SFMN) has initiated a study to assess the available and potential reservoirs in technical means and human resources to meet the needs and ensure equitable access throughout France. This study was jointly conducted by the health consultancy Madis-Phileo and medical physics consultancy Esprimed. ***Materials and Methods:*** Participation in the study was based on a voluntary approach from Nuclear medicine departments (NMDs) across France, public and private. Evaluators visited these departments for two days to interview RLT professionals and management staff. The analysis tools, evaluation grid and ISHIKAWA diagram were used to establish and present a score from -100 to 100 for each area studied: regulatory requirements, technical investments, decision-making by center management, regional and national health administrations, human resources, care coordination and organization, leading to an overall score that categorized centers into Experienced (EC), Initiated (IC), Medium-Term prospects (MT), and Long-Term prospects (LT). The alignment between the supply and demand for PRLT was finally assessed. ***Results:*** Seventy-nine centers amongst the 322 French NMDs agreed to participate. At the time of the study which started in May 2023 and finished February 2024, 24 were already PRLT active, 23 would start at least during 2024 and 17 were still under consideration. After interviewing 542 individuals, the centers were classified as 27(34%) EC, 13(16%) IC, 23(29%) MT, and 16(20%) LT including 13 private centers. The average scores across 79 centers [LT score to EC score] were: 45[-17.8 to 81.9] for regulatory requirements; 17[-21 to 62.2] for technical investments; 43[24 to 67.4] for decision-making; -12[-33 to 11.9] for human resources ; 15[-59 to 74.8] for care coordination; and 0[-86 to 64.6] for care organization. The overall national score gathering all domains was 18[-34 to 60]. For 70% of the EC, RLT led to substantial investments despite the pricing being perceived as favorable for only 48%. Of the 5,700 patients eligible for PRLT annually in France, 2,485 can be treated in 2024, and 3,955 will be by 2026. ***Conclusion:*** Current resources are sufficient for only half of the necessary PRLT treatments meeting the VISION criteria. To ensure alignment between the supply and the already significantly unmet demand for RLT, major recruitment efforts, improvements in care organization and coordination, and increased technical investments are required, with support from decision-making authorities.

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Sunday, October 20, 2024, 09:45 - 11:15
Hall 1

CME 2 - Oncology & Theranostics Committee - PSMA PET and Radioligand Therapy

OP-071

PSMA PET: Radiotracers and Clinical Trial Data

M. Eiber;
Technical University of Munich, Munich, GERMANY.

OP-072

Impact Of PSMA PET On Radiation Oncology Planning

A. Grosu *;*
University Medical Centre Freiburg, Freiburg, GERMANY.

OP-073

PSMA RLT: The Data Behind It And Trials Under Progress

J. Walz;
Department of Urology, Institut Paoli-Calmettes Cancer Centre, Marseille, FRANCE.

OP-074

Next Steps In PSMA RLT: Applications and Radionuclides

O. Sartor;
Mayo Clinic, Rochester, UNITED STATES OF AMERICA.

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Sunday, October 20, 2024, 09:45 - 11:15
Hall 4

Special Track 2 - Thyroid Committee - Challenge the Expert: Therapeutic Dillemas in Patients with low-intermediate Risk Thyroid Cancer

OP-075

Iodine-131 therapy in lower-risk Differentiated Thyroid Cancer (DTC) patients: is it really only to facilitate the follow-up ?

A. Campenni;

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OP-076
Challengers' cases
A. Maurer;
Department of Nuclear Medicine, University Hospital Zurich, University of Zurich, Zurich, SWITZERLAND.

OP-077a
Challengers' cases
E. Deininger-Czermak;
Department of Nuclear Medicine, University Hospital Zurich, University of Zurich, Zurich, SWITZERLAND.

OP-077b
Challengers' cases
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OP-077c
Challengers' cases
M. Kulgawczuk;
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OP-077d
Challengers' cases
T. Leike;
Department of Radiology and Nuclear Medicine Lucerne Cantonal Hospital, Lucerne, SWITZERLAND.

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Sunday, October 20, 2024, 09:45 - 11:15
Hall X9-X12

LIPS Session 2 - Neuroimaging Committee: What is expected from the Clinicians with Neurological PET Imaging?

OP-078
… in neurodegenerative disorders
S. Morbelli;
University of Torino, Department of Nuclear Medicine, Torino, ITALY.

OP-079
… in epilepsy
T. Traub-Weidinger;
Vienna Healthcare Group, Vienna, AUSTRIA.

OP-080
…in neurooncology
A. Verger;
Universitè de Lorraine, Department of Nuclear Medicine and Nancyclotep Imaging, Nancy, FRANCE.

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Sunday, October 20, 2024, 09:45 - 11:15
Hall X1-X4

M2M Track - TROP Session: Radiopharmaceutical Sciences + Translational Molecular Imaging & Therapy Committee: Antibodies & Co.

OP-082
GMP development of the [^{177}Lu]Lu-AKIR001 for clinical translation in first-in-human studies of CD44v6 expressing cancer patients
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Aim/Introduction: Recently, a novel high-affinity monoclonal antibody (mAb) targeting the cell surface antigen CD44v6 was generated and characterized for the purpose of using it for molecular radiotherapy of cancers overexpressing CD44v6 (1). The mAb (AKIR001) was radiolabelled with 177Lu and evaluated in several in vitro and in vivo studies. Following a comprehensive toxicological assessment of AKIR001 was found suitable for clinical translation in a first-in-human clinical trial in cancer patients. The aim of this study was to optimize, scale up, and validate the synthesis of [177Lu]Lu-AKIR001 in compliance with cGMP to prepare for the future clinical phase I study. ***Materials and Methods:*** GMP-grade DOTA-conjugated mAb, AKIR001 in 10 mM phosphate buffer was tested in initial small-scale 177Lu-labelling, up to 1 GBq. Critical parameters of pH, amount of mAb, and incubation time were optimized. Aimed maximum patient dose, up to 3 GBq, were developed by stabilizing the product to avoid radiolysis. The quality control (QC) methods were validated to ensure the product could be consistently analysed and quantified, even during worst-case conditions. Following scale up, stability studies and purification were optimized and the production was validated in three consecutive batches. ***Results:*** The manual synthesis of [177Lu]Lu-AKIR001 showed optimal conversion (>95%) in 10 mM phosphate buffer containing ~80 mg/mL sucrose and PS-80 (0.02% w/v) at $5.0 \leq pH \leq 5.3$. To prevent radiolysis, it was essential to stabilize the product by adding sodium ascorbate during the reaction. Purification was effectively carried out using Amicon Ultra 15 spin filters (50 kDa MWCO) with the addition of DTPA, which sufficiently removed unreacted 177Lu. The subsequent formulation in saline/sodium ascorbate was pivotal to obtaining long-term stability of the product (up to 6 days at +4°C + 24 h at room temperature post-EOS). ***Conclusion:*** The scaled up and optimized synthesis of [177Lu]Lu-AKIR001 was robust and validated according to cGMP. Up to 3500 MBq could be produced at a concentration of 198 MBq/mL suitable

for infusion to patients in the clinical phase I trial. ***References:*** 1. (1) Mortensen, A.C.L., Berglund, H., Segerström, L. et al. Selection, characterization and in vivo evaluation of novel CD44v6-targeting antibodies for targeted molecular radiotherapy. Sci Rep 13, 20648 (2023). https://doi.org/10.1038/s41598-023-47891-2

OP-083

Preliminary assessment of novel HER2-targeted single domain antibody fragment NB46 for theranostic applications

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Aim/Introduction: Progress in HER2-targeted drug development has advanced significantly since Trastuzumab approval. Single domain antibody fragments (sdAbs) are promising candidates due to their small size, stability, and effective tumor targeting. Herein, we've developed NB46, a new HER2-targeted sdAb with high affinity and a distinct binding site, potentially offering earlier-stage use in HER2-positive breast cancers because it is not blocked by Trastuzumab, currently part of standard of care. Moreover, its different HER2 binding site would allow for potential heterodimers to be developed with other sdAbs, notably 5F7. ***Materials and Methods:*** NB46 was conjugated with SGMIB, iso-SGMIB, or their 211At counterparts and evaluated using HER2-positive BT-474 cells and xenografts. SGMTB or iso-SGMTB was labeled with radioiodine or 211At, conjugated to NB46, and assessed for binding, cellular retention, and internalization in HER2-positive BT-474 and HER2-negative MCF-7 cells. Paired-label biodistribution was performed to compare different isomers, while a single-label biodistribution was done to examine 211At-labeled NB46 in mice bearing BT-474 tumors. To verify binding to an epitope distinct from the one targeted by both 5F7 and Trastuzumab, a paired-label biodistribution was conducted using [125I]SGMIB-NB46 and [131I]SGMIB-5F7 under Trastuzumab blocking conditions. ***Results:*** Using HER2-expressing BT-474 cells, [*I]SGMIB-NB46 and iso-[*I]SGMIB-NB46 demonstrated high affinities after labeling - 7.3 ± 4.0 nM and 5.3 ± 2.2 nM, respectively. Paired-label biodistribution indicated comparable tumor uptake between isomers. Thyroid and stomach uptake were low for both isomers but significantly lower for [*I]SGMIB-NB46 at all time points. [*I]SGMIB-NB46 showed better clearance in other normal tissues and thus we selected this isomer for further assessment with 211At. [211At]SAGMB-NB46 showed good tumor uptake of 9.9 ± 1.4 %ID/g at 1 h, 14.7 ± 2.5 %ID/g at 4 h and 8.0 ± 1.6 %ID/g at 21 h, with minimal uptake in stomach and thyroid. In the paired-label experiment, [125I]SGMIB-NB46 and [131I]SGMIB-5F7 demonstrated similar tumor uptake (11.1 ± 2.6 %ID/g for NB46 vs 13.5 ± 3.4 %ID/g for 5F7 at 1 h; P>0.05); importantly, binding of NB46 sdAb was not blocked by Trastuzumab (9.5 ± 1.7 %ID/g at 1 h) while binding of 5F7 sdAb was blocked (0.8 ± 0.1 %ID/g), confirming their distinct binding epitopes. ***Conclusion:*** NB46 radioconjugates showed excellent HER2-specific binding to BT-474 cells, promising tumor uptake and minimal retention in stomach and thyroid with no blocking by Trastuzumab. Taken together, these results suggest NB46 warrants further investigation either alone or in combination with Trastuzumab or 5F7 for HER2-positive cancer treatment.

OP-084

Redistribution of the daughter radionuclides generated from ^{225}Ac-pelgifatamab and their contribution to therapeutic efficacy in LNCaP/KUCaP prostate cancer xenograft models

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Aim/Introduction: Prostate-specific membrane antigen (PSMA) is highly expressed in prostate cancer. 225Ac-pelgifatamab, a targeted alpha therapy (TAT) consisting of the PSMA antibody pelgifatamab linked to a macropa chelator and labelled with the alpha-emitting radionuclide actinium-225, has showed robust antitumour efficacy in preclinical models of prostate cancer. Actinium-225 decays via its alpha-emitting daughters francium-221 (t1/2 = 4.8 min), astatine-217 (t1/2 = 32.3 ms), bismuth-213 (t1/2 = 45.6 min) and polonium-213 (t1/2 = 3.4 µs) to stable, nonradioactive bismuth-209. 225Ac-pelgifatamab containing actinium-225 is targeted to the tumour, but the clearance of its in vivo generated daughter radionuclides is unknown. As the daughter radionuclides may have an impact on therapeutic efficacy, we studied the distribution of actinium-225 and the redistribution of the measurable daughters francium-221 and bismuth-213 after 225Ac-pelgifatamab treatment in tumour-bearing mice. ***Materials and Methods:*** The biodistribution of 225Ac-pelgifatamab and a radiolabelled isotype control was evaluated using subcutaneous LNCaP and KUCaP human prostate cancer xenograft models in SCID male mice, respectively. The mice were treated with a single i.v. injection of 225Ac-pelgifatamab (250 kBq/kg) or a radiolabelled isotype control antibody (250 kBq/kg), and sacrificed either 10-15 minutes or 1, 24, 72, 168, or 336 hours post injection. Organs were measured either immediately or 24 hours after sacrifice using a germanium detector and a gamma detector. Dosimetry calculations to evaluate the gray dose for actinium-225, francium-221 and bismuth-213 were based on actinium-225 and francium-221 at both timepoints and the immediate bismuth-213 measurements. ***Results:*** 225Ac-pelgifatamab showed prominent LNCaP tumour accumulation (~250 %ID/g), peaking 240 hours (10 days) post injection. Furthermore, 225Ac-pelgifatamab exhibited slow clearance from the blood and low accumulation into most of the other organs. Importantly, actinium-225 decaying in the tumour generated bismuth-213 and francium-221, which were effectively retained within the tumour. In contrast, minor fractions of the bismuth-213 generated in the blood were redistributed into the kidneys. The redistribution of francium-221 occurred in a similar fashion. This is reflected by an increase of total absorbed dose to the kidneys from 0.40 (no daughter redistribution considered) to 2.16 Gy. Contrary to 225Ac-pelgifatamab, the isotype control did not accumulate into the KUCaP tumour, resulting in a higher rate of daughter radionuclide redistribution into the kidneys and other organs. ***Conclusion:*** Both bismuth-213 and francium-221, the alpha-emitting daughter radionuclides of actinium-225, are mostly retained in the tumour. Only minor amounts of the daughter radionuclides generated in the blood were redistributed to the kidneys.

OP-085

A Novel ^{177}Lu-labelled Affibody Molecule with Deimmunized ABD: Enhanced Biodistribution Profile and Anti-tumour Efficacy

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Aim/Introduction: We have previously demonstrated that [177Lu]Lu-ABY-027, HER2-binding Affibody molecule fused with an albumin-binding domain (ABD035), provides HER2-specific targeting of human xenografts and a strong anti-tumour effect in preclinical radionuclide therapy studies [1, 2]. The Affibody molecule ZHER2:2891 fused with a deimmunized ABD variant, denoted PEP49989, was designed to reduce immunogenic potential, which is crucial for clinical translation. In this preclinical study, the targeting characteristics and therapeutic efficacy of the novel construct, PEP49989, were evaluated. ***Materials and Methods:*** PEP49989 was labelled with 177Lu via DOTA, which was conjugated to a unique C-terminal cysteine. In vitro evaluation of affinity, specificity, and cellular processing were performed using HER2-expressing SKOV3 and BT474 cell lines. In vivo specificity and biodistribution of [177Lu]Lu-PEP49989 were characterised in tumour-bearing Balb/c nu/nu mice, followed by dosimetry calculation. Experimental therapy was evaluated in mice with human HER2-expressing xenografts. ***Results:*** The labelling of PEP49989 with 177Lu provided radiochemical yield exceeding 95%. The binding of [177Lu]Lu-PEP49989 to HER2-expressing cells was specific both in vitro and in vivo. The affinity of [177Lu]Lu-PEP49989 binding to SKOV3 cells was 363±112 pM, which was similar to the affinity of [177Lu]Lu-ABY-027 (333±45 pM) containing the parental ABD035 variant. The uptake of [177Lu]Lu-PEP49989 was 1.4-fold higher than the uptake of [177Lu]Lu-ABY-027 in kidney, but 1.7-2-fold lower in liver and spleen. The tumour uptake of [177Lu]Lu-PEP49989 was 1.5-fold higher than the uptake of [177Lu]Lu-ABY-027. Treatment of mice with SKOV3 xenografts using 21 MBq [177Lu]Lu-PEP49989 significantly prolonged the median survival (>90 days) compared to mice treated with vehicle (38 days) or trastuzumab (45 days). Co-treatment of [177Lu]Lu-PEP49989 and trastuzumab both extended the median survival to over 90 days and led to a higher number of complete tumour remissions. ***Conclusion:*** In novel Affibody-based construct, [177Lu]Lu-PEP49989, fusion with a deimmunized ABD did not affect the affinity and specificity of binding to HER2. [177Lu]Lu-PEP49989 demonstrated advantageous biodistribution profile in the mice model, compared with [177Lu]Lu-ABY-027, containing parental ABD035. In an experimental therapy, [177Lu]Lu-PEP49989 demonstrated strong anti-tumour effect both alone and co-treated with trastuzumab, which creates preconditions for clinical translation. ***References:*** 1. Orlova A et al. Site-specific radiometal labeling and improved biodistribution using ABY-027, a novel HER2-targeting affibody molecule-albumin-binding domain fusion protein. J Nucl Med. 2013;54:961-8.2. Liu Y et al. Radionuclide Therapy of HER2-Expressing Xenografts Using [177Lu]Lu-ABY-027 Affibody Molecule Alone and in Combination with Trastuzumab. Cancers 2023;15:2409.

OP-086

A fully automated process and a generic kit to reduce development and production costs of [^{89}Zr]mABs in clinical trial settings

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Aim/Introduction: ImmunoPET using 89Zr-labeled antibodies (mABs) is gaining importance in nuclear medicine given the impressive potential of this imaging technology platform. Currently, [89Zr]mAB batches are mostly produced manually, requiring highly qualified personnel while exposing them to the high radiation doses due to the intense 909 keV emission of Zr-89. We herein report the development of a fully automated, cassette-based process for the production of 89Zr-labelled antibodies that makes antibody radiolabeling a plug-and-play, time-saving, cost-effective and safe procedure. ***Materials and Methods:*** Zr-89 was used at 1M and 0.05M oxalic acid concentration. PD-10 and HiTrap size-exclusion chromatography (SEC) cartridges were purchased and used on the disposable cassettes. Panitumumab-DFO, Trastuzumab-DFO and Cetuximab-DFO were chosen as model compounds for the development of the process ; in all radiolabeling experiments, CAR values were in the range of 0.7 - 2.1. The automated process was developed on the miniAllinOne synthesis module. ***Results:*** A disposable cassette as well as a reagent kit were designed for standardized process automation. The process includes Zr-89 and bulk vial rinsing, reagents transfer, radiolabeling and purification on either one PD-10 or two HiTrap SEC columns. Process fluidics were carefully designed to maximize the accuracy of small volume transfers and to suppress the risk of channeling and drying effects to guarantee the outcome of the SEC purification. Manual radiolabeling experiments were performed to define Na2CO3 and HEPES volumes maximizing radiochemical conversions across an activity range of 0 - 400 MBq (≈ 0 - 400 µL 89Zr-oxalate). Those conditions were transferred to the programmed miniAllinOne sequence so that the 89Zr-oxalate volume was the only required user input during the process. The resulting fully automated process yielded [89Zr]Panitumumab, [89Zr]Trastuzumab and [89Zr]Cetuximab with 70-87% RCY (n.d.c.) in ≈ 80 minutes starting from 50 - 400 µL 89Zr-oxalate, with radiochemical purities >98%. ***Conclusion:*** We report the availability of a generic, fully automated process and kit for antibody radiolabeling with Zr-89 on the miniAllinOne. The developed process offers a cost-effective approach to the use of [89Zr]mABs in clinical trials while allowing for an effortless transfer to subsequent routine production. The process is compatible with potentially any mAB-DFO conjugate, with both PD-10 and HiTrap purification cartridges, a wide range of 89Zr-oxalate volumes and concentrations while delivering state-of-the-art production yields. Efforts to render the process and consumables compatible with Lu-177 and Ac-225 mAB labeling are actively ongoing.

OP-087

AI Optimized Target Selection for Cocktails of Targeted Alpha Particle Radiopharmaceutical Therapy against Metastatic Liver Cancers

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Aim/Introduction: Radiopharmaceutical therapies (RPT) using alpha-particle-emitting radionuclides conjugated to target specific antibodies are being actively investigated to treat cancer. However, intrinsic tumor cell heterogeneity limits the efficacy of single targeting agents due to the consequent non-uniform distribution of radiopharmaceuticals. Overcoming these challenges necessitates the optimization of targeted RPT through dosimetry and personalized treatment planning. We hypothesize that using 2-3 distinct types of antibody-based radioconjugates (e.g "cocktail") administered based on the distribution of target expression on tumor cells can therapeutically outperform treatment with a single radioconjugate against liver cancers, and their associated circulating and disseminated tumor cells. ***Materials and Methods:*** Human hepatocellular carcinoma and hepatoblastoma cell lines, Hep3B and HepG2, were tested for the distribution of antibody targets that have shown promise (GPC3, EGFR, CD147, ROBO1, MET, and MUC13) through flow cytometry. Using these measured distributions, MIRDcell V4, an AI based treatment planning software developed by the Howell lab, we determined the best cocktail of these antibodies to radiolabel with the alpha particle emitter, actinium-225 (225Ac) for treatment. Specifically, MIRDcell AI determines the molar activity of 225Ac required for each antibody in the cocktail to achieve a specified cell kill while minimizing the total decays required. The absorbed dose calculations made by the model are for cells in suspension which are representative of isolated circulating or disseminated tumor cells. ***Results:*** Preliminary data shows that for the Hep3B cell line, no single 225Ac-labeled antibody can achieve the specified surviving fraction of 0.001 (2 surviving cells out of 1500 cells). In contrast, a combination of 225Ac-anti-EGFR and 225Ac-anti-CD147 with optimized molar activities of 5.3 × 107 and 5.6 × 107 GBq/mol are able to achieve a surviving fraction of 0.001. The results for HepG2 show that although 225Ac-anti-CD147 alone could kill the cell population at the specified cell death, a combination of two agents like 225Ac-anti-EGFR and 225Ac-anti-GPC3 can kill at the same effectiveness with less than one-third the number of total 225Ac decays (8.8 × 105 compared to 2.8 × 106 Bq s). ***Conclusion:*** Our results predict that personalized RPT cocktails have higher therapeutic efficacy than monotherapies and require less administered activity to do so. They also imply that antibodies that fail as monotherapies can be effectively repurposed in a cocktail as is shown with the HepG2 cell line. Our approach will be further tested in the future with in vitro and in vivo studies.

OP-088

Efficacy and safety of novel [^{225}Ac]Ac-labeled anti-HER2 antibody drug radioconjugates against HER2 positive breast cancer xenografts

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Aim/Introduction: Breast cancer (BC) is the leading cause of morbidity and mortality in women worldwide. Human epidermal growth factor receptor 2 (HER2) is overexpressed in 25-30% of BC. Actinium-225 (225Ac) has an ideal half-life of 9.9 days with 5.8 MeV mean energy, and decays into 4-alpha, 3-beta, and 2-gamma emitters hence a potent candidate for targeted alpha therapies. Again, pertuzumab is a domain II anti-HER2 monoclonal antibody and causes a complete blockade of HER2 heterodimerization critical for tumor growth. Also, antibody-drug conjugates (ADCs) are highly cytotoxic, have antitumor activities, with good therapeutic index. We, therefore, intend to develop an antibody-drug radio-conjugate (ADR) based on pertuzumab ([225Ac]Ac-Macropa-pertuzumab-PEG6-DM1) and determine its efficacy against this disease. ***Materials and Methods:*** [67Cu]Cu-DOTA-pertuzumab-PEG6-DM1 and [225Ac]Ac-Macropa-pertuzumab-PEG6-DM1 were developed with drug linker NHS-PEG6-DM1 and bifunctional chelators p-SCN-DOTA and p-SCN-Macropa respectively. Quality control was done. Biodistribution and safety evaluation of [225Ac]Ac-Macropa-pertuzumab-PEG6-DM1 were done in healthy female Balb/c mice (pharmacokinetics, toxicology/histology, and dosimetry) and HCC1954/JIMT-1 athymic Balb/c nude mice. ImmunoSPECT/CT imaging and biodistribution using [67Cu]Cu-DOTA-pertuzumab-PEG6-DM1 and radiotherapy using [225Ac]Ac-Macropa-pertuzumab-PEG6-DM1 were done in nude mice bearing trastuzumab-resistant HCC1954 and T-DM1/trastuzumab-resistant JIMT-1 tumors. ***Results:*** Pure pertuzumab ADCs and ADRs were obtained. [67Cu]Cu-DOTA-pertuzumab-PEG6-DM1 and [225Ac]Ac-Macropa-pertuzumab-PEG6-DM1 had a radiochemical purity of 92-97% at specific activity of 1 MBq/µg, and 1MBq/150-300µg, respectively. Low EC50 values of Macropa-pertuzumab-PEG6-DM1 in HCC1954 (33 ± 0.4 nM) and JIMT-1 (25.2 ± 0.6 nM) were obtained. After 7 days of incubation at 37°C, [225Ac]Ac-Macropa-pertuzumab-PEG6-DM1 showed good stability in both human serum (86.6 ± 0.4%) and PBS (83.6 ± 0.5%). Internalization in HCC1954 and JIMT-1 cells was HER2 density-dependent with pertuzumab-PEG6-DM1 total red object area (14696573 ± 697882 vs 3879041 ± 129076) significantly higher than pertuzumab (5786017 ± 343453 vs 179200 ± 11481), respectively ($p<0.0001$). Imaging and biodistribution of [67Cu]Cu-DOTA-pertuzumab-PEG6-DM1 in athymic Balb/c nude mice showed high tumor uptakes of 30 ± 7.3% IA/g (HCC1954) and 17.2 ± 2.3% IA/g (JIMT-1) after 24 h post-injection. Pertuzumab-PEG6-DM1 (8 mg/Kg) and [225Ac]Ac-pertuzumab-PEG6-DM1(3 X 18 KBq) administered separately in healthy Balb/c mice, 10 days apart was well tolerated biochemically and haematologically for 20 days. In HCC1954-mice xenografts, all treatment groups had complete remission, while in T-DM1-resistant JIMT-1 tumor-bearing mice at 28 days post-treatment, tumor volumes were 104.7 ± 8.7 mm3 ([225Ac]Ac-Macropa-P-PEG6-DM1), 386.4 ± 86.3 mm3 (P-PEG6-DM1), and 359 ± 102 mm3 (saline). ***Conclusion:*** The ADR [225Ac]Ac-Macropa-pertuzumab-PEG6-DM1 is more potent than its ADC pertuzumab-PEG6-DM1 against trastuzumab- or T-DM1-resistant BC necessitating clinical investigation.

OP-089

Construction and preclinical evaluation of a radioiodinated nanobody probe for the detection of CD147-overexpressing cancer

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Aim/Introduction: The extracellular matrix metalloproteinase inducer CD147, which is significantly over-expressed in various solid tumors but scarcely found in normal tissues, offers an optimal target for molecular imaging and targeted therapy. Nanobodies are the smallest fragments derived from antibodies and are easily modified for conjugation with functional reagents. In this study, we developed a novel CD147-targeted nanobody radiotracer, 124I-NB147, providing guidance for the detection of CD147-overexpressing cancer. ***Materials and Methods:*** Flow cytometry, Western blot, and Immunofluorescence were used to verify the expression of CD147 on the surface of Human pancreatic

cancer cells ASPC1 and BXPC3, human malignant melanoma cells A375 and SK-MEL-28, human triple-negative breast cancer cells MDA-MB-435, and mouse triple-negative breast cancer cells 4T1. The CD147 nanobody was labeled with 124I using the Iodogen method and purified by the PD-10 column. The physicochemical properties, affinity, metabolic characteristics, biodistribution and immunoPET imaging of 124I-NB147 were performed. Finally, CD147 expression analysis was performed by immunohistochemistry, tissue microarray and autoradiography on human cancer specimens. ***Results:*** The labeled 124I-NB147 was purified by PD-10. The results showed that the radiochemical purity was over 99% and maintained over 95% in both 0.01 moL/L PBS and 10 % HSA for more than 4 h. The molecular weight of NB147 was 17.1 kDa as measured by MALDI-TOF-MS and SDS-PAGE. FCM, WB and IF showed that the cell lines A375, ASPC1 and MDA-MB-435 expressed CD147 highly, while SK-MEL-28, BXPC3 and 4T1 showed low expression of CD147. The radio-ELISA indicated that 124I-NB147 had high binding affinity to CD147. The cell uptake test showed that there was a significant difference in 124I-NB147 uptake between CD147 high-expression cells and CD147 low-expression cells (P<0.01). The biological half-life of distribution and clearance phases were 0.05 h and 1.58 h, respectively. The imaging results show that in CD147-positive tumor models, the probe accumulates at the tumor sites of A375, ASPC1 and MDA-MB-435. However, in CD147-negative tumor models, no significant uptake was observed at the tumor site of SK-MEL-28, BXPC3 and 4T1. Finally, the correlation analysis between tumor uptake and CD147 expression level was established. ***Conclusion:*** In this study, we successfully validated one specific CD147 nanobody, NB147, and the derived immunoPET probe 124I-NB147 showed precise visualization for accurate diagnosis of CD147-expressing lesions. Based on high yield, high radiochemical purity, and good stability, biological evaluation has shown its specificity and affinity for CD147. It will be promising for dynamically monitoring CD147 expression in pan-cancer.

OP-090

Evaluation of ^{68}Ga-NOTA-Mal-NB147 for the detection of CD147 expression onmalignant tumors

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Aim/Introduction: Recent studies have demonstrated that extracellular matrix metalloproteinase inducer (CD147) contributes to pan-cancer immunity and progression. Nanobodies are the smallest fragments derived from antibodies and are easily modified for conjugation with functional reagents. They possess ideal characteristics suitable for PET imaging applications, such as a rapid clearance rate and excellent distribution curves, allowing for same-day imaging with sufficient contrast. In this study, we developed a novel CD147-targeted nanobody radiotracer, 68Ga-NOTA-Mal-NB147, providing guidance for the detection of CD147 on malignant tumors. ***Materials and Methods:*** In this study, we utilized the dual-function chelator NOTA-Mal for the specific site-specific labeling of the CD147-targeted nanobody NB147 with nuclide 68Ga. Then the probe was purified by PD-10 column, and its quality control and in vitro stability were determined by a radio-TLC. The in vitro stability of the 68Ga-NOTA-Mal-NB147 in normal saline and 5% HSA was analyzed. Flow cytometry, Western blot, Immunohistochemistry, and immunofluorescence were used to verify the expression of CD147 on the surface of human colon cancer cells LS174T, human pancreatic cancer cells BXPC3, human liver cancer cells SMMC-7721 and human gastric cancer cells NCI-N87, and screen high and low expression models. The physicochemical properties, affinity, metabolic characteristics, biodistribution, and immunoPET imaging of 68Ga-NOTA-Mal-NB147 were performed. ***Results:*** The labeled 68Ga-NOTA-Mal-NB147 was purified by PD-10. The results showed that the radiochemical purity was over 98% and maintained over 95% in both 0.01 moL/L PBS and 10 % HSA for more than 4 h. FCM, WB, IHC and IF showed that the cell lines LS174T, BXPC3 and SMMC-7721 expressed CD147 highly, while NCI-N87 showed low expression of CD147. The radio-ELISA indicated that 68Ga-NOTA-Mal-NB147 had high binding affinity to CD147. The imaging results show that in CD147-positive tumor models, the probe accumulates at the tumor sites of LS174T, BXPC3, and SMMC-7721. However, in CD147-negative tumor models, no significant uptake was observed at the tumor site of NCI-N87. Simultaneously, the co-injection of an excess amount of cold antibody significantly reduces the uptake of the probe in LS174T tumors, indicating the specific targeting binding of 68Ga-NOTA-Mal-NB147 to CD147 high-expression tumor models. ***Conclusion:*** We successfully validated one specific CD147 nanobody, NB147, and the derived immunoPET probe 68Ga-NOTA-Mal-NB147 showed precise visualization for accurate diagnosis of CD147-expressing lesions. Based on high yield, radiochemical purity and stability, biological evaluation showed its specificity and affinity for CD147, and immunoPET/CT imaging confirmed the feasibility of visualizing tumor CD147 in vivo.

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Sunday, October 20, 2024, 09:45 - 11:15
Hall Y4-Y9

Cutting Edge Science Track - Featured Session: Radiation Protection Committee / EARL: Radiation Protection for Radionuclide Therapy and Animal Protection

OP-091 & 092 - please see Addendum at page 1025

OP-093

Establishing a ^{177}Lu-PSMA treatment site in an oncology outpatient day-ward

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Aim/Introduction: 177Lu-PSMA treatment is an emerging therapy for patients with metastatic castration-resistant prostate cancer. Radiation-safety precautions often raise concerns and may cause unnecessary investments when starting a novel radionuclide-therapy site. We introduced a treatment site established in an oncology outpatient day-ward meanwhile optimizing the therapy practice, treatment and radiation-protection facilities and utilization of staff. ***Materials and***

Methods: A typical single outpatient day-ward room with a private toilet was equipped for the therapy use. The 7.4-GBq 177Lu-PSMA was administrated with a 30–60 s injection, after which the patient remains in the treatment room for 3–4 h in hydration and radiation isolation. The room is equipped with a mobile barrier with a 2.0-mm lead-equivalent panel to attenuate an external radiation especially to the neighboring room. A patient isolation-discharge measurement is conducted 3–4 hours after receiving the treatment using a remote dose-rate meter installed in the celling of the treatment room. After discharging the patient, he is transferred to the SPECT-CT imaging. A four-days intensive training was given to the lutetium nurses who previously worked in the oncology outpatient clinic to familiarize them to radiation work including contamination and waste management actions. During the injection the nurse wears personal dosimeter and a lead apron. After completing the handling of radioactivity, a possible hand-contamination is measured using a portable monitor. Radioactive waste and the possible contamination of the room are measured after the treatment. ***Results:*** The lutetium patient induces approximately 1.8 μSv/h radiation exposure into the neighboring room behind the lead barrier 1-m away from the patient bed. In the other surrounding rooms 4.4-6.2 m from the bed the radiation exposure was negligible. The nurse administrating the 177Lu-PSMA received a mean effective dose of 4.3 μSv during the therapy day. The patient waste and laundry radiated 0.05-1.11 μSv/h, when measured on the surface of packages. The external dose-rate from the patients after the mean isolation period of 3.7 h was 12.6 μSv/h converted to the 1-m distance. The investments made for the therapy room amounted to approximately 15000 euros. After fourth therapy session our nurses took over all the practical duties including radioprotection tasks and measurements. ***Conclusion:*** The 177Lu-PSMA therapy site can be launched with a reasonable investment on a normal oncology outpatient day-ward with nurses without any previous radiation-work experience. The radiation-safety actions are straightforward and radiation exposure to the environment from a 177Lu-PSMA patient is rather moderate.

OP-094

Radiation Exposure to Children and Others During Therapy for Pediatric Neuroblastoma With Lu-177 DOTATATE

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Aim/Introduction: The objective of this study is to evaluate the clearance of Lu-177 DOTATATE in children with neuroblastoma and the resulting radiation dose to the child, family caregivers and medical staff during the therapy. ***Materials and Methods:*** Twenty-three consecutive children (rang 3-13 years) with neuroblastoma treated with Lu-177DOTATATE were enrolled. External dose rates were measured at various distances from the patient at 1, 2, 4, 6, 24, 48 and 96 hours to estimate Lu-177DOTATATE clearance, effective half-life and maximum potential cumulative dose around the patient. Measurement of whole-body and red marrow absorbed dose in children based on Lu-177 DOTATATE SPECT/CT multitemporal imaging and HERMES workstation. The whole-body radiation dose to family caregivers and medical staff was measured by means of TLDs (Thermoluminescence Personal Dosimeters), and the radiation dose to the fingers of medical staff measured by means of ring TLDs. ***Results:*** The median administered activity of Lu-177 DOTATATE was 145.01 MBq/kg, and the whole-body retention rates at 1, 2, 4, 6, 24, 48 and 96 hours after administration were 63.4%, 51.9%, 38.7%, 33.7%, 21.7%,17.4% and 9.5%, respectively. The retention of Lu-177 DOTATATE within the body as a bi-exponential decay process, with short and long effective half-lives of 1.4 ± 0.8 hours and 52.4 ± 18.4hours, respectively. The maximum potential average radiation dose at 1m and 2m from the patient was estimated to be 0.233 ± 0.046 mSv/GBq and 0.071 ± 0.015 mSv/GBq, respectively. The mean dose for children were 4.186 ± 2.155 mGy/MBq to whole body and 0.611 ± 0.416 mGy/MBq to red marrow. The mean whole-body radiation dose for the family caregivers was 0.24 ± 0.06 mSv (ranging from 0.13 to 0.39 mSv, 0.077 ± 0.037 mSv/GBq). The mean whole-body and fingers radiation dose to the radiopharmacists were 3.7 ± 1.8 μSv/per patient and 155.3 ± 73.0 μSv/per patient, respectively. The mean whole-body radiation dose and median fingers radiation dose to the nurses were 4.7 ± 1.4 μSv/per patient and 16.7 μSv/per patient, respectively. ***Conclusion:*** Lu-177 DOTATATE is cleared more rapidly in children with neuroblastoma, and all radiation exposures to others are below personal dose limits.

OP-095

^{177}Lu-Dotatate effective half-life estimation for personalized radiation protection recommendations

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Aim/Introduction: The incidence of neuroendocrine tumors has increased in recent years. Metabolic therapy with 177Lu-Dotatate has shown promising results in pain and symptom control, presenting itself as an effective alternative for patients with inoperable or even metastatic disease. The use of this radiopharmaceutical implies exposure to radiation of family members, close people and general public. The usual treatment consists in 4 dose administered 8 weeks apart, so the radiation protection restrictions may be important although dose rates at medical discharge are low. The aim of this work is to determine the 177Lu-Dotatate average effective half-life that will allow us to calculate individualized radiological protection recommendations. ***Materials and Methods:*** A retrospective analysis of 40 cycles from 15 patients treated with 177Lu-Dotatate in our Hospital (aged between 50 and 70 years old) is presented. All of them completed the whole treatment. The average injected activity was 7.2 GBq/cycle, and gets the medical discharge 24 hours after injection. The measurements of dose rate at one meter were performed using an environmental radiation monitor in anteroposterior and posteroanterior projections at different stages of each cycle: 24 hours, 4 days and 7 days from injection. The average dose rate for each patient was obtained by a geometric mean. The effective decay was performed using a mono-exponential fit. ***Results:*** The average dose rate was 6.2±2.5 μSv/h and the median was 5.4 μSv/h. The obtained values for effective half-life result in a mean value of 2.9±0.5 days and 3.0 days for percentile 75. ***Conclusion:*** The results show lower discharge dose rate and effective half-life values than other metabolic treatments, such as 131I for thyroid cancer disease. It suggests that the treatment may be safe, under normal living conditions, for both the patient and those close to them. However, as it is administered in four separate cycles, cumulative doses throughout the whole treatment may involve a certain risk. On the basis of the results obtained in this study, the personalization of the radiation protection recommendations at discharge may be a powerful strategy to reduce this risk. Nevertheless, even though obtained results are encouraging,

further data is needed to improve statistics. In any case, radiation protection measures are necessary in this type of procedures, especially considering the emergence of new treatments, such as 177Lu-PSMA for patients with metastatic castration-resistant prostate cancer.

OP-096

Development of the world's largest High Dose Therapy ward (Radioiodine ward) facility by radiation dose and delay tank activity simulation: the challenges and opportunities

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Aim/Introduction: I-131 has Beta and gamma emission and has a half-life of 8 days and a gamma energy of 364 keV. Its gamma energy makes it difficult to manage the radiation safety aspect. I-131 therapy has been categorized as high-dose more than 30 mCi and low-dose therapy less than 30 mCi. Performing high-dose therapy requires a specialized high-dose therapy ward with a delay-decay tank in India. This study aimed to propose a method to develop a high-dose therapy facility within the ambit of existing regulation. ***Materials and Methods:*** In this study, we designed a 41-bed radionuclide facility over two floors; the 4th and 5th floors of the hospital building covering a 260 square meter carpet area. we performed a theoretical simulation of radiation exposure and residual activity in the delay and decay tank at the time of discharge of effluent in the municipal sewer system. Theoretical calculation of radiation exposure at a point inside and outside of the therapy ward. Theoretical calculation of residual activity in the tank: The formulae in the table cell 2 were proposed for the calculation: ***Results:*** Radiation exposure outside the radionuclide therapy ward: 0.10 mSv yearly dose was considered the constraint for exposure calculation outside the ward (10 times less than the prescribed limit of 1mSv/year for the general public) The maximum dose calculated was well within the constraint set by our institution for the general public. Radiation exposure inside the radionuclide therapy ward: 1mSv yearly dose was considered the constraint for exposure calculation outside the ward (20 times less than the prescribed limit of 20mSv/year for the radiation workers)The maximum dose calculated was well within the constraint set by our institution for the radiation worker. Activity in the delay tank before the discharge in the main municipal sewer: Total activity in the delay tank was found to be 15 MBq total and 8.3kBq/m3 which was well within the permissible limit of discharge prescribed by the regulator (AERB). ***Conclusion:*** The formulae proposed in this study may be used to calculate the wall thickness, and radiation exposure inside and outside the radionuclide therapy ward and the size of the delay tank during the site designing phase of the high-volume radionuclide therapy ward adhering to the regulatory norms and ALARA principle. ***References:*** A) Regulatory requirement by AERB, https://www.barc.gov.in/about/05.pdf B) water consumption pattern in domestic households in major cityhttp://indiaenvironmentportal.org.in/files/Water%20consumption%20patterns.pdf

OP-097

Modeling-based Assessment of Exposure Measurements After High-Dose Targeted ^{131}I-apamistamab: Results and Analyses from the Phase III SIERRA Trial

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Aim/Introduction: SIERRA investigated targeted induction and conditioning prior to hematopoietic cell transplant using 131I-apamistamab. The activity of this high-dose targeted therapy ranged from 300 to 1030 mCi, requiring administration in an in-patient setting with subsequent radiation isolation. Here, we analyzed exposure readings from patients treated on the SIERRA trial and determined the clearance dynamics and time to reaching the specified radiation release criteria at different administered activity levels. ***Materials and Methods:*** 131I-apamistamab was administered to patients 55 years or older with relapsed/refractory AML as an intravenous infusion over median 5 hours. Site-specific radiation safety protocols were developed for nuclear medicine and transplant staff to minimize exposure. Administered activity of 131I-apamistamab was determined for each patient following a dosimetric infusion and evaluation, with 24 Gy to the liver being dose limiting. This ensured safe delivery of this high-dose targeted therapy, with a wide range of administered activity between patients. In this analysis we used the exposure readings acquired at 1 meter distance starting after infusion until release from isolation. A single exponential function was fit to the exposure readings over time and the clearance half-life and time until reaching the U.S. 131I release criteria of 0.07 mSv/hr was calculated for each patient. ***Results:*** Out of 106 patients receiving the 131I-apamistamab therapeutic infusion, exposure readings were evaluable for 96 patients, with a median 6 measurements per patient (range: 2 - 8). The effective clearance of 131I-apamistamab closely followed a single exponential fit (median R2=0.98), with median effective clearance half-life 35.2h (range: 3.3 - 66.9h). Median time to reach release criteria was calculated to 5.0 days (IQR: 3.9 - 6.1 days), and this was similar between varying levels of administered activity. This relates to the personalized dosing of 131I-apamistamab as patients with a faster biological clearance were prescribed a higher activity. This is further shown by the difference in median clearance half-lives, with 40.0h for those receiving <450 mCi, 38.2h for 450-600 mCi, 32.5h for 600-800 mCi and 35.2h for >800 mCi. ***Conclusion:*** Exposure readings following radiation isolation showed considerable variability in clearance rate between patients, although no difference was seen in estimated time needed to reach release criteria by administered activity level, with a median of only 5 days even for patients receiving activities over 800 mCi. This ensured that patients were well below the 131I release criteria at the time of transplant, typically 12 days following the 131I-apamistamab infusion.

OP-098

Measurement of ^{225}Ac in the air in nuclear medicine treatment rooms and assessment of the internal dose to clinical staff and caregivers

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Aim/Introduction: In the nuclear medical treatment of metastatic castration-resistant prostate cancer, targeted alpha therapies (TAT) with intravenous injection of radiopharmaceuticals such as [225Ac]Ac-PSMA are applied. Patients may excrete this radionuclide, posing a risk of radiation exposure to clinical staff. This work aims to investigate the presence of 225Ac in treatment room air due to patients' breathing. Further, the eventual dose due to inhalation of the radionuclide will be estimated by an implemented biokinetic model that takes into consideration the size distribution of the inhaled particles. ***Materials and Methods:*** An aerosol monitor is employed to measure the air in TAT treatment rooms. Inside a specifically built calibration chamber, an 225Ac-aerosol was produced and characterized using an impactor to classify the particles by size and an alpha/beta counter to determine the activity per impactor stage. In addition, a biokinetic compartment model for the inhalation of 225Ac was implemented using the parameters provided by the International Commission on Radiation Protection (ICRP). First, systemic models of actinium and its progeny were built up for the Reference Adult Male[1]. Subsequently, the human respiratory tract[2,3] and the human alimentary tract[4] models, also developed by the ICRP, were added. ***Results:*** It was possible to generate a radioactive aerosol with a size distribution similar to that in human breath. The activity increased with particle concentration in the range of interest (< 0.3 µm). Time-integrated activity coefficients were computed for the systemic model, showing rapid blood clearance and high absorbed doses of 225Ac progeny: 155 mGy/MBq in kidneys, 943 mGy/MBq in the liver, and 82 mGy/MBq in the bone marrow. The inhalation model was validated by comparing retention data in liver and lungs for a 0.1 µm 225Ac-aerosol to ICRP values. ***Conclusion:*** In this study, experimental data on room and breathing air are collected. Although the systemic model was implemented for unlabelled 225Ac, owing to the recoil of α-decay, the daughters can leave the radiopharmaceutical compound and distribute independently of the parent radionuclide. Therefore, the dose contribution of the progeny is expected to be the same as in [225Ac]Ac-PSMA treatments. In conclusion, the described inhalation model of 225Ac can provide a realistic estimate of the radiation exposure of the clinical staff. ***References:*** (1) ICRP, 2019. Occupational Intakes of Radionuclides: Part 4 (2) ICRP, 2015. Occupational Intakes of Radionuclides: Part 1 (3) ICRP,1994. Human Respiratory Tract Model for Radiological Protection (4) ICRP, 2006. Human Alimentary Tract Model for Radiological Protection.

OP-099

HERCA survey on alarms at waste incineration plants from radioactive patient waste after radionuclide therapy

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Aim/Introduction: The administration of radiopharmaceuticals potentially results in radioactive waste produced by the patient like potentially radioactive tissues, pads, etc. and, in case of incontinent patients, potentially radioactive diapers. In some European countries, radiation portal monitors (RPM's) are installed at waste incineration plants to prevent the inadvertent incineration of (high-activity) orphan sources leading to the potential exposure of personnel and environment as well as the contamination of the facility. Due to the notably high sensitivity of modern RPM's, they are capable of detecting even trace amounts of radiation potentially triggering an alarm. This radiation could be emanating from a (high-activity) orphan source but also from (low-activity) radioactive waste produced by patients. The increasing use of radionuclide therapies contributes to a rising number of alarms which have to be effectively managed by the personnel at waste incineration plants. The Heads of the European Radiological Protection Competent Authorities (HERCA) Working Group Medical Applications (WGMA) wants to evaluate current regulation and deployment of measuring devices at waste incineration plants as well as the prevalence of radionuclide therapies across Europe. The objective is to develop strategies to help minimise this type of alarms at the waste incineration plants and establish efficient and straightforward protocols for managing this. ***Materials and Methods:*** A survey was sent to the 27 countries represented in the HERCA WGMA regarding radiation measuring devices at waste incineration plants (regulations, implementation, threshold levels, procedures and statistics) and the current practices for radionuclide therapies (release criteria and instructions on potentially radioactive patient waste given to the non-incontinent or incontinent patient). ***Results:*** Preliminary results from 13 responders show a wide variation in regulations and deployment of radiation measuring devices at waste incineration plants. Also, release criteria and content of instructions given to patients differs significantly potentially impacting the number of alarms. ***Conclusion:*** Although RPM's at waste incineration plants were not installed for the purpose of finding radioactive patient waste, this specific type of waste is a frequent trigger for alarms resulting in an extra workload (measurements with portable devices to identify the nuclides, sorting out of the waste, ···), and frustration for its personnel. Hence, it is crucial to minimize the frequency of these alarms and/or the workload associated with each alarm in order to keep the personnel vigilant and motivated to respond appropriately, thereby preventing the inadvertent incineration of the real (high-activity) orphan sources they were originally tasked to detect.

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Sunday, October 20, 2024, 09:45 - 11:15
Hall Z

Clinical Oncology Track - TROP Session: Oncology & Theranostics Committe: Head & Neck

OP-100

Covalent FAPI PET enables accurate management of medullary thyroid carcinoma: a prospective single-arm comparative clinical trial

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Aim/Introduction: Localizing medullary thyroid carcinoma (MTC) is crucial for treatment decision, but the detection using the current imaging modalities is unsatisfied, and the therapeutic strategy (i.e., surgical extent) was therefore inaccurate. Previously, we reported a paradigm-shift platform technology by adding a targeted covalent radioligand (TCR) to fibroblast activation protein inhibitor (FAPI) for improved and sustained tumor targeting. In this first-in-class comparative clinical trial, we assessed the detection rate and diagnostic accuracy of 68Ga-TCR-FAPI PET/CT in 50 MTC patients and head-to-head compared with the currently approved 18F-FDG PET/CT, aiming to provide a new standard of imaging for MTC. ***Materials and Methods:*** This study was a prospective, single-center, open-labeled, single-arm comparative clinical trial, designed to assess the effectiveness of 68Ga-TCR-FAPI PET/CT compared to the currently approved 18F-FDG PET/CT in evaluating MTC patients. Patients with newly diagnosed, recurrent or metastatic MTC with biochemical residual disease (serum calcitonin > 10 pg/ml) and no previously/currently administrated targeted therapy were enrolled between May 11th, 2023 and Feb. 1st, 2024, and 68Ga-TCR-FAPI PET/CT, 18F-FDG PET/CT and serum calcitonin level were performed on separate days. ***Results:*** On manual evaluation by independent physicians, 68Ga-TCR-FAPI exhibited significantly higher patient-based detection rate than 18F-FDG PET/CT (98% vs. 66%, p=0.0002) and displayed 16-38% improved region-based detection rate (p=0.0001-0.0269), facilitating MTC detection at patient level. The superior detection can be attributed to covalent ligation of 68Ga-TCR-FAPI for elevated tumor activity than 18F-FDG (SUVmax 11.71±9.16 vs. 2.55±1.73, p<0.0001). The diagnostic accuracy, for the first time, was validated on 60 lesions available for point-to-point matching of PET/CT images and histopathology, and was substantially greater with 68Ga-TCR-FAPI than 18F-FDG (96.7% vs. 43.3%, p<0.0001). Notably, 60% patients directly benefited from 68Ga-TCR-FAPI PET/CT, with 66.7% experiencing changes in surgical plans, and 100% of the newly diagnosed MTC with R0 resection achieved biochemical cure at 1-month post-surgery. ***Conclusion:*** In conclusions, 68Ga-TCR-FAPI PET/CT has demonstrated superior detection rate, metabolic value and diagnostic accuracy compared to 18F-FDG PET/CT in MTC patients, which aid the disease localization and surgical planning. Together with the previous reports that 68Ga-TCR-FAPI outperformed the original FAPI, 68Ga-TCR-FAPI PET/CT has the potentiality to be the standard of imaging for MTC patients.

OP-101

Head-to-head evaluation of ^{18}F-FDG and ^{68}Ga-FAPI PET/CT in surveillance of postradiotherapy recurrence of EBV-associated nasopharyngeal carcinoma

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Aim/Introduction: This study aims to investigate the potential role of 68Ga-labeled fibroblast activation protein inhibitor (FAPI) positron emission tomography/computed tomography (PET/CT) for the surveillance of postradiotherapy recurrence of nasopharyngeal carcinoma (NPC), compared with 18F-fluorodeoxyglucose (18F-FDG) and Epstein-Barr virus-DNA (EBV-DNA). ***Materials and Methods:*** In this prospective comparative imaging trial conducted at Fudan University Shanghai Cancer Center (ChiCTR2100054163, Chinese Clinical Trial Registry), 36 patients with elevated EBV-DNA load or equivocal findings of conventional imaging (CT or magnetic resonance imaging (MRI)) were enrolled from August 2021 to April 2023. Presence of local recurrence and distant metastasis were recorded by two experienced nuclear medicine physicians. Malignant lesions were validated by histopathologic analysis and a composite reference standard. ***Results:*** Of the 36 patients (8 females, 28 males; median age: 50.5 years, range: 29-66 years), 25 (69.44%) patients suffered recurrences and received further treatment. Compared to EBV-DNA, contrast-enhanced MRI/CT and 18F-FDG PET/CT, 68Ga-FAPI PET/CT showed the highest diagnostic accuracy rate (94.44% vs. 47.22%, 50.00% and 83.33%, respectively; $p < 0.001$, $= 0.033$ and $= 0.004$, respectively). Regarding to the lesion-based analysis, a total of 78 lesions (64 malignant lesions and 14 benign lesions) were detected by 18F-FDG and 68Ga-FAPI PET/CT. Compared to 18F-FDG, 68Ga-FAPI PET/CT outperformed in sensitivity, specificity, positive predictive value, negative predictive value, and accuracy for the detection of lesions (96.88% vs. 90.63%, 64.29% vs. 7.14%, 92.54% vs. 81.69%, 81.82% vs. 14.29%, and 91.03% vs. 75.64%, respectively; $p = 0.004$). ***Conclusion:*** 68Ga-FAPI PET/CT outperforms EBV-DNA, contrast-enhanced MRI/CT and 18F-FDG PET/CT in detecting local recurrence and distant metastasis, and could serve as an accurate, reliable and reproducible surveillance modality for NPC patients.

OP-102

Diagnostic Performance of 68Ga-Trivehexin PET-CT in Follow-Up Head and Neck Squamous Cell Carcinomas (HNSCC) and Comparison with ^{18}F-FDG PET-CT

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Aim/Introduction: Trivehexin is a cancer-specific (αvβ6) integrin targeting agent over-expressed in the tumor microenvironment and is responsible for tumor growth and proliferation·. The study aims to perform tandem 68Ga Trivehexin & 18F-FDG PET-CT scans on treated head and neck squamous cell carcinoma patients who had a clinical suspicion for loco-regional residual or recurrent disease and to evaluate the incremental advantage of Trivehexin PET over FDG PET. ***Materials and Methods:*** This a single institutional non-blinded interventional study conducted from October 2022 to December 2023· A total of 30 post-treated HNSCC patients with suspected locoregional residual or recurrent disease were included· Both 68Ga Trivehexin & 18F FDG PET-CT scans were done on two different days with a time gap of not more than 7 days. Any well-defined focus of increased tracer uptake

greater than the background activity in the expected anatomical region was regarded as a positive finding for both scans. All the dual tracer study data were analyzed by two experienced nuclear medicine physicians. Histopathological sampling / radiological follow-up data was considered as gold standard ***Results:*** Loco-regional Analysis- 30 patients had a total of 17 suspicious locoregional recurrent/residual lesions with only 12 being true positive (histopathologically) for local and/or regional disease. 17 lesions were detected by FDG and 15 lesions by Trivehexin· The true positive, false positive, true negative, and false negative of FDG and Trivehexin were 10,7,13,2 and 12,3,17,0 respectively. Metastatic disease analysis- A total of 5 (5/30) patients were found to have 6 true metastatic lesions in our study· The distant lesions include lung and bone· Of these 5(5/6) lesions show true positive findings in both the scans and false negative finding in 1(1/6). Additionally there was no statistical difference between the SUV max of both the tracers in benign (two-tailed P-value 0.7922) and malignant (P -value 0.48 at 95% CI) lesions. ***Conclusion:*** The diagnostic accuracy of 68Ga-TRIVEHEXIN is better than 18F-FDG PET-CT in the early detection of active loco-regional residual/ recurrent disease in HNSCC with the advantage of differentiating osteoradionecrosis from true recurrences. However, the incremental role of Trivehexin PET CT in metastatic disease particularly in the lung is questionable. A larger study with a larger study population is required to conclude any further.

OP-103

Exploring ^{18}F-FDG PET/CT as a Screening Tool for Boron Neutron Capture Therapy: Correlation Analysis with ^{18}F-FBPA Uptake in Malignant Tumors.

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Aim/Introduction: In the clinical practice of boron neutron capture therapy (BNCT) using BPA as a boron carrier, 18F-FBPA PET/CT is essential for candidate selection. However, due to its challenging preparation, not all medical institutions are able to use this probe for patient screening. In contrast, 18F-FDG, as a conventional probe, is widely available in most medical institutions. Therefore, exploring the correlation in tumor uptake between 18F-FDG and 18F-FBPA and considering the feasibility of 18F-FDG as an alternative for 18F-FBPA in patient screening may potentially extend treatment opportunities to a broader patient population. ***Materials and Methods:*** 27 patients with histologically confirmed malignant tumors were enrolled between January 2022 and April 2024, comprising 11 head and neck cancer patients and 16 high-grade glioma patients. All patients underwent both whole-body 18F-FBPA and 18F-FDG PET/CT within two weeks. The correlation of maximum standardized uptake value (SUVmax), maximum tumor-to-normal tissue ratio (TNRmax), metabolic tumor volume (MTV), and total lesion activity/glycolysis (TLA/G) between 18F-FBPA and 18F-FDG were evaluated. Receiver operating characteristic (ROC) analysis of 18F-FDG SUVmax was conducted to determine the optimal threshold for quantitative discrimination. ***Results:*** The accumulation of 18F-FDG was correlated with that of 18F-FBPA. Among all parameters, MTV and TLG exhibited a strong correlation in head and neck cancers and high-grade gliomas. In high-grade gliomas, a strong correlation was observed between the SUVmax. The remaining parameters showed a moderate correlation in both types of cancers. The SUVmax of 9.45 for 18F-FDG in head and neck cancers and 8.20 in high-grade gliomas are considered as the optimal threshold values for predicting a TNR of 2.5 for 18F-FBPA. ***Conclusion:*** The tumor uptake in 18F-FDG PET/CT is correlated with 18F-FBPA. Performing 18F-FDG PET/CT may serve as an effective screening method to identify suitable patients for BNCT treatment when 18F-FBPA PET/CT is unavailable.

OP-104

Machine Learning-Based Analysis of Cachexia and Survival in HNSCC via$^{[18F]}$FDG PET/CT Metabolic Profiling

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Aim/Introduction: Cancer-associated cachexia in head and neck squamous cell carcinoma (HNSCC) presents significant diagnostic challenges due to its complex pathophysiology and the absence of precise diagnostic tools. We investigated potential metabolic biomarkers linked to cachexia and survival in patients with HNSCC through 18F-FDG PET/CT imaging and machine learning analysis. ***Materials and Methods:*** We conducted a retrospective analysis of 253 histologically confirmed HNSCC patients from Vienna General Hospital and MD Anderson Cancer Center (The Cancer Imaging Archive1). For quantitative analysis, we utilized MOOSE (Multi-Organ Objective Segmentation2), an in-house developed tool, to automatically segment tissues of interest and derive volumetric and metabolic value (SUVbw) from [18]F-FDG PET/CT scans. We assessed image-based parameters in 26 tissues and organs (e.g., mean SUVbw and volume of skeletal muscle, subcutaneous fat and visceral adipose tissue) and evaluated their association with 17 clinical parameters (e.g., gender, clinical staging, smoking history, HPV and therapy regimen). Patients were categorized by cachexia severity using the Weight Loss Grading System (WLGS). Additionally, a machine learning-based model and Cox regression analysis were employed to identify predictors for patient survival. The machine learning model incorporated organ-level metabolic activities, volumes of anatomical structures, and clinical parameters. Shapley additive explanation (SHAP) analysis was employed to demonstrate the importance of various features in predicting cachexia severity and patient survival. ***Results:*** Patients with severe cachexia (WLGS 3/4) exhibited significant metabolic changes, notably increased glucose metabolism in skeletal muscle and adipose tissue, contrasted by decreased lung metabolism in those with less severe cachexia (WLGS 0/1/2). The one-year survival rates were significantly different: 84.11% in WLGS 0/1/2 versus 69.18% in WLGS 3/4 ($p<0.05$). Interestingly, pancreatic volume was identified as a crucial metabolic biomarker through SHAP analysis. The predictive model demonstrated robust performance, achieving an AUC of 0.79 (95% CI 0.77-0.80) and accuracy 0.82 (95% CI 0.81-0.83). Additionally, a multivariate Cox regression analysis confirmed the significance of pancreatic volume as an independent prognostic factor (HR: 0.66, 95% CI: 0.46-0.95; $p<0.05$). ***Conclusion:*** By integrating advanced [18] F-FDG PET/CT with computational analysis, this study underscores

the significance of pancreatic volume in understanding the metabolic complexities associated with cachexia in HNSCC. Our findings enhance understanding of the complex organ interactions in cachexia development in HNSCC, highlighting new avenues for therapeutic intervention. ***References:*** 1 AJ Grossberg JAMA Oncol 2016, 2 LKS Sundar J Nucl Med 2022.

OP-105

The Prognostic Value of PARS Deep Learning Software in Patients with Nasopharyngeal Carcinoma

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Aim/Introduction: The development of Deep learning software PET-Assisted Reporting System (PARS) assists clinicians to identify lesions and measure metabolic tumor volume (MTV) and total lesion glycolysis (TLG). This study aimed to evaluate the value of PARS software for prognostic assessment of patients with nasopharyngeal carcinoma (NPC). ***Materials and Methods:*** This study retrospectively enrolled NPC patients who underwent 18F-FDG PET/CT at the PET center of Wuhan Union Hospital in 2018. Clinical characteristics were collected, and patients were followed up through the Hospital Information System (HIS) and by telephone. Survival analysis endpoints include disease progression or all-cause death. Progress Free Survival (PFS) and overall survival (OS) were defined as the duration from the date of pathologic diagnosis until the first disease progression (local recurrence or distant metastasis) or all-cause death, respectively. The reconstructed images were imported into the PARS software and analyzed with SUVmax > 2.5 and 40% of region SUVmax as thresholds. SUVmax, SUVpeak, SUVmean, CV40%, MTV, and TLG at the primary lesion were collected, and Heterogeneity index (HI) was defined as the SUVmean divided by SUVmax. Two senior nuclear medicine physicians performed benign-malignant discrimination of all suspicious foci and physiological uptakes drawn by the PARS software and summarized the total-body MTV (TB-MTV) and TLG (TB-TLG). Univariate and multivariate COX regression were used to screen survival-related factors. ***Results:*** A total of 69 patients were included, of whom 48 were males. The average age was 49.07±1.38 years. The median follow-up time for PFS was 832 (725.5, 971) days, with 14 patients experiencing disease progression, the median PFS time was 867 (95% CI: 837.15, 896.85) days, and the 2-year progression-free survival rate was 81.25%. The median follow-up time for OS was 840 (757, 935) days, with 5 all-cause deaths (all with disease progression), the median survival time was 865 (95% CI: 835.67, 894.33) days, and the 2-year OS rate of 91.94%. In univariate COX regression models, age, TB-MTV, and MTV were selected as independent factors for disease progression; while age, lymphocytes, albumin, and HI were selected as independent factors for all-cause death ($P < 0.05$). Age, albumin, TB-MTV, TB-TLG, MTV, and HI were independent factors for disease progression, while age, albumin, neutrophils, and lymphocytes were selected as independent predictors of all-cause death. ***Conclusion:*** The PARS software is capable of recognizing primary and metastatic lesions of NPC, and its acquired image information is beneficial for the prognosis assessment of NPC patients.

OP-106

Radiomics and Machine Learning in Head and Neck Cancer: Differentiating Post-Intervention Changes from Tumor Recurrence

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Aim/Introduction: Head and neck (H&N) cancers constitute the seventh most common cancer globally. The main management strategy includes surgery+chemo-radiotherapy whenever possible. However, one major predicament post-primary management is differentiation of post-interventional changes from recurrent disease. Thus, we evaluated the utility of 18F FDG PET-CT derived radiomic features (RF) and machine learning model (MLM) to correctly differentiate post-interventional changes from recurrent disease. ***Materials and Methods:*** Patients with suspicion of recurrent H&N cancer who underwent 18F FDG PET-CECT imaging were included in the study. Experienced nuclear medicine physicians manually delineated the regions of interest (ROIs), and intensity-threshold restrictions of 25% and 35% were applied to create three distinct sets of ROIs and high-dimensional RF were extracted using LIFEx (v7.6).Statistical analysis included the Mann-Whitney test to identify the difference of mean of all individual RF and their statistical significance in differentiating patients with post-interventional changes versus recurrent disease. RF with an area under the curve(AUC) greater than 0.7 on receiver operator curve(ROC) were retained. Subsequently, the least absolute shrinkage and operator (LASSO) algorithm was used to further refine the feature selection by removing low-weight features. A support vector machine(SVM) -based MLM was developed using R v.4.1.3, with 75% of the data for training and 25% for validation. The model's performance was assessed using ROC curves, with histopathological examination(HPE) or follow-up as the gold standard. Key metrics such as sensitivity, specificity, negative predictive value (NPV), positive predictive value (PPV), and accuracy were calculated to evaluate the model's effectiveness. ***Results:*** The study included 142 H&N cancer patients (120 males, median age-51, range: 25-89 years). Among these, 74 had post-interventional changes and 68 had recurrence as confirmed by HPE or follow-up. A total of 161 RF were extracted from each 18F FDG PET-CT image at three intensity thresholds, with the most significant results observed at the 35% threshold. Univariate analysis revealed 134 RF were statistically significant predictors of outcome ($P<0.05$). Among these, 81 features with AUC>0.7 were selected for multivariate analysis using the LASSO algorithm. The LASSO algorithm identified 8 high-weightage parameters, forming the basis for the SVM-MLM. The SVM-MLM achieved a sensitivity, specificity, PPV, NPV and accuracy of 82.3%, 77.7%, 77.7%, 82.3% and 80% respectively with AUC of 0.873. ***Conclusion:*** SVM-MLM using RF can effectively differentiate interventional changes from disease recurrence in H&N cancer patients, demonstrating its potential clinical utility in addressing this perplexing clinical scenario.

OP-107

Total tumor burden measured by FDG-PET in patients with oropharyngeal squamous cell carcinoma predicts distant metastases

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Aim/Introduction: The incidence of oropharyngeal squamous cell carcinoma is steadily rising, the tumor is often diagnosed in locally advanced stages (LOPC). Chemoradiation (CRT) is a frequently chosen primary treatment approach with considerable toxicities and high rates of loco-regional control, especially in human papillomavirus positive disease. Therefore, treatment de-escalation is an ongoing issue with mutliple clinical trials investigating its feasibility. Metachronous distant metastasis is less common compared to other locally advanced squamous cell malignancies but affects up to 20% of patients. A biomarker based selection of patients with high risk for development of distant metastases is urgently needed. This biomarker could be used for consolidative checkpoint inhibition or other pharmacological interventions. Here, we investigated the prognostic utility of total tumor burden (TTB) in LOPC for prediction of distant metastases. ***Materials and Methods:*** Altogether, 431 patients ((61+/-9)y, 335 male) with newly diagnosed LOPC were included. All patients received FDG-PET/CT prior to definitive radiochemotherapy. In the PET images, the metabolically active volume of the primary tumor (MTV) and of all FDG avid lymph nodes was delineated with an adaptive threshold method. TTB was computed as the cumulative volume of primary tumor and lymph nodes. Survival analysis with respect to freedom from distant metastases (FFDM) was performed. ***Results:*** Survival analysis revealed MTV and TTB as prognostic factors for FFDM (P<0.001). Hazard ratio (HR) for TTB was significantly higher than HR for MTV (4.1 vs. 2.7, P=0.02). In multivariate analysis with clinical parameters (age, sex T, N, UICC) as confounding factors a significant effect was found only for TTB (P<0.001). ***Conclusion:*** In the investigated group of patients, TTB has a significantly larger prognostic value with respect to FFDM compared to MTV. Further investigations are necessary to confirm these promising results.

OP-108

Sentinel lymph node biopsy with ^{99m}Technetium-labeled nanocolloidal albumin in patients with oral cavity squamous cell carcinoma. Our 7 year experience.

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Aim/Introduction: Lymph node status is the most important prognostic factor in oral squamous cell carcinoma (OSCC). Around 30% of patients with early-stage(T1-T2) disease will have occult cervical metastasis. The management of these patients has traditionally involved therapeutic elective neck dissection (END). Our aim was to describe our 7-year experience performing sentinel lymph node biopsy (SLNB) in patients with early-stage and cN0 OSCC. ***Materials and Methods:*** A descriptive-retrospective study of 65 patients diagnosed with cT1-T2 cN0 OSCC was performed. Stage was clinically and radiologically assessed (CT or MRI). Exclusion criteria included history of external-radiotherapy and/or cervical surgery. Peritumoral and submucosal injection of 74MBq of 99mTc-Nanocolloidal albumin (99mTc-Nanocoll) was performed, followed by acquisition of lymphoscintigraphic images, and cervical SPECT/TC. Two nuclear medicine experts interpreted the images, describing the presence of lymphatic migration and its characteristics. Subsequently, the patients underwent surgery with complete resection of the primary tumor and gamma-probe-guided SNLB. The histopathological analysis evaluated the presence (pN+) or absense (pN0) of cervical lymphatic metastasis. Finally, the evolution of the patients with a pN0 result was investigated, describing the presence of lymphatic recurrence during a follow-up of at least 2 years. ***Results:*** We studied 34 male and 31 female patients, aged 24-91 years (mean 69.27) and diagnosed with early-stage OSCC (T1:81.54%; T2:18.46%), located in: lip(35.38%), tongue(33.85%), floor of the mouth(15.38%), gingiva(10.77%), or jugal mucosa(4.62%). Lymphatic migration was observed on 95.38% of patients, of which 64.52% had unilateral drainage. Patients with bilateral drainage (35.48%) had a tumor located near the midline in 63.64% of cases. The histopathological analysis found pN+ in 7 patients (10.77%), 4 of whom showed no metastatic involvement of any other lymph node after END, meaning that SLNB itself succesfully treated local cervical disease in 90.77% of cases (58 pN0 and 4 pN+). There were 3 patients without radiotracer migration, 2 of whom showed pN+ after lymphadenectomy was performed. 33 (60%) of the patients with pN0 after SLNB, completed a minimun follow-upof 2 years (mean 2.7), showing zero cases of lymphatic recurrence after SLNB. ***Conclusion:*** SLNB with 99Tc-Nanocoll demonstrated a high efficiency in the cervical staging of the patients with early-stage and node-negative OSCC, with a high percentage of lymphatic migration, a high rate of local cervical disease control, and with a very low rate of lymphatic recurrence. SLNB presents an opportunity to decrease more invasive surgical interventions and potentially associated morbidity for patients who are ultimately N0.

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Sunday, October 20, 2024, 09:45 - 11:15
Hall Y10-Y12

TROP Session: Paediatrics Committee: Paediatric Nephrourology & Others

OP-109

First experience with^{18}F-FAZA PET in kidney allografts dysfunction

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Aim/Introduction: Investigate if 18F-FAZA-PET can be used to evaluate post-transplant kidney allografts to determine the extent, location and severity of renal injury; Evaluate the correlation of 18F-FAZA-PET-derived parameters with histopathology findings on a concomitant biopsy. ***Materials and Methods:*** This IRB-approved, prospective pilot study evaluated renal transplant patients with a dedicated PET/MR protocol between 2018 and 2023. We included 20 patients with impaired kidney graft function, as evidenced by elevated serum creatinine (Cr), or significant proteinuria, and 10 sex- and graft age-matched control patients with stable graft function. For all patients, standard-of-care investigations were performed. Patients with graft impairment also underwent an ultrasound-guided biopsy to identify the underlying impairment cause. 18F-FAZA-PET was performed on a 3.0T PET/MR scanner. Patients were injected with up to 5MBq/kg 18F-FAZA and imaged simultaneously with the injection for the initial 20min. Two hours after injection, a static PET was acquired for 20min. Volumes of interest (VOIs) were contoured manually in consensus post PET and MR registration. The kinetic modelling and parameters (k1,k2,k3,k4, as well as VT -total volume distribution) were derived from the dynamic PET. On the delayed PET, the average standardized uptake value (SUVmean) was measured. ***Results:*** Overall, 30 patients (mean age=53y; Male%=48%; mean estimated glomerular filtration rate [eGFR]=45ml/min; mean Cr=174µmol/L) underwent PET/MR. The kinetic parameters, k1, k3, k3/k4, and VT were 2.45±1.06, 0.92±0.75, 0.75±0.66, 2.11±0.55 in non-biopsied, stable patients versus 1.74±0.79, 0.68±0.66, 0.76±0.69 and 1.62±0.45 in biopsied patients. VT was significantly lower in the biopsied patients (Mann-Whitney U; p=0.026). The delayed SUVmean was 4.83±0.88 versus 5.13±0.83 (p=0.501). Correlating the PET parameters with the clinical factors, VT was significantly inversely correlated with the serum Cr (rs=-0.446;p=0.008) and directly correlated with eGFR (rs=0.467;p=0.005). Furthermore, in the biopsied patients, we evaluated the correlations between PET parameters and histopathology findings. K1 was significantly correlated with vascular fibrous intimal thickening (p=0.036), k3 with arteriolar hyalinosis (p=0.006), k3/k4 with globally sclerotic glomeruli and arteriolar hyalinosis (p=0.009 and 0.038, respectively), VT with interstitial inflammation (p=0.032), and SUVmean with globally sclerotic glomeruli (0.012). ***Conclusion:*** 18F-FAZA-PET is potentially a valuable modality in post-transplant allografts. In particular, the kinetic parameters correlated significantly with clinical factors (e.g., Cr, eGFR) and various pathological parameters, making 18F-FAZA-PET a potential non-invasive alternative for allograft assessment; not only visualizing impairment, but more importantly, determining the underlying cause of renal dysfunction. Further analyses of the correlation between PET-derived parameters and biomarkers of kidney injury are ongoing.

OP-110

Using Clinical and Imaging Data to Forecast [^{99m}Tc]Tc-DMSA Scan Findings

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Aim/Introduction: Renal scan using technetium-99m labelled dimercaptosuccinic acid ([99mTc]Tc-DMSA) is a valuable sensitivity tool to detect permanent renal parenchymal scarring at least six months following an acute urinary tract infection (UTI). However, because most of [99mTc]Tc-DMSA scan do not show any abnormalities, a risk assessment is necessary for the selective use of this imaging test. We aimed to assess the association of the [99mTc]Tc-DMSA results with risk factors for renal scar, such as urine culture growth results (UC), the number of previous UTIs, as well as imaging abnormalities detected by kidney ultrasound (US) and cystography. ***Materials and Methods:*** We conducted a retrospective cohort study involving paediatric patients referred, between January 2015 and December 2017, for [99mTc]Tc-DMSA scan to detect renal scar. We collected clinical and imaging data, including age at presentation, number of previous UTIs, UC results, kidney US findings and cystography results. A Binomial Logistic Regression model (utilizing SPSS Statistics 29.0.2.0) was employed to examine the associations between US results, UC results, presence of previous UTI, and [99mTc]Tc-DMSA scan findings. ***Results:*** Out of 633 patients included in the study, the [99mTc]Tc-DMSA scan was considered normal in 481 (75.9%). The remain 152 (24.1%) scans, showed findings consistent with renal scarring, including 100 (15.8%) with impact in split renal function. The analysis revealed that the presence of non-Multidrug Resistant (MDR) bacteria was independently linked to normal [99mTc]Tc-DMSA scan results, with an odds ratio (OR) of 2.79 (95% CI: 1.548 to 5.004, P<0.001). Additionally, the absence of a prior UTI was significantly associated with normal [99mTc] Tc-DMSA scan findings, indicated by an OR of 13.03 (95% CI: 7.91 to 21.48, P<0.001). Furthermore, a normal kidney US was strongly predictive of normal [99mTc]Tc-DMSA results, with an OR of 14.51 (95% CI: 7.38 to 28.55, P<0.001). ***Conclusion:*** Our results emphasize the statistical significance and the strength of the associations between clinical/imaging factors with [99mTc]Tc-DMSA scan outcomes. This model is potentially helpful in patient triage, particularly in the presence of a normal US, non-MDR bacteria, and no previous history of UTI, where the likelihood of normal [99mTc]Tc-DMSA scan results is high.

OP-111

Potential for Shortening Acquisition Time or Administered Activity in Paediatric DMSA Scans with a 360-degree CZT Digital SPECT/CT Camera

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Aim/Introduction: New 360-degree CZT Digital SPECT/CT cameras are superior in sensitivity and spatial resolution to conventional SPECT/CT. This pilot study investigated the potential of these cameras to shorten acquisition time or injected activity in pediatric DMSA scans. ***Materials and Methods:*** Fifteen successive DMSA scans of children 2-17 years old (median age 7 years) were analyzed. The original, vendor recommended, acquisition time was 5 minutes. Injected activities were based on the EANM dosage calculator. Original study counts were retrospectively truncated by 25%, 50%, and 75% to simulate similar reductions in acquisition time or dose. All 4 count groups were reconstructed using similar OSEM parameters. Altogether, 60 reconstructions were presented twice in random order to an experienced reader blinded to clinical, acquisition, and count group information. Each reconstruction was evaluated for image quality using a Likert scale

(1-unacceptable, 2-poor, 3- 3-acceptable, 4-good, 5-excellent), interpretation confidence level (1-low, 2-intermediate, 3-high) the number of cortical defects and relative function of the kidneys. Differences between the original full-time group and the 3 count truncation groups were statistically analyzed by ANOVA. Intra-observer variability was evaluated by paired t-test. ***Results:*** The mean image quality score was 4.2 in the full-time and 3.8, 3.4, and 2.7 in the 25%,50%, and 75% count groups respectively. The difference was statistically significant between the full-time and the 50% and 75% groups, but not between the full-time and 25% groups. Interpretation confidence was 2.7, 2.4, 2.2, and 1.8 in the full-time, 25%, 50%, and 75% groups respectively. The difference between the mean confidence scores of the 50% and 75% count truncation groups and the full-time group was statistically significant. No significant difference was observed between the full-time and 25% count groups. A good correlation was found between image quality and confidence scores (Spearman's rank correlation- 0.78, P-value <0.001). The mean number of cortical defects was 0.9, 0.8, 1.2, and 1.3 in the full-time, 25%,50%, and 75% groups respectively. The differences were not statistically significant. The kidneys' differential function was similar in all groups. Intra-observer variability was non-significant. ***Conclusion:*** Performing pediatric DMSA scans with a 360-degree CZT Digital SPECT/CT camera can potentially reduce the default 5-minute acquisition or the standard radiopharmaceutical activity by 25%. Interpretation confidence can be affected when the reduction is greater than 25%. These preliminary observations should be substantiated in larger patient cohorts.

OP-112

Diagnostic utility of ^{68}Ga-DOTANOC PET/CT in paediatric neuroblastic tumours presenting as Opsoclonus myoclonus ataxia syndrome - a retrospective analysis

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Aim/Introduction: Paediatric neuroblastoma may initially manifest with Opsoclonus myoclonus ataxia syndrome (OMAS) (Kinsbourne syndrome/ Dancing eye syndrome), a paraneoplastic neurological syndrome, in approximately 2 - 3% of children. But in as many as 50% of children with this syndrome, neuroblastoma is the cause. In children with OMAS, therapy with steroids or immunosuppressive or cytotoxic drugs is required, along with treating the primary cause. Routine tests to detect occult neuroblastoma include anatomical imaging of chest and abdomen with USG/ CT/ MRI. 131I-MIBG scintigraphy has also been used, but, limited by its availability, strenuous patient preparation and high radiation exposure. Hence, a single screening study which is sensitive, readily available, detect metastasis and simultaneously staging is required. ***Materials and Methods:*** Retrospective data of 68Ga-DOTANOC PET/CT of 74 paediatric patients presenting with OMAS from March 2012 2019 to December 2023 was evaluated. Somatostatin receptor (SSTR) expressing lesion (lesion uptake greater than physiological adrenal uptake) with corresponding morphological change on CT image was considered PET-positive, while no abnormal SSTR expression or lesion was considered PET-negative. Reference standards for comparing the PET/CT results included histopathology and/or clinical/imaging follow-up (at least a year). ***Results:*** Of 74 patients, (29 males, 45 females, with mean age 1.5 years), 43 (58.1%) patients had SSTR expressing lesions (PET-positive). Histopathology revealed neuroblastic tumours in 39/43 lesions and reactive hyperplasia in 4/43 patients. The remaining 31/74 (41.9%) patients did not demonstrate any SSTR expressing lesion (PET negative). The mean SUVmax of PET-positive lesions was 10.5 (SD = 6.3). The PET/CT results revealed 39 true-positive, four false-positive, 31 true-negative, and zero false-negative. The sensitivity, specificity, positive predictive value, negative predictive value, and accuracy were 100%, 88.57%, 90.7%, 100%, and 94.6% respectively. ***Conclusion:*** In this retrospective analysis, neuroblastic tumours were the cause for OMAS in 52.7% of the patients. 68Ga-DOTANOC PET/CT can identify neuroblastic tumours with high accuracy and can provide rapid diagnosis, and hence guide optimal management.

OP-113

How Does Clinical Prognosis In Antenatal Hydronephrosis Correlate With Diuretic ^{99m}Tc MAG3 Renal Scintigraphy Retention Parameters?

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Aim/Introduction: This retrospective study aimed to evaluate the predictive value of renal pelvic retention ratios at specific time points on 99mTc MAG3 renal scintigraphy for the clinical decision and outcome of patients with antenatal hydronephrosis. ***Materials and Methods:*** 156 patients who underwent diuretic 99mTc MAG3 renal scintigraphy for antenatal hydronephrosis were included in the study. The mean age was 2.98 ± 1.45 years (0.5-6 years). Furosemide adjusted per kg was administered i.v. after 20 minutes of the study. 40-minute, post-void images and 2-hour late images were evaluated for their ratio to maximal activity and 1-2 minute activity (NORAmax) using an Excel sheet created for this purpose. Patients were divided into 4 groups: (A) 90 patients with a normal diuretic pattern, (B) 23 patients who recovered during follow-up, (C) 34 patients who recovered after pyeloplasty and double-J catheter insertion, or (D) 9 patients who ended up with atrophy/dysfunctional kidney despite interventional procedure. Wilcoxon signed-rank test for comparison of means and ROC curve analysis for sensitivity and specificity values were used. ***Results:*** No significant difference was observed between the 40-minute/maximum activity ratios of patients with normal renal function and patients who recovered during follow-up, whereas a significant difference was observed between all other groups ($p < 0.05$). The most sensitive method for determining which patients would recover at follow-up was the extent of retention on postvoid imaging, while the most sensitive values for the patients who benefited from the interventional procedure were the retention rates on late imaging. The NORAmax values were not meaningful enough to differentiate the prognosis of the patients. The mean values for the 40 min/max, post-void/max, and 2-hour image/max ratios were 15.6%, 9.6%, 3.4% for group A, 31.7%, 25.5%, 10% for group B, 85.5%, 67.1%, 49.3% for group C, 91.7%, 78% and 39.8% for group D, respectively. The ROC curve analysis showed that post-void and 2-hour images increased the accuracy of the test for differentiating the patients who needed an intervention. ***Conclusion:*** Maximum activity-based retention ratios can be used more sensitively and specifically to differentiate patients with the potential for spontaneous resolution. Patients with renal retention values of 25% post-void and less than 10% on 2-hour images are more likely to benefit from clinical follow-up, while patients with post-void retention values of 67%, and 2-hour retention values of 50% are more likely to benefit from interventional procedures.

OP-114

Efficacy of FAPI-PET as a noninvasive method for detecting liver fibrosis

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Aim/Introduction: Liver fibrosis occurs as a result of chronic liver injury of different etiologies, leading to a scar formation with excessive deposition of extracellular matrix. Progression of fibrosis is usually a latent process, which leads to impaired liver architecture and irreversible organ failure. Although fibrosis was previously assumed to be irreversible, recent evidence shows that fibrosis may recover, which highlights the importance of earlier detection. Fibroblast activation protein inhibitor (FAPI) PET/CT is a novel imaging method to visualize the activated fibroblasts with the possibility of noninvasively quantifying fibrosis relevant activity. The aim of this retrospective study is to evaluate the diagnostic potential of FAPI-PET/CT in liver fibrosis. ***Materials and Methods:*** 124 patients with various oncological diseases, who had undergone FAPI-PET/CT between July 2017 and Oct 2020 at the University of Heidelberg, were retrospectively analyzed and the SUVmax and SUVmean of liver were measured. In 82 of 124 patients with laboratory findings of serum transaminases and platelet count within 3 months from the date of PET/CT scan, three known fibrosis indices (APRI, FIB-4 and FibroIndex) were calculated. Correlation between these values was analyzed. ***Results:*** Mean standardized uptake value (SUVmean) of FAPI-PET correlated strongly with CT parameter (Hounsfield Unit; $p<0.005$). All of the evaluated fibrosis indices (APRI, FIB-4, FibroIndex) showed a mild positive correlation with SUVmean ($r=0.2$-0.3). Although the grade of correlation was moderate, the observed correlation was statistically significant for all indices (SUVmean vs. APRI: $p<0.01$, SUVmean vs. FIB-4: $p<0.05$, SUVmean vs. FibroIndex: $p<0.01$). ***Conclusion:*** FAPI-PET/CT is a promising method of imaging liver fibrosis with the possibility of visualizing and quantifying disease activity. Its potential use in disease monitoring and noninvasive assessment of clinically relevant disease activity should be warranted in the future study.

OP-116

Visualisation of Superficial Peritoneal Endometriosis with ^{99m}Tc-maraciclatide

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Aim/Introduction: Superficial peritoneal endometriosis (SPE) is the most common form of endometriosis, comprising approximately 80% of all diagnoses. However, due to the plaque-like nature and generally small size of lesions, SPE is not well visualised with current non-invasive imaging tools (US and MRI) and definitive diagnosis requires laparoscopy. 99mTc-maraciclatide contains the RGD motif (Arg-Gly-Asp) and binds to αvβ3 integrin which plays a key role in cell proliferation, inflammation, and angiogenesis, which are hallmarks of endometriosis. Maraciclatide has been shown to bind to ectopic endometriotic lesions in preclinical studies and 99mTc-maraciclatide has demonstrated diagnostic promise in other inflammatory conditions, such as rheumatoid arthritis. The current study aims to evaluate the potential of 99mTc-maraciclatide in detecting endometriosis and specifically, SPE. ***Materials and Methods:*** Up to 25 women with confirmed or suspected endometriosis are being recruited into a study to determine whether SPECT/CT imaging following intravenous injection of 740 MBq 99mTc-maraciclatide can detect endometriotic lesions, in particular superficial peritoneal lesions, in the pelvis and elsewhere. Images were acquired ranging from 10 mins to 21 hours post-injection. A range of image processing tools were employed to enhance lesion visualisation. To evaluate effectiveness, laparoscopic/histopathology and SPECT/CT findings were compared. ***Results:*** Evaluation of images from the first 12 participants suggests 10 minutes post-injection to be the optimal imaging time point allowing clearance of the agent from the blood pool and minimising bladder activity. 99mTc-maraciclatide uptake has been observed in superficial peritoneal and deep endometriosis lesions seen on laparoscopy. For example 99mTc-maraciclatide image showed uptake into a superficial lesion seen on laparoscopy, the 22 year old subject had a recent negative ultrasound study for endometriosis. Recruitment and scanning are ongoing, and supplementary findings and insights, in particular with reference to the detection of disease subtypes will be presented. ***Conclusion:*** These encouraging preliminary data suggest that 99mTc-maraciclatide could have the potential to be the first non-invasive imaging test for superficial peritoneal endometriosis and impact the lives of millions of women. If confirmed, it could expand our understanding of the pathogenesis of endometriosis, increase diagnostic imaging sensitivity, contribute to a reduction in the diagnostic delay (average of 7.5 years from symptom onset), and complement the existing diagnostic pathway by mitigating current imaging modalities' limitations by aiding in the detection of superficial, deep and extra-pelvic lesions.

OP-117

Head-to-head comparison of perfusion SPECT and volumetric CT for predicting post-segmentectomy lung function

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Aim/Introduction: Lung perfusion single-photon emission computed tomography (SPECT) has already shown to be predictive of post-operative lung function after lobectomy for advanced lung cancers. The objective of this study was to compare the accuracy of quantitative lung perfusion SPECT and volumetric computed tomography (CT) fused images for predicting lung function after segmentectomy in early-stage lung cancer patients. ***Materials and Methods:*** From April 2021 to June 2023, all early-stage lung cancer patients planned for therapeutic segmental lung resections underwent lung perfusion SPECT/CT prior to surgery. Segment contouring on the CT images was manually performed by two experienced nuclear physicians. The function of lung segments planned for resection were obtained from pre-operative perfusion SPECT and from volumetric CT and were compared with parameters obtained from spirometry at 1- and 6-months post-surgery, namely the predicted forced expiratory volume in one second (FEV1), the lung carbon monoxide diffusion capacity (DLCO), and the vital capacity (VC). Multivariate analyses for the prediction of FEV1 at 1- and 6-months post-surgery, including perfusion SPECT and volumetric CT values as well as age, sex and number of segments resected, were also performed.

Results: Fifty-two consecutive patients (67 years [Q1:65, Q3:72], 21 women), with a median of 1 [Q1:1, Q3:2] segment resected, were included in this retrospective analysis. Significant associations were found between the lung function values of planned resected segments according to perfusion SPECT and the 1-month post-operative FEV1 (R=0.33, p=0.019), DLCO (R=0.32, p=0.033), and CV (R=0.39, p=0.009). By contrast, only CV showed significant association with function values of planned resected segments according to perfusion SPECT at 6 months (R=0.35, p= 0.017). No significant association was found using the function of the planned resected lung segment(s) obtained with pre-operative volumetric CT at either 1 month or 6 months. In multivariate analysis, only age and quantitative SPECT were significantly related with the FEV1 at 1 month (p=0.01). ***Conclusion:*** Lung function values of planned resected segments are more accurate when determined from perfusion SPECT than from volumetric CT for prediction of post-segmentectomy lung function. This prediction showed better correlation with spirometry at 1 month rather than at 6 months post-segmentectomy, probably due to patient rehabilitation program effects. Perfusion SPECT, with relatively low associated irradiation (median of 6,49 mSv [Q1: 6,14, Q3:7,18]), is an interesting tool to pre-operatively assess the immediate risk of post-operative dyspnea and to help manage patient rehabilitation in early-lung cancer patients undergoing therapeutic segmental lung resection.

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Sunday, October 20, 2024, 09:45 - 11:15
Hall G2

Joint Symposium 1 - Cardiovascular Committee / EACVI - Coronary Artery Disease in Women: the X Factor?

OP-118
Specific aspects of coronary artery disease in women
C. Gebhard *;*
University Hospital Zurich, Department of Nuclear Medicine, Zurich, SWITZERLAND.

OP-119
Role of MPI for the detection of epicardial coronary artery disease
M. Lyngby Lassen ;
Rigshospitalet and University of Copenhagen, Department of Biomedical Sciences, Copenhagen, DENMARK.

OP-120
Role of myocardial perfusion imaging for the detection of microvascular disease
A. Gimelli;
Fondazione Toscana G. Monasterio, Nuclear Medicine, Pisa, ITALY.

OP-121
Role of cardiac MRI for the detection of microvascular disease
G. Pontone;
Director of peri-operative Cordiology and Cardiovascular Imaging Department and Directory of Sport Cardiology c/o Centro Cardiologico Monzino IRCCS Milan, ITALY.

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Sunday, October 20, 2024, 09:45 - 11:15
Hall F

e-Poster Presentations Session 2: Oncology & Theranostics Committee: Neuroendocrine and Gastro Intestinal Cancers

EPS-022
Condylar hyperplasia - assessment of the temporomandibular joints' asymmetry using ^{99m}Tc-HDP bone SPECT with voxel-based evaluation: 10-years' experience.
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Aim/Introduction: Enlargement of the articular head or joint capsule can occur as a result of persistent growth activity (idiopathic condylar hyperplasia ICH), tumours or bone disease (fibrous dysplasia, Paget's disease). Joint head shrinkage can occur due to resorptive activities (post-traumatic changes, degenerative changes, idiopathic condylar resorption). The most often cause of the temporomandibular joints (TMJ) asymmetry is ICH. Its diagnosis is based on combination of clinical symptoms observation and imaging methods. Single photon emission computed tomography (SPECT) or SPECT/CT is used for detection of positive or negative growth activity. The aim of the study was to quantify TMJ asymmetry using 99mTc-HDP bone SPECT with voxel-based assessment for selection of a suitable surgery or another therapy. ***Materials and Methods:*** Our experience covers 725 patients (490 female a 235 male, mean age 22 years) with a diagnosis of facial asymmetry due to the enlargement of articular process examined in our department within 2013-2022. A tumorous condyle was ruled out using a panoramic radiograph and cone-beam CT. All patients underwent bone SPECT, which was performed 2-3 hours after injection of 300-700MBq 99mTc-HDP on dual-head gamma camera GE Infinia using low-energy, high-resolution collimator, with the following acquisition parameters:120 projections, 20s per projection, matrix 128x128 pixels, auto-contouring. TMJ asymmetry was evaluated in terms of right/left uptake ratio. Counts on either side were calculated as the sum within VOI defined as the intersection of two spatial masks. One mask was defined via an intensity threshold and served to separate out the background. The other mask was defined as a sphere and served to separate out objects outside the condyle. Total counts from each VOI (L from left condyle, R from right condyle) served as inputs to the calculation of left-to-right ratio: L/(L+R)·100% vs. R/(R+L)·100%. ***Results:*** 119 patients had uptake difference higher than 10 percentage points (pp). These patients were indicated for condylar shaving to stop the condyle growth, however 4 of them refused this solution. In 606 patients no pathological growth activity was observed having uptake difference of 10pp or lower, which disproved working diagnosis of ICH. These patients underwent planned orthodontic therapy (422 patients) and orthodontic-surgical therapy (184 patients) to correct facial asymmetry. ***Conclusion:*** TMJ growth asymmetry assessed by 99mTc-HDP bone SPECT with voxel-based evaluation is crucial in diagnosis of ICH and for choosing the proper surgery or other suitable therapy.

EPS-023

Clinical impact of the 75 taurosecolic (75SeHCAT) scintigraphy on chronic diarrhoea and bile acid malabsorption

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Aim/Introduction: To assess the clinical impact of 75SeHCAT scintigraphy diagnosing patients with chronic diarrhoea and suspected bile acid malabsorption (BAM) and evaluating the guided treatment and tolerability with cholestyramine resin. ***Materials and Methods:*** Retrospective analysis of patients who underwent 75SeHCAT scintigraphy for chronic diarrhoea in our nuclear medicine department (1st January and 31st December 2022). A positive result of BAM was defined as a retention of less than 15% of bile acids 7 days after oral intake of 75SeHCAT. Bile acid malabsorption was further subclassified as mild (<15%), moderate (<10%), or severe (<5%). We also, classified BAM by types: 1) BAM from ileal disease or ileal resection/bypass; 2) primary (idiopathic) and 3) all other causes not included within type 1 or 2. ***Results:*** 75SeHCAT scintigraphy was performed in 269 patients (173 women, mean age 49,8 years [15-90]).It was positive in 144 patients (53,5%): 41 mild (type1=4; type2=28; type3=9), 48 moderate (type1=4; type2=27; type3=17), and 55 severe (type1=7; type2=33; type3=15). Ninety-eight received cholestyramine resin treatment: 22 mild (type1=2; type2=14; type3=6), 28 moderate (type1=1; type2=12; type3=15), and 48 severe (type1=6; type2=29; type3=13). Eighty-two showed clinical improvement: 14 mild (type1=1; type2=9; type3=4), 25 moderate (type1=1; type2=10; type3=14), 43 severe (type1=5; type2=26; type3=12). In terms of treatment tolerance, 21 (21,4%) needed to suspend treatment due to intolerance or adverse effects: 3 mild; (type1=1, type2=2), 5 moderate; (type2=2, type3=3) and 13 severe; (type2=8, type3=5).Forty-six patients with positive result did not receive cholestyramine treatment. Of these, 3 improved by using a different bile acid sequestrant, 7 by making changes in their diet and two by modifying oral antidiabetic treatment (switching metformin for GLP1 receptor agonist).The scintigraphy result was negative in 125 patients. Of these, 31 received cholestyramine treatment and 13 showed clinical improvement (mean retention of 75SeHCAT was 21,8% and 13 showed intolerance. They were subclassified into two groups, using a cut-off point of 22 % of retention, 16 patients with ≥ 22% of retention and 15 <22%. The first group showed intolerance in 56 % of the patients (9) and the second group in 26,6% (4). ***Conclusion:*** 75SeHCAT scintigraphy is a diagnostic tool that helps in the selection of patients with BAM who are potentially candidates for treatment with cholestyramine; consequently, it avoids unnecessary side effect. Most patients with a negative scan who benefited from cholestyramine treatment had a mean retention rate of less than 22 % on day 7.

EPS-024

Exploring the Potential Value of [68Ga]Ga-FAPI-46 PET-CT for Molecular Assessment of Fibroblast Activation in Interstitial Lung Disease: a single-center pilot study

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Aim/Introduction: The aim of the study was to evaluate the association of high-resolution computed tomography (HRCT) findings with pulmonary fibrotic activity in the corresponding regions using [68Ga]Ga-FAPI PET/CT in patients with interstitial lung disease (ILD). Additionally, the potential of [68Ga]Ga-FAPI-46 PET/CT for evaluating the active fibrosis process and 99mTc-MIBI scintigraphy for assessing the inflammatory process in ILD patients was also assessed. ***Materials and Methods:*** In this pilot study, 20 ILD patients underwent [68Ga]Ga-FAPI-46 PET/CT and 99mTc-MIBI SPECT/CT. Additionally, 10 patients without lung or thoracic involvement who were undergoing [68Ga]Ga-FAPI PET/CT for cancer detection were enrolled in the control group. The images were evaluated both visually and quantitatively and compared with HRCT and pulmonary function tests (PFTs). Multiple quantitative parameters were derived from the lung segments in the PET scan, including SUVmax, SUVmean, maximum target-to-liver ratio (TLRmax), TLRmean, and total lesion FAPI-expression (TL-FAPI) for the entire lung as well as its lobes and zones. Additionally, the maximum Hounsfield unit (HUmax) and mean HU (HUmean) in HRCT were calculated for the whole lung as well as its lobes and zones. Furthermore, an HRCT fibrosis score (HFS) was defined according to the HRCT findings. ***Results:*** Based on visual assessment, the FAPI scan was positive in 12 (60%) of the patients. Similarly, the MIBI scan was positive in 12 (60%) of the patients. In the 20 ILD cases, both scans were positive in six cases and both were negative in two cases. Six cases showed FAPI-negative and MIBI-positive results, while another six cases showed FAPI-positive and MIBI-negative results. Comparing the control and ILD patients, there was a significant difference in SUVmax, SUVmean, TL-FAPI, TLRmean, HUmax, and HUmean ($p<0.05$). When comparing TFS with PET-derived parameters in zones, a significant positive correlation was found between TFS and SUVmean, SUVmax, TLRmax, and TLRmean ($p<0.05$). Additionally, a significant difference was noted between FAPI results and TFS ($p=0.003$). An ancillary finding, 9 out of 20 (45%) ILD patient showed intensely FAPI uptakes in gallbladder while none of 10-control group showed such uptake. ***Conclusion:*** The present study may suggest that combining [68Ga]Ga-FAPI PET/CT and 99mTc-MIBI SPECT/CT yields an additive effect for evaluating ILD-related fibrosis and inflammatory processes over using either modality alone. Furthermore, it appears that [68Ga]Ga-FAPI PET/CT has the potential to ascertain levels of fibrotic activity from population of resident fibroblasts, active fibroblasts, and scar maturation among ILD patients based on their HRCT patterns.

EPS-025

Analysis of the relationship between radionuclide post-treatment scintigraphic imaging data and hematological toxicity in patients with bone metastases

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Aim/Introduction: In order to identify prognostic factors for complications of radionuclide therapy with 153Sm-oxabiphore and further prevent their development, the relationship between hematological toxicity (HT) and the maximum percentage of 153Sm-oxabiphor uptake in pathological foci on post-treatment scintigraphic images (A max.) was studied in patients with bone metastases. ***Materials and Methods:*** The ranges of hemoglobin, leukocyte, granulocytes and platelets were analyzed in 45 patients three times: on days 2-6, days 10-14 and 3-4 weeks after administration 153Sm-oxabiphore. HT levels ranging from zero to three were determined. During computer processing of scintigraphic data, A max. was quite varied and ranged from 119% to 626%. There were 5 subgroups of patients according to level A max..The range of A max. in the first subgroup (11 patients) there was: 119 % - 150 %; in the second subgroup (15 patients): 151 % - 200 %; in the third subgroup (8 patients): 201 % - 295 %; in the fourth subgroup (4 patients): 309 % - 329 %; in the fifth subgroup (7 patients): 420 % - 626 %. ***Results:*** Among all patients, regardless of the level of 153Sm-oxabiphore uptake in pathological metastatic foci and specific activity upon intravenous administration, a low level of HT was detected. According to the hemoglobin level, the zero degree of HT was established in 88.8 %, the first degree of HT - in 10.6 %, the second - in 0.8 %, the third - never recorded. For leukocyte, the zero degree of HT was recorded in 76.8 %, the first - in 13.0 %, the second - in 7.4 %, the third - in 2.8 %. For granulocytes, the zero degree of HT was established in 89.8 %, the first degree of HT - 7.9 %, the second - 0.8 %, the third - 1.5 %. For platelets, the zero degree of HT was detected in 99.5 %, the first degree of HT was found in 0.4 %, the second and third were not observed. ***Conclusion:*** The above indicates a relatively safe prognosis on the HT, regardless of A max.. No correlation was found between these indicators. Thus, A max. cannot be a predictive factor for the occurrence of HT for therapy with 153Sm-oxabiphore.

EPS-026

Generalizability of an Adult-Trained Lymphoma PET/CT Metabolic Tumor Volume Segmentation Model to Pediatric Hodgkin Lymphoma Patients

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Aim/Introduction: In pediatric lymphoma cases, assessing total metabolic tumor volume (TMTV) via FDG PET/CT scans is crucial for prognosis and risk stratification. However, accurately delineating tumor volume through segmentation poses significant challenges due to variations in tumor characteristics and the presence of brown fat. To ensure accurate assessment and optimal patient management, there is a pressing need for robust and efficient segmentation techniques tailored specifically to pediatric lymphoma cases. This study aims to evaluate the generalizability and applicability of a segmentation model trained and tested initially on adult lymphoma cases when applied to pediatric cases. ***Materials and Methods:*** This retrospective study analyzed 200 pediatric patients with high-risk Hodgkin lymphoma using 18F-FDG PET/CT images from the Children's Oncology Group AHOD1331 clinical trial. Reference contours were created by three experienced physicians using MIM software after multi-reader adjudication. Additionally, 8 and 18 cases from other centers were included, with segmentation performed by a nuclear medicine physician using MIM software. TMTV-Net resamples PET/CT images, trains multiple 3D U-Net models with cross-validation, combines their outputs, feeds them into another 3D U-Net with original data, and uses a semi-supervised loss function. ***Results:*** TMTV-Net was able to accurately segment lymphoma in pediatric patients with a Dice score of 0.70±0.19 (precision/recall: 0.71/0.74) on data from Center I, which is comparable to the overall performance of the external multi-site testing set (0.66 ± 0.16) consisting of adult patients. Dice scores of 0.40±0.0 (precision/recall: 0.61/0.33) and 0.59±0.26 (precision/recall: 0.79/0.56) were achieved on the data from two other centers. Additionally, Pearson's r correlation for TMTV between physician and AI measurements was notably high at 0.90 on data from centers I, II, and III. The relative error of TMTV measurement were 0.32, 0.46, and 0.44 for centers I, II, and III respectively. ***Conclusion:*** We validated a fully automated segmentation network designed for adult lymphoma in pediatric cases across three centers. The model showed promising results in quantifying TMTV in pediatric patients at Center I, comparable to adult patients in an external testing set. However, results from Centers II and III suggest a need for fine-tuning the model for pediatric cases, possibly due to variations in imaging protocols or differences in segmentation methods, highlighting the importance of post-processing adjustments. ***References:*** Yousefirizi F, et al. TMTV-Net: fully automated total metabolic tumor volume segmentation in lymphoma PET/CT images—a multi-center generalizability analysis. European Journal of Nuclear Medicine and Molecular Imaging. 2024 Feb 8:1-8.

EPS-027

Feasibility Study of Advanced Renal Function Assessment Using Dynamic ^{99m}Tc-DTPA SPECT-CT

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Aim/Introduction: Glomerular filtration rate (GFR) assessment plays a crucial role in managing renal function. We introduce an advanced novel method utilizing dynamic 99mTc-DTPA SPECT-CT for evaluating both renal plasma flow and GFR. The SPECT estimated GRFSPECT is compared against GFRplasma estimated through conventional blood plasma sampling. Our approach employs a simple model to estimate GFRSPECT for each kidney. Additionally, the method provides advanced insights through estimates of renal plasma flow and plasma mean transit times through both the renal vascular bed and renal tissue. ***Materials and Methods:*** Two healthy volunteers underwent renal function assessment using our novel technique. We performed a dynamic scan using a 12-headed CZT SPECT-CT scanner following a bolus injection of approximately 200 MBq 99mTc-DTPA. To correct

the SPECT images for attenuation and accurately delineate the kidney structure and volume, we acquired a low-dose CT scan prior to the SPECT scan. We modeled individual kidney time-activity curves by convolution of the plasma input curve with a retention function. This retention function is composed of two smooth step functions, the first step function models the non-filtered tracer and the second step function models the tissue-filtered tracer. Both functions are characterized by a flat portion corresponding to the model parameters kidney plasma flow and GFRSPECT, respectively. The width of each step function simulates the mean transit time of non-filtered tracer through the renal capillaries/vascular bed (MTTcapillary) and the filtered tracer through renal tissue (MTTrenal) respectively. We also estimated total GFRplasma using plasma samples collected at various time points from 10 minutes to 6 hours post-injection. ***Results:*** We found GFRSPECT from both kidneys to be 142 ml/min, compared to GFRplasma of 106.5 ml/min. We measured plasma flow per kidney to be 247 ml/min, with a summed kidney flow value of 495 ml/min. We estimated MTTcapillary to be 15.8 seconds and transit time through the kidney tissue (MTTrenal) to be 192 seconds. All estimates represent mean values from both volunteers. ***Conclusion:*** Our study demonstrates the feasibility of simultaneous renal function assessment using GFRSPECT and advanced renal functional measures as plasma flow and transit times through both the vascular bed and the renal tissue. The observed plasma flow values fall within the expected normal range indicating the potential utility of our method. Importantly, our study successfully demonstrated a pioneering technique using both the tissue filtered and non-filtered characteristics of 99mTc-DTPA, marking a significant advancement in renal function assessment methods.

EPS-028

A long-term follow-up in conservative management of unilateral pelviureteric stenosis with impaired drainage and good renal function

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Aim/Introduction: In the last few decades, an increased understanding of the natural history of hydronephrosis related to the ureteropelvic junction (UPJ) stenosis has been accompanied by a change in management, from systematic surgical approach to active surveillance and selective surgery. The aim of our study was to prospectively determine, in children with antenatally detected UPJ stenosis with a good renal function and abnormal renal drainage at the first diuretic renal scan, the predictive value of an impaired renal drainage in case of conservative attitude. ***Materials and Methods:*** We have followed 80 consecutive children with antenatally diagnosed PUJ stenosis during a 5-year period (between 2016 and 2020). From this cohort, we retained 80 children with unilateral PUJ and strictly normal contralateral kidney with a median follow up of 42 months. Repeated ultrasounds and 99mTc-ethylene-dicysteine (EC) renograms were performed in all children. The quality of renal drainage was evaluated on the basis of the post micturition post erect normalized residual activity (NORA.PM). Drainage was described as poor (NORA>2), good (NORA<0.5), or partial (0.5<NORA<2). DRF of 45%-55% was considered as normal. ***Results:*** Among the 80 patients of the study, 52 patients did not underwent a surgical intervention (65%), while surgical repair (Anderson-Hynes dismembered pyeloplasty) was performed in 28 (35 %). During conservative follow-up, DRF deterioration was observed in 11.5% of cases. When analyzing the DRF evolution in function of the quality of renal drainage, the rate of DRF deterioration was not significantly different, whatever the quality of drainage. In 61.5% of patients with poor renal drainage and 92.5% with partial drainage, no DRF deterioration could be observed. The quality of drainage was not predictive of DRF deterioration in case of conservative approach. ***Conclusion:*** impaired drainage does not mean the presence of UPJ obstruction and therefore the need of systematic surgery, spontaneous improvement may occur. Scheduled controls are needed for early discovery of functional renal deterioration. ***References:*** [1]- Koff SA, Campbell KD. The nonoperative management of unilateral neonatal hydronephrosis : natural history of poorly functioning kidneys. J Urol 1994 Aug :593e5., 152(2 Pt.[2]- Koff SA, Campbell K. Nonoperative management of unilateral neonatal hydronephrosis. J Urol. 1992 et 148 :525-31. [3]- Hong Phuoc Duong, Amy Piepsz, Frank Collier, Karim Khelif-UROLOGY 82 : 691e696, 2013.

EPS-029

Role of Preoperative Hepatobiliary Scintigraphy in Children Requiring Liver Resection

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Aim/Introduction: Post-hepatectomy liver failure (PHLF) is still a significant concern after major liver resection, particularly in adults. The assessment of future remnant liver function (FRLF) through hepatobiliary scintigraphy has proven to be important in preventing PHLF, with a threshold value of FRLF > 2.7%/min/m2. However, there are no such data available for pediatric population. The objective of this study was to determine the role of preoperative assessment of FRLF using HBS and its comparative analysis with FRLV and RLV-BWR values in children requiring liver resection. ***Materials and Methods:*** Seventy-seven pediatric patients with liver tumors who underwent one-stage liver resection were enrolled in this study. Prior to surgery, an evaluation of future remnant liver function (FRLF), future remnant liver volume (FRLV), and the ratio of remnant liver volume to body weight (RLV-BWR) was assessed. ***Results:*** Our findings showed that every patient had RLV-BWR values exceeding 0.5%/kg. FRLV values varied from 19 to 89%, while FRLF values ranged from 1.8 to 31.8%/min/m2. It was observed that only 7 out of the 77 patients had FRLV values below 25%, but their FRLF values surpassed 2.7%/min/m2. Additionally, two patients developed grade-A and grade-B PHLF. The values of FRLV and FRLF were 19% and 4.1%/min/m2 respectively for the patient with grade-A PHLF: and 31% and 1.8 %/min/m2 respectively for the patient with grade-B PHLF. It is worth noting that patient with grade-B PHLF developed severe intraoperative complications due to massive blood loss. ***Conclusion:*** In conclusion, both FRLV and the RLV-BWR are suitable for evaluating the liver in pediatric patients prior to hepatectomy. According to our data, implementation of FRLF assessment using HBS can be most beneficial for children with FRLV < 25%. The cut-off value of FRLV > 25% can be slightly decreased with minimal risk of developing PHLF. However, further prospective studies with larger numbers of patients with FRLV < 25% are necessary to establish a new cut-off value for FRLV in children. Keywords: future remnant liver function, hepatobiliary scintigraphy, liver volumetry, liver tumor.

EPS-030

^{18}F-fluorocholine PET/CT in detecting abnormal parathyroid glands in patients younger than 19

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Aim/Introduction: The diagnostic performance, reproducibility and impact of ^{18}F-fluorocholine (FCH) PET/CT in patients with hyperparathyroidism (HPT) aged <19 was never reported. ***Materials and Methods:*** Our dual-centre retrospective study included 24 patients, 14 girls and 10 boys, who underwent 28 FCH PET/CTs at an average age of 13.9 years (4.6-18.4 years), 19 for primary HPT (PHPT), including one case of mutation of the HPRT2 gene but no MEN1, and 9 for renal HPT (RHPT). PET/CT acquisition started 20 to 30 min after injection of 141 MBq on average (65-232) of FCH. In 25 cases, ultrasonography (US) was performed during the same imaging work-up, generally before PET (22/25). After re-evaluation, the diagnosis of HPT was abandoned in 3 patients with negative PET and US. Were determined, overall and separately for PHPT and RHPT, the positivity rate, and then, in operated (PTX) patients, the patient-based sensitivity (Se), the gland-based Se, with the histology of the resected PTs as a standard of truth, equivocal FCH or US foci being considered as negative. The results of FCH PET/CT vs. US were compared using the Mc Nemar test, * notes a significant difference p<0.05. Were also determined for FCH PET/CT the impact of on patient management initially based on US. and the accordance between open and masked readings. ***Results:*** Open reading (FCH & US). Positivity rate. Overall: 22/25=88% & 9/23=39%*; PHPT: 15/16=94% & 6/16=38%*; RHPT: 7/9=78% & 3/7=43%. 4 examinations not followed by PTX were excluded from further analysis. Patient-based Se. Overall: 20/21=95% & 8/21=38%*; PHPT: 15/15=100% & 5/15=33%*; RHPT: 5/6= 83% & 3/6=50% Gland-based Se. Overall: 25/29=86% & 10/29=34%*; PHPT: 16/16=100% & 5/16=31%*; RHPT: 9/13=69% & 5/13=38%. Se according to histology. Adenoma: 14/14=100% & 4/14=29%*; Hyperplasia: 11/15=73% & 6/15=40%. True-negative results. Patient-based 3/3 & 2/2; gland-based (2 normal PT resected) FCH=US=2/2. FCH PET/CT induced a change in management based on US in 12/22=55% of cases. The management was adequate in all cases as no PTX was futile. A post-PTX persistence of HPT was observed only in two cases of RHPT corresponding to a PT that was not resected despite FCH-positivity. Concordance between open and masked readings was 20/28=71% for the patient-based number of PTs detected as abnormal (Kappa=0.53) and 34/46=74% concerning identification of PTs (Kappa=0.44). ***Conclusion:*** FCH PET/CT was suited for detecting abnormal PTs in primary or renal hyperparathyroidism, was quite reproducible between observers and influenced favourably the management in half of patients.

EPS-031

Is ^{18}F-Fluorodexyglucose testicular uptake using PET/CT correlated with the results of a testicular sperm extraction procedure in the case of azoospermia (results of the French prospective multicenter AZOPREDHISTOTEP study)?

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Aim/Introduction: Positron emission tomography/computed tomography with 18F-Fluorodeoxyglucose (PET/CT FDG) shows testicular uptake, possibly related to spermatogenesis (1) and thus maybe correlated with the positivity rate of the surgical sperm extraction procedure (TESE), which has only a success rate of about 50%, in men with azoospermia. The aim of this study is to assess if testicular FDG uptake with PET/CT is correlated with the positivity rate of TESE. ***Materials and Methods:*** In this prospective multicenter trial, men with secretory azoospermia (SA), with excretory azoospermia (EA) and with normal spermogram (C) were included from february 2014 to may 2020. The baseline FDG PET/CT parameters that included peak, maximum and mean standardized uptake value and the functional testicular volume (FTV) were correlated with the TESE positivity and the standard clinical work up and the hormonal work up (FSH and inhibin and testosterone). A bivariate analysis was performed for the comparison between the two groups (positive or negative biopsy) and for the comparison between SA, EA and C with a significance level of 5%. ***Results:*** The study included 84 SA, 26 EA and 25 C . TESE was positive for 46 of the 88 men (52.2%) with PET/CT FDG. There was a significant correlation between the FTV and the positivity of TESE as well as with the FSH and inhibin and not with testosterone. The sum and the averaged FTV is significantly different between the three groups (SA, EA and C). FTV is significantly different from the testicular volume as determined via ultrasound or CT. We found no significant correlation or difference for the intensity or the heterogeneity of FDG testicular uptake. ***Conclusion:*** FTV obtained via PET/CT FDG is correlated with positivity of TESE in azoospermic men and is significantly different between the 3 groups (EA, SA and C). Furthermore, FTV is correlated with FSH and inhibin, which are parameters of the spermatogenesis and not with testosterone, a parameter of the steroidogenesis. ***References:*** 1. Dierickx LO, Huyghe E, Nogueira D, Zerdoud S, Filleron T, Brillouet S, et al. Functional testicular evaluation using PET/CT with 18F-fluorodeoxyglucose. Eur J Nucl Med Mol Imaging. jan 2012;39(1):12937.

EPS-032

Comparison of planar and SPECT/CT lung perfusion scintigraphy before surgery

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Aim/Introduction: SPECT/CT systems are replacing planar gamma cameras, prompting a comparison of lung perfusion scintigraphy (LPS) methods to determine if SPECT/CT offers a more accurate assessment of relative lung perfusion (rLP) than conventional planar scans. We aimed to compare the LPS results, potential clinical impact and reproducibility of SPECT/CT against the classic planar technique. ***Materials and Methods:*** We analysed 27 patients (17 males, 10 females; average age 63.6 years) who underwent preoperative planar and SPECT/CT LPS at the Department of Nuclear Medicine, UMC Ljubljana. Using a dedicated commercial software, we compared rLP lobar values calculated from planar and SPECT/CT scans, assessed their potential clinical impact (predicted postoperative FEV1) and

compared the reproducibility of SPECT/CT rLP measurements in two scenarios: (i) automated computer segmentation (ACS) versusmanual segmentation by a nuclear medicine specialist (MSp) and (ii) manual segmentation by a trained medical student (MSt) versus MSp. Additionally, we measured the average time required to perform the analysis using both methods.Results with $p < 0.05$ were deemed statistically significant. ***Results:*** We observed statistically significant differences in rLP values between planar and SPECT/CT methods in the three right lung lobes: right upper ($p < 0.001$), right middle ($p < 0.0001$), and right lower lobe ($p = 0.02$). Predicted postoperative FEV1 could be calculated only in 7 patients due to limited clinical data availability, but showing no significant difference between planar and SPECT/CT methods ($p = 0.307$). Comparing the reproducibility of segmentation methods, rLP values from ACS versus MSp showed no statistical difference (ICC > 0.9 for all lobes; table 1). Similarly, values from analysis by nuclear medicine specialist versus medical student were not statistically different, with ICC values > 0.8. SPECT/CT scans required significantly more time to complete (264 s for SPECT/CT vs. 86 s for planar scans, $p = 0.006$). ***Conclusion:*** Planar and SPECT/CT LPS methods are highly comparable for assessing rPLP. Significant differences in rPLP assessment were observed in the right lung lobes. SPECT/CT method showed high reproducibility and comparability, suggesting its potential to replace planar analysis in clinical practice, especially if novel automated segmentation methods diminish the need for manual corrections of segmented lung lobes.

EPS-033

Diagnosis of pulmonary embolism in cancer patients: contribution of personalized QSPECT-CT

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Aim/Introduction: Pulmonary embolism (PE) is a potentially fatal condition requiring accurate diagnosis for appropriate treatment initiation and improved outcomes. The diagnostic workup for suspected PE commonly involves imaging modalities like ventilation-perfusion (V/Q) scintigraphy or computed tomography pulmonary angiography (CTPA). While CTPA is considered the reference standard, it exposes patients to substantial radiation doses, a significant concern for radiosensitive populations such as cancer patients. Hybrid imaging techniques combining functional and anatomical data have emerged as promising approaches to optimize diagnostic accuracy while minimizing radiation exposure. ***Materials and Methods:*** This prospective, unicentric study evaluated the diagnostic accuracy of perfusion single-photon emission computed tomography combined with low-dose computed tomography (QSPECT-CT) for PE. Consecutive patients with suspected PE underwent QSPECT-CT between January 2020 and May 2022 and were stratified into cancer (n=88) and non-cancer (n=96) cohorts. The QSPECT-CT algorithm involved perfusion SPECT imaging, chest radiography, and selective incorporation of low-dose CT when SPECT defects lacked corresponding radiographic abnormalities. The final diagnosis of PE was established at 3-month clinical follow-up. The primary outcome measures were the sensitivity and specificity of QSPECT-CT for identifying PE in each cohort. ***Results:*** QSPECT-CT demonstrated excellent diagnostic performance in both cohorts. In the cancer group, the sensitivity was 92% (95% CI: 84-97%), and specificity was 86% (95% CI: 77-92%). In the non-cancer group, sensitivity was 95% (95% CI: 89-98%), and specificity was 90% (95% CI: 82-95%) The area under the receiver operating characteristic curve was 0.93 (95% CI: 0.88-0.97) for the cancer group and 0.96 (95% CI: 0.92-0.99) for the non-cancer group, with no statistically significant difference (p=0.28) Comparison of diagnostic accuracy using Fisher's exact test did not reveal significant differences in sensitivity (p=0.56) or specificity (p=0.45) between cohorts. ***Conclusion:*** This study demonstrated the high diagnostic accuracy of the hybrid QSPECT-CT imaging technique for PE in both cancer and non-cancer patient populations, with no statistically significant performance differences between cohorts. A key strength was the personalized diagnostic algorithm, integrating perfusion SPECT with chest radiography and selectively adding low-dose CT only when necessary, potentially minimizing radiation exposure compared to strategies universally employing CT. Despite promising results, the study had limitations, highlighting the need for larger, multicenter trials with methodological refinements. Nevertheless, QSPECT-CT with its personalized algorithm may represent an accurate and judicious diagnostic pathway for PE evaluation, particularly valuable in radiation-sensitive populations like cancer patients. Future research should directly compare QSPECT-CT's diagnostic performance against established reference standards.

EPS-034

99Tcm-HAS SPECT/CT imaging can improve the specificity and diagnostic accuracy of PLE diagnosis

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Aim/Introduction: To investigate the value of 99Tcm-human serum albumin (HSA) SPECT/CT imaging in the diagnosis of protein-losing enteropathy (PLE). ***Materials and Methods:*** A retrospective analysis was conducted on 112 patients who underwent 99Tcm-HAS abdominal dynamic planar imaging and SPECT/CT imaging at the Department of Nuclear Medicine, the First Affiliated Hospital of Zhengzhou University, due to hypoalbuminemia from October 2016 to October 2023. Among them, there were 46 males and 66 females, with ages ranging from 5 to 80 years (mean age, 49 ± 18 years). The diagnostic efficacy of 99Tcm-HAS abdominal dynamic planar imaging and SPECT/CT imaging for protein-losing enteropathy was calculated based on the final clinical diagnosis. ***Results:*** Among the 112 patients, a total of 94 were clinically diagnosed with PLE. Among them, systemic lupus erythematosus accounted for the highest proportion of primary diseases, reaching 34% (32/94). Positive findings were observed in 91 cases on planar imaging, with the highest proportion of patients showing positivity on the 8-hour imaging being 25% (23/91). There were 96 cases with positive findings on SPECT/CT imaging, with the highest proportion of colon positivity being 41% (39/96). According to the final clinical diagnosis, out of the 112 patients, 94 were diagnosed with PLE and 18 were non-PLE cases. The sensitivity, specificity, and accuracy of diagnosing PLE using planar dynamic imaging were 90.40% (85/94), 66.70% (12/18), and 86.70% (97/112), respectively; while for SPECT/CT imaging, the corresponding values were 100% (94/94), 88.90% (16/18), and 98.20% (110/112). The difference in specificity between the two diagnostic methods was statistically significant (Fisher exact probability test, P=0.005), and the difference in accuracy indicators between the two methods was also statistically significant (X2=9.166, P=0.002). ***Conclusion:*** 99Tcm-HAS SPECT/CT tomographic imaging can improve the specificity and diagnostic accuracy of PLE diagnosis. ***References:***
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EPS-035

Could ^{18}F-Dopa PET/CT replace ^{123}I-MIBG scintigraphy in childhood Neuroblastoma management?

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Aim/Introduction: Neuroblastoma (NB) is the most frequent extracranial solid tumour in childhood, representing 8-10% of cases of childhood cancer. Approximately 50% of cases are metastatic at presentation with a poor prognosis in high-risk NB. Exquisite staging is crucial, so imaging features before surgery, determine patient management. At the moment, 123I-MIBG scan, is considered the Gold Standard radionuclide imaging in NB, with limited sensitivity mainly for detecting osteomedullary metastases. The aim of the study is to compare the value of 18F-Dopa PET/CT and 123I-MIBG scan in initial diagnosis and relapse of patients with NB. ***Materials and Methods:*** 10 patients were included (5M:5F), with an average of 24 months old (0-9 years) at the time of diagnosis, including 3 congenital disease. 7/10 patients were intermediate or high risk. 11 paired 18F-Dopa PET/CT and 123I-MIBG scintigraphy, were retrospectively evaluated, taken less than one month apart. 8 of 11 scans were performed at the time of diagnosis and 3 when relapse was suspected. A patient-base and a lesion-based analysis was done for 18F-Dopa PET/CT, 123I-MIBG scintigraphy and 123I-MIBG SPECT/TC. Follow up was based on clinical, imaging and histological data. ***Results:*** All NB were localized in the abdomen (6 adrenal and 4 retroperitoneal). 60% were metastasic at initial diagnosis: 3bone, 1 bone and liver, 1 liver and lung and 1 pleura. Main lesion was detected in 9 (81,8%) and 8 (72,7%) for 18F-Dopa and 123I-MIBG scans respectively. Not detected lesion by conventional imaging corresponded to low grade NB. On patient-based analysis 18F-Dopa PET/CT showed a 100% sensitivity while 123I-MIBG scintigraphy adding SPECT/TC reached 88,8%. No significant difference in terms of specificity was found. No real change in patient management was done according to PET/TC image.84 lesions (68 bone and 16 soft tissue) were found by 18F-DopaPET/CT of which 27 were correctly detected by 123I-MIBG scintigraphy, increasing to 35 by 123I-MIBG SPECT/TC. On lesion-based analysis 123I-MIBGscintigraphy showed a poor sensitivity of 32% improving to 41,7% when using SPECT/TC compared to 18F-Dopa PET/CT. ***Conclusion:*** In our NB population 18F-Dopa PET/CT is able to diagnose more lesions than 123I-MIBG, mainly in bone structures. Despite the small sample size and taking into account that, as far as we know, there are only two studies including more than 10 patients with paired scans yielding similar results, we suggest that 18F-Dopa PET/CT can be used instead of 123I-MIBG and its inclusion in guidelines should be analyzed, firstly in High-Risk NB.:

EPS-036

Improving Accuracy of SUV Estimates in Paediatric Oncology: Recommending against the use of the Body Weight-Based Correction in [18F]FDG PET

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Aim/Introduction: Fluorine-18-fluorodeoxyglucose positron emission tomography computed tomography ([18F]FDG PET/CT) is an important imaging technique for diagnosing and staging paediatric oncology patients. Standardized Uptake Value (SUV) measurements are used to quantify [18F]FDG-uptake, which is typically normalized to body weight. However, as fat contributes to the body weight but accumulates only minimal [18F]FDG, heavier patients show higher SUV. Few studies have investigated body weight dependency of SUV formulations in paediatric patients. Our aim is to compare different SUV formulations measured in the liver in a large cohort of paediatric oncology patients and determine which correction has the least body weight dependency. ***Materials and Methods:*** A retrospective analysis was conducted of [18F]FDG PET/CT scans performed at the Princess Maxima Center of Pediatric Oncology between December 2018 and August 2022. Measurements were performed in the liver on EARL1 PET reconstructions. The mean SUV was calculated using formulations corrected for body weight (SUVBW), for lean body mass (LBM) according to James (SUVLBMJames) and Janmahasatian (SUVLBMJanma), and for body surface area (BSA) according to DuBois (SUVBSADuBois) and Haycock (SUVBSAHaycock). The correlation between the SUV formulations and body weight was assessed using Pearson's correlation coefficients and linear regression coefficients. The linear regression coefficients were used to assess the relative increase of SUV per kg. ***Results:*** In total, 462 scans were analysed, including 185 of girls (40%). The mean age was 11.5±6.7 years (range, 2 months - 23 years). The mean height was 150±29.6 cm (range, 54 - 201 cm) and mean body weight was 46.6±22.4 kg (range, 3.8 - 125 kg). The mean SUVBW was 1.49±0.43, the mean SUVLBMJames 1.22±0.29, the mean SUVLBMJanma 1.17±0.29, the mean SUVBSADuBois 0.046±0.008, and the mean SUVBSAHaycock was 0.046±0.008. The relative SUV increase per kg for SUVBW was 2.60%, for SUVLBMJames 1.17%, for SUVLBMJanma 1.18%, for SUVBSADuBois 0.28%, and for SUVBSAHaycock 0.35%. The correlation between body weight and SUVBW was r=0.81, p<0.001, for SUVLBMJames r=0.71, p<0.001, for SUVLBMJanma r=0.69, p<0.001, for SUVBSADuBois r=0.30, p<0.001, and for SUVBSAHaycock r=0.30, p<0.001. ***Conclusion:*** For paediatric patients, we recommend to avoid the use of SUVBW, as it shows the least consistency when measured in the liver and results in elevated SUV measurements in heavier patients. Formulations corrected for LBM also tend to increase SUV, although to a lesser extent. Corrections based on BSA are shown to have the lowest dependency on body weight.

EPS-037

Incremental value of varied time point imaging and SPECT/CT in diagnosis of Duplication Cysts.

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Aim/Introduction: The aim of our study was to see the incremental valueof 99mTc-Pertechnetate multi time point imaging and

SPECT/CT in patients who were referred to department of nuclear medicine for evaluating and diagnosing ectopic gastric mucosa in foregut and midgut duplication cysts. ***Materials and Methods:*** This hospital based, retrospective cum prospective research spans over a period of 10 years from April 2014 to January 2024. Previous hospital medical records were analysed and subsequently a database was prepared which included the age, sex, clinical indication of a 99mTc-Pertechnetate scan, the planar& SPECT-CT imaging findings and post operative histopathology whenever available. Dynamic and planar static imaging was performed. We included delayed imaging and SPECT-CT in suspected duplication cysts to increase the sensitivity and negative predictive value. A total of 103 patients were subjected to a 99mTc-Pertechnetate scan for suspected foregut or midgut duplication cysts. All were subjected to dynamic planar and delayed static images up to 24 hours or until focal uptake of radiotracer was noted which corroborated to the anatomical findings, whichever was earlier. SPECT-CT was performed along with the planar study in 55 patients which confirmed the findings. Previously performed CT scans were used for anatomical correlation in the remaining ones. ***Results:*** Duplication cysts were localized in a total of 40 patients (foregut duplication cysts and small bowel duplications-4 patients had dual duplication cysts, both foregut and midgut). 63 patients had no scintigraphic evidence of ectopic gastric mucosa. Of these 103 patients, histopathological diagnosis was available for 35 patients. The report was concordant with the scan findings in 27 patients and 8 patients showed discordance in histopathological diagnosis and scan findings. The sensitivity with conventional Meckel's scan for duplication cyst was 50% and negative predictive value was 65.2%. This increased to 87.5% and 86.6% respectively with additional delayed static images and SPECT/CT. ***Conclusion:*** In conclusion, multi time point imaging with SPECT/CT is the key to diagnosing ectopic gastric mucosa of various sizes and in various locations. There was a significant improvement in the diagnostic performance of the study when we included various time points and SPECT/CT and thus we recommend its use on a routine basis.

EPS-038

Peritoneal scintigraphy to detect dialysate leakage: a 15 year experience

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Aim/Introduction: Patients with renal failure typically need dialysis to replace the lost kidney function. Continuous Ambulatory Peritoneal Dialysis (CAPD) offers advantages such as the ability to be performed at home and a more flexible lifestyle compared to in-center hemodialysis. However, it has some disadvantages, including risk of infection, fluid imbalance, hernia development, toxin clearance limitations, and potential membrane function decline. Dialysate leakage in CAPD can occur due to various reasons and prompt evaluation of the leakage site and intervention are essential to prevent complications. While the main diagnostic imaging studies include ultrasound, computed tomography, or magnetic resonance, peritoneal scintigraphy can give valuable information regarding the leakage site. We aim to analyse the main clinical indications and the diagnostic value of peritoneal scintigraphy. ***Materials and Methods:*** We selected all the patients who underwent peritoneal scintigraphy at our nuclear medicine department from 2008 to 2023 (n=127). Electronic records were analysed including imaging and clinical data. Indirect follow-up criteria were used to confirm or exclude leakage: surgical intervention related to the identified leak/CAPD suspension - "confirmation"; maintenance of CAPD without further surgical interventions - "non-confirmation". Our protocol for peritoneal scintigraphy includes the infusion of 185 MBq of [99mTc] Tc-MAA in 1L of dialysate solution through the peritoneal catheter. Images are acquired approximately 5 hours after administration and again after drainage of the dialysate. The protocol includes anterior and lateral views of the peritoneal cavity, with the patient in a supine position and standing-up. SPECT/CT is performed in most patients. ***Results:*** The clinical reasons for performing the scintigraphy were the identification of abdominal wall swelling (54,3%), of poor drainage/ultrafiltration (26,1%), of pleural fluid (10,9%), or of inguinal/genital swelling (8,7%).We detected leaks in 91 patients (71,1%), 10 with multiple sites, resulting in 106 leaks (umbilical region - 52.8%; hypogastric region - 12.3%; iliac region - 15.1%, lumbar region - 4.7%; pleural cavity - 5.7%, genital region - 7.5%; other - 1.9%). Leakage was confirmed in 66 patients; 19 patients maintained CAPD without any further intervention; 11 patients lost follow-up. Of the 36 negative studies, 28 maintained CAPD without any further intervention; 3 had otherwise diagnosed leakage; 3 discontinued CAPD; and there were no records on the follow-up of 2 patients. ***Conclusion:*** Peritoneal scintigraphy is a straightforward, safe and non-invasive method that determines the site of dialysate leak with great sensitivity and specificity, highlighting its value in guiding clinical management decisions, such as surgical interventions.

EPS-039

Individualized calibration of estimated glomerular filtration rate for serial renal function monitoring

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Aim/Introduction: Serum creatinine based estimates of glomerular filtration rate (eGFR) are known to be imprecise compared to GFR measurement (mGFR). In addition eGFR is frequently inaccurate in many patient populations. While inaccuracy can be reduced by applying a population specific calibration (pceGFR), the problem of imprecision remains. We aim to investigate the performance of individually calibrated estimated GFR (iceGFR) for estimation of GFR by comparison with measured GFR (mGFR). ***Materials and Methods:*** Retrospective data from January 2009 and December 2022 were included. All patients underwent radionuclide based mGFR on two separate occasions during this period, with each mGFR also having serum creatinine measurement available within 3 months. A patient specific calibration factor (Kpt) was derived from the ratio of the initial mGFR and eGFR values. At the time of the second mGFR measurement, iceGFR was calculated from the product of Kpt and the second eGFR value, and pceGFR was determined using a previously described methodology.1 Bland-Altman analyses were used to compare the performance of eGFR, pceGFR and iceGFR relative to mGFR. Lin's concordance correlation coefficient (CCC) was estimated for mGFR and each of eGFR, pceGFR and iceGFR as a summary measure of agreement. The test for the comparison of paired correlations was used to compare the three CCC's pairwise. ***Results:*** Fifty-three patients (24 women and 29 men; median age, 60.5 y; age range, 25-75 y) were included. Using Bland-Altman analyses, the bias for eGFR, pceGFR and iceGFR was -16, -5 and -3 ml/min/1.73m2 respectively. The limits of agreement for eGFR,

pceGFR and iceGFR were -51 to 20, -41 to 31 and -27 to 21 ml/min/1.73m2 respectively. The CCC (95% CI) of the of the three estimated GFR measures was 0.56 (0.41 - 0.72), 0.64 (0.49 - 0.80) and 0.84 (0.75 - 0.92) for eGFR, pceGFR and iceGFR respectively. The iceGFR CCC was significantly different from the other two GFR CCC estimates (p<.0001) which did not differ from each other (p=0.12). ***Conclusion:*** Compared to eGFR, pceGFR had an improved accuracy but similar imprecision and concordance. iceGFR outperformed eGFR and pceGFR with improvements in bias, precision and concordance. iceGFR shows promise for serial renal function monitoring in environments with limited access to GFR measurement. ***References:*** 1.Holness, J.L., Brink, A., Davids, M.R. et al. Estimated glomerular filtration rate in children: adapting existing equations for a specific population. Pediatr Nephrol 36, 669-683 (2021). https://doi.org/10.1007/s00467-020-04770-6.

EPS-040

^{123}I-MIBG SPECT-CT Quantification outperforming Curie score in the evaluation of neuroblastoma metastasis and response assessment

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Aim/Introduction: Neuroblastoma is the most common extracranial solid tumor in children with poor prognosis. Iodine 123 labeled meta-iodobenzylguanidine ([123I]MIBG) scan with SPECT/CT imaging is the standard nuclear imaging technique with Curie score as main index which mainly based on the number or size of MIBG-avid lesions. The aim of this study was to assess the diagnostic threshold, response evaluation value of quantitative 123I-MIBG SPECT/CT imaging and compared with Curie score in a prospective series of Neuroblastoma patients. ***Materials and Methods:*** 23 participants (mean age 4.0 ± 3.5 years, 6 cases of low and high risk group, 11 cases with 96 metastatic lesions after treatment, 6 cases repeated [123I]MIBG imaging after treatment) with history of neuroblastoma were enrolled in this study. All children underwent [123I]MIBG planar imaging and Quantitative SPECT/CT imaging using GE Discovery 670 pro. Normal organ uptake (SUVmean), lesion uptake (SUVmax) and tumour-to-muscle ratio (T/M) were measured. Whole body tumor activity or tumor burden (%ID) based on ROI were compared with Curie scores to evaluate therapeutic effect. Lesion-by-lesion analysis was performed to compare detection ratios (DR) between [123I]MIBG planar imaging and SPECT/CT quantitative imaging. MRI, bone marrow puncture or/and 68Ga-DOTA-TATE PET-CT, 6 months follow up were used as gold standard. ***Results:*** [123I]MIBG distribution (SUVmax: g/ml) in normal organs such as bone, bone marrow, muscle, liver, left ventricle wall, blood pool in the mediastinum and adrenals was (0.35±0.21), (0.49±0.32), (0.25±0.178), (5.2±3.9), (4.1±2.6), (0.42±0.26), (1.45±1.2). [123I]MIBG uptake (SUVmax) by metastatic lesions in bone, bone marrow, liver and lymph node ranging from 1.5 to 37. Tumor uptake of [123I]MIBG (SUVmax: 0.6±0.3) in low risk group was significantly less than that in high risk group (SUVmax: 6.3±3.2). The mean DR with [123I]MIBG planar imaging based on visual analysis, semiquantitative analysis (T/M) was significantly lower than SPECT/CT quantitative imaging when tumor uptake threshold(SUVmax: g/ml) was set at 1.0. (60.0% ±16.7% vs. 95.2%±1.5%; p = 0.027). Lesion-by-lesion analysis revealed tumor uptake decrease of [123I]MIBG (60.1% ±35.6) in 23 lesions and increase (1.5 to 4 fold) in 7 lesions after treatment. Whole body tumor uptake (%ID) of [123I]MIBG in all metastatic lesions decreased significantly after treatment while there is no significant Curies scores changes in 4 patients. ***Conclusion:*** 123I-MIBG SPECT-CT Quantification can offer one objective threshold for neuroblastoma metastasis detection, whole body tumor burden assessment and maybe useful to reveal tumor heterogeneity during treatment.

EPS-041

Using whole body low dose PET/CT to assess the lean body mass in a cachexia patient cohort

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Aim/Introduction: The monitoring of lean body mass is an important indicator in the determination of possible cachexia in patients. Diagnostic CT measurements have utilized the L3 skeletal muscle content from regional abdomen/pelvis as an indicator of lean body mass. With the availability of whole-body CT from 18F-FDG PET/CT scans, there exists the possibility to determine a whole-body assessment of lean body mass. This study assesses the accuracy of whole-body low dose CT determination of lean body mass compared to L3 skeletal muscle determination against the DEXA gold standard. ***Materials and Methods:*** A cohort of 28 patients being investigated for cachexia were acquired. Scans from DEXA, diagnostic CT and low dose CT (from 18F-FDG PET/CT) were compiled. L3 vertebral muscle content was assessed using a muscle window [-20, 150] established from previous studies. The low dose CT scans were assessed for fat content using a fat window of [-250, -50] from which the Fat:Whole-body ratio is calculated. The lean body mass ratio is then calculated as Lean Body Mass:Whole body ratio = 1 - Fat:Whole body ratio. ***Results:*** A regression of the PET/CT low dose determined lean mass ratio versus the DEXA determined lean mass ratio yields a correlation coefficient of 0.94. The corresponding vertebral lean mass determination yields a poorer correlation coefficient of 0.73. ***Conclusion:*** Whole-body low dose CT acquired as part of the whole-body 18F-FDG PET/CT procedure allows for an estimate of the lean body mass. This important information can assist with diagnosis of cachexia in patients with cancer.

EPS-042

Correlation of standard uptake values (SUV) and net influx rate (Ki) in healthy organs from whole-body FDG PET/MRI scan

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Aim/Introduction: Dynamic positron emission tomography (PET) can be performed for accurate quantification of the net influx rate, Ki, but it involves long imaging times and mathematical modelling of the PET data. The semi-quantitative metric, standard uptake value (SUV) is simple, widely used and requires only a short static PET acquisition. For a more accurate SUV metric, especially for obese patients, the SUL can be used, which is similar to SUV but normalized to lean body mass instead of the total body weight. The SUV/SUL has demonstrated a good correlation to the Ki value in different tumors, which enables the use of this simplified metric

instead of the more practically demanding metric Ki for many applications. The aim of this study was to investigate the correlation of Ki and SUV/SUL in healthy organs from whole-body FDG scans in an integrated PET/MRI scanner. ***Materials and Methods:*** Twenty-three non-diabetic obese subjects were included in the study. They underwent a ten-minute dynamic PET scan covering the heart starting with injection of 3 MBq/kg FDG, followed by five repeated whole-body PET/MRI scans (5x10 bed positions, 30 s/bed position). A whole body pixelwise Patlak analysis was performed for calculation of Ki. For calculation of SUV/SUL, data from the fifth whole body PET acquisition (approx. 60 min p.i.) was used. Lean body mass was calculated from whole-body fat/water MRI images and was used for calculation of SUL. Mean values were obtained from spherical representative regions of interest in brain, heart, skeletal muscle and liver. Correlation between SUV/SUL and Ki in the healthy organs was investigated. ***Results:*** There was a good to moderate correlation between SUV/SUL and Ki in the healthy organs. The best correlation was found in the skeletal muscle (SUV: r2=0.81; SUL: r2=0.79) followed by the brain (SUV: r2=0.68; SUL: r2=0.65), and the heart (SUV: r2=0.65; SUL: r2=0.56). The correlation in the liver was lower (SUV: r2=0.35; SUL: r2=0.33), probably due to the small range of Ki values in the liver. The SUV was significantly higher ($p<0.001$) than the SUL-value in all organs. ***Conclusion:*** The standard uptake value (SUV) demonstrated a good correlation with the net influx rate Ki in skeletal muscle and a moderate correlation in the brain and the heart, indicating that SUV can be interpreted as a measure of glucose metabolism also in these healthy organs. In this study population, the SUV and the SUL values demonstrated similar correlation with Ki.

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Sunday, October 20, 2024, 09:45 - 11:15
Hall G1

CTE 2 - Technologists Committee: Whole-Body Multimodality Imaging

OP-122
SPECT/CT - A modern dinosaur?
F. Hoek;
Imelda Hospital, Nuclearmedicine department, Bonheiden, BELGIUM.

OP-123
PET/CT - An overview today and tomorrow
V. Mautone;
Istituto Romagnolo per lo Studio dei Tumori "Dino Amadori" - IRST IRCCS, Diagnostic Nuclear Medicine, Meldola(FC), ITALY.

OP-124
PET/MR - A wide view
S. Kvernby;
Akademiska Sjukhuset, Department of Surgical Sciences, Molecular imaging and medical physics, Uppsala, SWEDEN.

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Sunday, October 20, 2024, 09:45 - 11:15
Hall Y1-Y3

Special Symposium 1: EARL - Harmonisation - The Path For New Criteria and New Accreditations

OP-125
Onco accreditation updates ie TMTV
J. Zijlstra;
Amsterdam UMC, Amsterdam, NETHERLANDS.

OP-126
EARL's new Brain PET/CT accreditation – methodology confirmation
M. Shekari;
Barcelonaβeta Brain Research Center, Barcelona, SPAIN.

OP-127a
Clinical benefits of PET/CT brain accreditation
N. Tolboom;
University Medical Centre Utrecht, Utrecht , NETHERLANDS.

OP-127b
SPECT accreditation
J. Dickson;
University College London Hospitals, London, UNITED KINGDOM.

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Sunday, October 20, 2024, 11:30 - 13:00
Hall 1

Plenary 2: The Age of Theranostic

OP-128
Establish a Theranostic Center: Now or Never
K. Herrmann;
University Hospital Essen, Essen, GERMANY.

OP-129
Dr. Theranostic: Next Generation of Nuc Meds
M. Gotthardt;
Radboud University Nijmegen, Nijmegen, NETHERLANDS.

OP-130
Last Mile Challenge
C. Artigas;
Institut Jules Bordet – Hôpital Erasme, Université Libre de Bruxelles, Brussels, BELGIUM.

OP-131a
How early can we move PSMA Radioligand Therapy?
U. Vogl;
Oncology Institute of Southern Switzerland, Ospedale Regionale die Bellinzona e Valli, Bellinzona, SWITZERLAND.

OP-131b
Breast Cancer Radioligand Therapy challenge: A myth?
D. Deandreis;
Institute Gustave Roussy, Villejuif, FRANCE.

OP-131c
FAPI, CAIX and more: Will it ever happen?
H. Chen;
Xiamen University, CHINA.

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Sunday, October 20, 2024, 15:00 - 16:30
Hall 1

CME 3 - Cardiovascular Committee - Myocardial Perfusion Imaging with PET: Go with the Flow

OP-132
Physiology of myocardial blood flow made simple
T. van den Hoef;
University Medical Center Utrecht, Cardiology, Utrecht, NETHERLANDS.

OP-133
Quantification of myocardial blood flow: basics for the dummies
M. Lubberink;
Uppsala University, Department of Surgical Sciences/ Nuclear Medicine & PET, Uppsala, SWEDEN.

OP-134
Quantification of myocardial blood flow with SPECT: strong enough?
L. Imbert;
CHRU Nancy Brabois, Nuclear Medicine Department, Nancy, FRANCE.

OP-135
Quantification of myocardial blood flow with PET: can we afford it?
W. Acampa;
University Federico II, Department of Advanced Biomedical Sciences, Naples, ITALY.

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Sunday, October 20, 2024, 15:00 - 16:30
Hall 4

Special Track 3 - Physics Committee - Debate: Generative AI for NM: Blessing or Curse?

OP-136
Point of View: Blessing
F. Yousefirizi;
Departments of Radiology and Physics & Astronomy, BC Cancer Research Institute, Vancouver, CANADA.

OP-137
Point of View: Curse
V. Jaouen;
Laboratory of medical information processing (LaTIM), INSERM, IMT Atlantique, Brest, FRANCE.

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Sunday, October 20, 2024, 15:00 - 16:30
Hall X9-X12

LIPS Session 3 - Bone & Joint Committee - MSK Quantitative SPECT/CT

OP-138
Quantitative MSK
L. de Geus;
Department of Radiology, Leiden University Medical Center, Leiden, NETHERLANDS.

OP-139
Multi-time MSK
N. Icard;
Yves Le Foll Hospital, Saint-Brieuc, FRANCE.

OP-140
Multi-tracer MSK
S. Annunziata;
Policlinico Gemelli, Rome, ITALY.

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Sunday, October 20, 2024, 15:00 - 16:30
Hall X1-X4

M2M Track - TROP Session: Radiopharmaceutical Sciences + Translational Molecular Imaging & Therapy Committee: Receptor-targeted and Radionuclide Therapy

OP-141
[^{225}Ac]Ac-DOTA-mCAIX to eliminate CAIX-expressing hypoxic cancer cells
S. Wenker[1], *J. Bussink[1], D. Lobeek[1], S. Kleinendorst[1], D. Boreel[1], G. Tamborino[2], M. Konijnenberg[1,2], J. Molkenboer-Kuenen[1], G. Franssen[1], H. Peters[1], S. van Lith[1], S. Heskamp[1];*
[1]RadboudUMC, Nijmegen, NETHERLANDS,
[2]Erasmus MC, Rotterdam, NETHERLANDS.

Aim/Introduction: Tumor hypoxia, low level of oxygen, is associated with a poor prognosis. Hypoxic tumor cells a.o. suppress the immune system and induce resistance to immunotherapy. A promising treatment strategy to kill hypoxic cancer cells is the use of alpha-emitting radionuclides, since they cause irreversible DNA damage and cell death independent of tissue oxygenation. Under chronic hypoxia, tumor cells can upregulate membrane expression of carbonic anhydrase IX (CAIX). We aim to eliminate these CAIX-expressing hypoxic cancer cells using an actinium-225 labeled anti-CAIX monocloncal antibody (mAb), thereby increasing the potential of immune checkpoint inhibition to induce long-term anti-tumor efficacy. ***Materials and Methods:*** A mAb binding to murine and human CAIX (clone MSC3) was functionalized with SCN-DOTA and radiolabeled with indium-111 (111In-mCAIX) or actinium-225 (225Ac-mCAIX). C57Bl/6J mice with subcutaneous B16F10-OVA tumors (containing hypoxic CAIX-positive tumor

regions (1)), were co-injected with 13 kBq 225Ac-mCAIX and 1 MBq 111In-mCAIX. Tracer distribution was determined at 168h post injection with ex vivo gamma counting of indium-111 and intratumoral co-localization with CAIX was determined with autoradiograpy and immunohistochemistry. In the therapy study, mice with B16F10-OVA tumors were injected with 15 kBq 225Ac-mCAIX (radiation dose determined on longtidunal SPECT imaging) with or without anti-CTLA-4 and anti-PD1 (200 ug each at 1, 4, 6, 10, 13 and 16 days post tracer injection). Tumor growth, body weight and survival were followed over time until a tumor volume >2000 mm3 or a humane end point were reached. Statistics were performed on the median survival using the Mantel-Cox test. ***Results:*** 111In-mCAIX and 225Ac-mCAIX were labeled with >95% radiochemical purity. In vivo biodistribution showed high tumor uptake (18.0 ± 1.3 %ID/g), leading to excellent tumor-to-muscle ratios (69.3 ± 27.3) and tumor-to-blood ratios (17.7 ± 15.5). Analysis of tumor sections demonstrated that the 225Ac and 111In-derived radiosignal colocalized with CAIX expression, suggesting CAIX-specific tumor uptake. Furthermore, in the CAIX positive areas of these tumors, γH2AX staining suggests therapeutic effect of 225Ac-mCAIX. In the therapy experiment, the 225Ac-mCAIX group showed a signficantantly improved survival compared with the PBS control ($p = 0.0032$). Furthermore, survival of the 225Ac-mCAIX plus anti-CTLA-4/PD-1 group was significantly better than the PBS control ($p= 0.0019$) and anti-CTLA-4/PD-1 ($p = 0.0031$). Body weight was comparable between the groups. ***Conclusion:*** These results show the potential of 225Ac-mCAIX, especially in combination with anti-CTLA-4/PD-1, to treat hypoxic tumors. In ongoing experiments, the radiobiological and immunological effects of 225Ac-mCAIX are investigated. ***References:*** (1)Boreel 2023 Mol Pharm,20.

OP-142

^{225}Ac-FL-020 is a novel PSMA-targeting radionuclide drug conjugate with promising in vivo anti-tumor activity

J. Zhang[1], *J. Yang[1], F. Liu[1], N. C. L. Wong[1], K. T. Thrane[2], M. W. Hallund[2], R. V. Grønlund[2];*
[1]Full-Life Technologies, Shanghai, CHINA, [2]Minerva Imaging ApS, Ølstykke, DENMARK.

Aim/Introduction: Despite significant developments over the last few decades, metastatic castration-resistant prostate cancer (mCRPC) remains incurable. Prostate specific membrane antigen (PSMA) expression directly correlates with androgen independence, metastasis, and disease progression. PSMA is well-established as a radioligand target for the diagnosis and treatment of mCRPC. Lutetium-177 (177Lu) vipivotide tetraxetan was approved in 2022 for the treatment of progressive PSMA-positive mCRPC. However, only 30% of patients achieved a radiological response in the registrational trial together with a grade 1/2 xerostomia in around 39% of patients. The alpha emitter Actinium-225 (225Ac) is expected to offer significant advantages over beta-emitting 177Lu due to its higher tumor cell killing potency through double-strand DNA breaks and shorter tissue penetration depth. This profile supports the development of 225Ac based radiotherapies. We leveraged our proprietary platform to develop 225Ac-FL-020, a next-generation 225Ac-based PSMA radionuclide drug conjugate (RDC). ***Materials and Methods:*** Binding affinity against PSMA and internalization of the 177Lu-labeled FL-020 was evaluated in PSMA-expressing LNCaP cells. The biodistribution profile of FL-020 was characterized by SPECT/CT imaging and ex vivo biodistribution assays using Indium-111 (111In)-FL-020 and 177Lu-FL-020 in LNCaP tumor-bearing nude mice, respectively. Anti-tumor activity of 225Ac-FL-020 was evaluated in the LNCaP xenograft model and directly compared with 225Ac-PSMA-617. ***Results:*** 177Lu-FL-020 bound to LNCaP cells with a KD value of 29.1 nM. Uptake and internalization of 177Lu-FL-020 by LNCaP cells was time- and PSMA expression-dependent. Off-target screening showed that <50% inhibition of binding or activity was observed by FL-020 at 10 μM against 85 targets including receptors, ion channels, enzymes, and transporters, indicating the high selectivity of FL-020. Meanwhile, 111In-FL-020 and 177Lu-FL-020 displayed promising in vivo distribution profiles with high and sustained tumor uptake and fast systemic clearance. Furthermore, 225Ac-FL-020 exhibited enhanced anti-tumor activity compared with 225Ac-PSMA-617 at the same dose level (10 KBq/mouse) in the LNCaP xenograft model with a favorable safety profile as indicated by body weight and hematological parameters. A mechanistic study was also conducted in 225Ac-FL-020-treated LNCaP tumor samples where DNA double-strand breaks and tumor cell apoptosis were observed, confirming the mechanism of action of alpha emitters. ***Conclusion:*** These results collectively demonstrate that 225Ac-FL-020 is a potent and selective PSMA-targeting RDC with superior anti-tumor activity and a favorable safety profile. A Phase 1 study will be started in 2024 to evaluate the safety, tolerability, and anti-tumor activity of 225Ac-FL-020 in patients with mCRPC.

OP-143

Targeted Alpha Therapy of Prostate Cancer with Actinium-225-labeled Novel Dansylated Amino Acid Derived PSMA-Targeted Radioconjugate ^{225}Ac-LNC1011

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Aim/Introduction: Prostate-specific membrane antigen (PSMA) radioligand therapy (PRLT) has become a promising option for treating metastatic castration-resistant prostate cancer (mCRPC). Recently, albumin binders, such as p-iodophenyl, Evans blue, and ibuprofen-modified PSMA radioligands with prolonged blood circulation, have been developed to improve tumour uptake and therapeutic effectiveness. Herein, we report a new PSMA-targeted ligand incorporating dansylated phenylalanine as an optimised albumin binder (denoted as LNC1011) to balance blood circulation while preserving tumour retention. We evaluated the tumour uptake, pharmacokinetics, biodistribution and preliminary efficacy of 225Ac-LNC1011 in the PSMA-positive PC3 PIP model. Alpha emitter 225Ac was chosen for its higher linear energy and stronger tumour penetration over beta emitter 177Lu. ***Materials and Methods:*** Radiolabelling of 225Ac was conducted by mixing 0.5 ml of precursor (5 mg/ml) with 0.3 ml 0.25M NaOAc, added to 0.05 M metal-free HCl with solid 225Ac(NO3)3 salt (45 mins, 100oC), performed on the IPhase automated synthesis module. PSMA-targeting specificity was investigated using saturation binding assay and cellular uptake in PC-3 and PSMA-positive PC-3 PIP cell lines. Radioligands' distribution and tumour uptake were evaluated using single-photon emission computed tomography (SPECT/CT) imaging with 37 MBq of 177Lu-LNC1011. The ex vivo biodistribution study was performed in healthy mice intravenously injected with 18.5 kBq 225Ac-LNC1011. Therapeutic studies were conducted in the PC-3 PIP xenograft mice model with 3.7, 9.25, and 18.5 kBq of the tracer (n = 6/group). ***Results:*** 225Ac-LNC1011 was successfully synthesised, radiolabelled with > 97% radiochemical purity, and analysed at 24 h post-production. Cell uptake and binding assay showed increased uptake of 225Ac-LNC1011 (0.37 kBq/well) up to 8 h in PC-3 PIP cells, effectively blocked by unlabelled PSMA-617. SPECT/CT biodistribution imaging of 177Lu-

LNC1011 showed a rapid tumour uptake at 0.5 h post-injection and peaked (125.8 ± 12.3 %ID/g) at four h post-injection, which persisted high up to 72 h with excellent tumour-to-background contrast. Biodistribution in healthy BALB/c mice showed the highest kidney uptake (16.5 ± 2.0 %ID/g at one h p.i.) but quickly washed out after four h. Our therapy results demonstrated a noteworthy inhibition of tumour growth after a single dose of 9.25 kBq 225Ac-LNC1011, and 6/6 achieved complete remission (CR) in the 18.5 kBq group. ***Conclusion:*** LNC1011, characterised by a favourable improvement in tumour uptake and rapid clearance from background organs, is a promising candidate for PRLT and should be clinically evaluated. Targeted alpha therapy holds great promise to enhance its therapeutic effect.

OP-144

PARP-targeted alpha therapy for treatment of PARPi-resistant ovarian cancer with dosimetric modelling

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Aim/Introduction: Despite chemotherapy and PARP inhibitor (PARPi) regimens, most BRCA1/2 mutant (BRCA1/2mut) epithelial ovarian cancers (EOC) recur, prompting the need for novel therapies. PARPi bind to active PARP-1 overexpressed in BRCA1/2mut cells. Astatine-211-Parathanatrace ([211At]PTT), an alpha-emitting radiopharmaceutical therapy analogue of rucaparib, binds to DNA-bound PARP-1 to induce lethal double-stranded DNA breaks. We investigated [211At]PTT as a novel therapy for EOC. ***Materials and Methods:*** [211At]PTT was synthesized and assessed for pharmacokinetics and cytotoxicity in 16 human EOC cell lines with varying sensitivity to PARPi. For saturation binding, cells were treated for 1 hour to reach equilibrium. For cytotoxicity, cells were treated with [211At]PTT or unlabeled 211At for 1 or 72 hours followed by bioluminescent assay. Maximum specific binding (Bmax), equilibrium dissociation constant (Kd), and half maximal effective concentration (EC50) were calculated. Monte Carlo micro-dosimetry was performed with TOol for PArticle Simulation (TOPAS) to model dynamic evolution of radioisotopes in the nucleus, the decay, and binding interactions of radioligands and cell-specific receptors as a function of time. ***Results:*** Compared to 211At, [211At]PTT had a 30-fold greater efficacy. Comparing EOC OVCAR8 cells with endogenous PARP1 expression and OVCAR8-PARP1ko cells, [211At]PTT activity was dependent on PARP-1 expression (EC50 0.0079 vs. 0.027 MBq/ml). EC50 was determined in isogenic-matched BRCA2mut PARPi-sensitive and -resistant PEO1 and BRCA2 reversion PEO4 (0.002-0.008), BRCA1mut and BRCA1 restored UWB (0.0021-0.0024), and BRCA2mut and PARPi-resistant JHOS4 cells (0.11- 0.63). Cytotoxicity was similar between PARPi-sensitive and -resistant cells (P=0.86). BRCA1/2WT and CCNE amplified cells had variable sensitivity (0.01-0.8) within concentrations that are safely administered in vivo. The number of [211At]PTT binding sites per cell (Bmax) ranged from 6.31x105 to 2.14x106 and the binding affinity 2.0-11.4 (Kd). EC50 values significantly correlated to binding affinity (r=0.69, P=0.009), whereas no correlation was observed with Bmax. ***Conclusion:*** [211At]PTT cytotoxicity is largely independent of PARPi-sensitivity and more dependent on PARPi binding affinity and line-specific radiation sensitivity, supported by simulated dosimetry results. This suggests PTT may overcome PARPi-resistance. Overall, this study highlights a novel role for radiopharmaceutical therapy in PARPi-resistant BRCA1/2mut EOC. Future work will investigate the mechanistic underpinnings governing sensitivity to predict suitable candidates for therapy.

OP-145

Biodistribution and contribution of in vivo generated daughter radionuclides to the antitumour efficacy of ^{225}Ac-PSMA-Trillium

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Aim/Introduction: Prostate-specific membrane antigen (PSMA) is upregulated in prostate cancer. 225Ac-PSMA-Trillium is a targeted alpha therapy (TAT), which consists of a high-affinity PSMA binder linked to a macropa chelator for stable complexation of the alpha-emitting radionuclide actinium-225. To reduce dose-limiting side effects, 225Ac-PSMA-Trillium has a customised albumin-binding moiety, which prolongs plasma residence, improves tumour uptake, and reduces salivary gland uptake. However, the clearance of the in vivo generated daughter radionuclides of actinium-225 is unknown. Here, we investigated the antitumour efficacy and biodistribution of 225Ac-PSMA-Trillium, and the redistribution of the daughters of actinium-225, bismuth-213 (t1/2 = 45.6 min) and francium-221 (t1/2 = 4.8 min), after 225Ac-PSMA-Trillium treatment in vivo. Astatine-117 (t1/2 = 32.3 ms) and polonium-213 (t1/2 = 3.4 µs) could not be investigated due to short half-lives. ***Materials and Methods:*** The biodistribution of 225Ac-PSMA-Trillium was evaluated using the subcutaneous LNCaP human prostate cancer xenograft model in SCID mice. The mice were treated with a single i.v. injection of 225Ac-PSMA-Trillium (1 MBq/kg with 375 kBq/nmol) and sacrificed either 15 min or 1, 3, 24, 48, 72, 96, 168, 240, or 336 hours post injection. Organs were measured immediately or 24 hours after sacrifice using a germanium detector and a gamma counter. The anti-tumour efficacy of 225Ac-PSMA-Trillium was investigated in the subcutaneous LNCaP xenograft (150 or 300 kBq/kg) and KUCaP-1 patient-derived xenograft (250 kBq/kg) models. ***Results:*** 225Ac-PSMA-Trillium exhibited fast and homogenous tumour penetration within 15 minutes post injection, and good tumour accumulation (~23 %ID/g), peaking 168-240 hours post injection, which were reflected by a prolonged residence time in the blood with clearance after 48 hours. In addition, 225Ac-PSMA-Trillium showed robust in vivo antitumour efficacy in both the androgen-dependent LNCaP and androgen-independent KUCaP-1 models. Actinium-225 decaying in the tumour generated bismuth-213 and francium-221, which were retained within the tumour. However, minor fractions of the bismuth-213 generated in the blood were redistributed into the kidneys. Redistribution of francium-221 from the blood was observed in the kidneys, small intestine and salivary glands. This was reflected by a change of total absorbed dose from 0.94 (calculated without daughter redistribution) to 2.39 Gy. ***Conclusion:*** 225Ac-PSMA-Trillium demonstrates a relatively slow pharmacokinetics profile and marked tumour uptake, which is consistent with its albumin-binding properties. Bismuth-213 and francium-221, the alpha-emitting daughter radionuclides of actinium-225, are predominantly retained in the tumour. Daughter radionuclides generated in the blood were more readily redistributed to the kidneys, salivary glands, or other organs.

OP-146

From Theory to Clinical Application: Understanding Ac-225 radiochemistry through [^{225}Ac]Ac-DOTA-TATE

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Aim/Introduction: Since interest in the treatment with Ac-225-labeled peptides is growing in the field of nuclear medicine, optimal labelling conditions and quality control (QC) of such radiopharmaceuticals is of great importance. Consequently, this research aims to define reaction parameters essential for optimal labeling and robust quality control of Ac-225-labeled radiopharmaceuticals, exemplified by [225Ac]Ac-DOTA-TATE. ***Materials and Methods:*** Determination of the quality of the different Ac-225 sources was performed by evaluating the radionuclidic purity with HP-Ge-detector and quantification of metal-ions (ingrowth) using UPLC-analysis at different time points (1-4 weeks after dissolving). [225Ac]Ac-DOTA-TATE was labelled under standardized conditions (90kBq/nmol, 0.035M ascorbate, pH=4) as a reference. The radiochemical yield (RCY) was monitored according to previous work [1]. For radiolabeling the parameters such as: pH of labelling, molar activity, (90kBq/nmol-540kBq/nmol) and labelling volume (0.1-10mL), buffering (0.015-1M TRIS (pH=9), 0.015-1M Na-Ac (pH=5)) and quenchers (0.035M, pH=8.5) ascorbic acid, cysteine, vanilin and L-methionine) were tested. The radiochemical purity (RCP) is based upon indirect measurement approach [1]. The HPLC-method was optimized and different parameters such as: gradient slopes, recovery/carry-over methods and volume/fraction was tested. Other characteristics like microwave heating and storage conditions like as dry-ice and -20oC were monitored on HPLC (t0, t4 and t24h). ***Results:*** Three different Ac-225 sources were tested and contained different amounts (<5%) of metal impurities (Fe, Zn, Cu); however, all sources were suitable for radiolabeling, up to 2 weeks after dilution. The standardized radiolabeling of DOTA-TATE with Ac-225 was performed successfully, resulting in a RCY>99% and RCP >90% up to 24h. 20 minutes 90oC resulted high incorporation, longer heating times showed no improvement. A positive effect on stability could be observed when buffering with 0.015M TRIS, using ascorbate (0.035M,pH=5.8) and ethanol (10%v/v). The HPLC-method as published previously showed a good separation profile for [225Ac]Ac-DOTA-TATE, varying the slope and concentration of the mobile phases showed no improvement. It has to be noted that for optimal recovery and carry over, in depth analysis and modifications to the HPLC-system and column, including injection parameters, are required. When the molar activity and labelling volume was decreased, a reduced RCY was obtained, furthermore, increased stability was observed when stored on dry-ice or by -20°C. ***Conclusion:*** This research underlines the importance of validating the different radiolabeling conditions for alpha-radionuclides such as Ac-225, as well as the appropriate quality control for implementation towards the clinic. ***References:*** Hooijman et al. 2024.

OP-147

Long-acting ^{225}Ac-ART-101 for targeted alpha therapy of advanced CRPC

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Aim/Introduction: Despite the undeniable clinical activity of PSMA-based targeted alpha therapy in castration-resistant prostate cancer (CRPC), PSMA-617 as a delivery vehicle for 225Ac has several disadvantages, such as fast kinetics, poor tumor retention, and significant off-target toxicity to salivary glands. Therefore, novel agents designed with optimal pharmacokinetics and tumor retention for long-lived 225Ac and reduced salivary gland uptake are needed to realize the full curative potential of targeted alpha therapy in mCRPC. ***Materials and Methods:*** To improve upon the pharmacokinetics of PSMA-617 we synthesized a next-generation PSMA-targeted radiopharmaceutical ((1-carboxy-5-(18-(4-(2-(4,7,10-tris(carboxymethyl)-1,4,7,10-tetraazacyclodo-decan-1-yl)acetamido)phenyl)octa-decanamido)pentyl)carbamoyl)-glutamic acid (ART-101; MW:1063). Longitudinal PET/CT imaging and ex vivo biodistribution compared the pharmacokinetic, tumor-targeting, and biodistribution of 86Y-ART-101 and 86Y-PSMA-617 in two immunocompromised mouse models of prostate cancer, LNCaP and PC3-PIP. The efficacy of therapeutic 225Ac-ART-101 was tested in groups of mice bearing PC3-PIP or LNCaP xenografts (n=5) receiving a single IV injection of saline, 225Ac-ART-101 20-80 kBq (~0.5-2 µCi), or 225Ac-PSMA-617 40-80 kBq (~1-2 µCi). Toxicity evaluations included overall health assessments, CBC, CMP, and normal tissue histology in naïve ICR mice. ***Results:*** PET/CT imaging studies showed rapid 86Y-PSMA-617 tumor uptake in PSMA-expressing tumor xenografts, peaking at 4.0 ± 0.2 percent injected activity per gram of tissue (%IA/g) at 4 hours post-injection (p.i.), but poor retention with only 2.9 ± 0.5 %IA/g remaining 24 h p.i. of the radioligand. Conversely, 86Y-ART-101 showed significantly higher (P<0.01) peak tumor uptake (8.9 ± 1.7 %IA/g at 24 h p.i) and prolonged tumor retention (7.9 ± 1.1 %IA/g at 72 h p.i.) resulting in markedly enhanced tumor exposure for 86Y-ART-101 compared to 86Y-PSMA-617. Given this prolonged tumor retention, ART-101 radiolabeled to 225Ac delivered significant absorbed doses to prostate tumors. Consistent with the literature, treatment with 225Ac-PSMA-617 40 kBq resulted in marked tumor growth inhibition and significant (P < 0.0001) survival advantage compared to controls in both LNCaP and PC3-PIP models. Similarly, treatment with 225Ac-ART-101 at either injected activity, 20 or 40 kBq, led to significant tumor regression and prolongation in mouse survival. Median overall survival was 43, 84, 92, and 92 days for control, 225Ac-PSMA-617 (40 kBq), 225Ac-ART-101 (20 kBq), and 225Ac-ART-101 (40 kBq), respectively. Toxicology data indicated a favorable safety profile of 225Ac-ART-101 at relevant human equivalent injected activity levels. ***Conclusion:*** In conclusion, ART-101 showed significantly improved blood kinetics, enhanced tumor uptake, prolonged retention, and primarily hepatic clearance, translating into an improved therapeutic efficacy of 225Ac-ART-101 in murine models of mCRPC.

OP-148

Absorbed dose estimation of [^{211}At]PSMA-5 using a novel semiconductor imaging system in a preclinical study

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Aim/Introduction: Astatine (211At) is an alpha-particle-emitting radionuclide that can be produced using a cyclotron with a natural bismuth target. The 211At-labeled prostate-specific membrane antigen (PSMA) compound ([211At]

PSMA-5) demonstrated excellent tumor growth suppression in a xenograft model (Watabe T, et al. Eur J Nucl Med Mol Imaging. 2023). This study aimed to compare the therapeutic effects of [211At]PSMA-5 with the absorbed dose, as estimated using a novel semiconductor imaging system. ***Materials and Methods:*** Tumor xenograft models were established by subcutaneous implantation of human prostate cancer cells (LNCaP) in NOD/SCID mice. [211At]PSMA-5 solutions were intravenously administered into mice and divided into four groups: 0.4 MBq, 0.1 MBq, 0.04 MBq, and a vehicle control group (each with n=4). Whole-body images were acquired at 1, 4 and 21h after administration using the XCam-CdTe planar imaging system (iMAGINE-X, Tokyo, Japan), which is equipped with a cadmium telluride semiconductor detector and a tungsten collimator. Scan durations were set as 10 min for each scan (n=2 for each group). Absorbed doses were estimated using the trapezoidal method according to the previous study (Watabe T, et al, J Nucl Med. 2019). Mice were monitored for 35 days to evaluate relative tumor sizes compared to baseline sizes at the time of administration by caliper measurement. ***Results:*** [211At] PSMA-5 images revealed high tumor retention (19.8 ± 5.8, 28.0 ± 9.3, and 38.6 ± 13.2 %ID/g at 1, 4, and 21 h, respectively) and significant uptake in the kidneys, indicative of PSMA expression in the proximal tubule. Tumor growth was significantly inhibited in a dose-dependent manner. Relative tumor sizes were 0.95 ± 0.12 for 0.4 MBq, 1.86 ± 0.18 for 0.1 MBq, 3.98 ± 0.15 for 0.04 MBq, and 5.77 ± 0.35 for the control group, respectively ($p<0.05$ by Dunnett test). Absorbed doses were estimated as 3.16 ± 1.14 Gy for 0.4 MBq, 1.89 ± 0.45 Gy for 0.1 MBq, and 0.63 ± 0.17 Gy for 0.04 MBq. A significant negative correlation was observed between relative tumor size and absorbed dose ($r=-0.825$ and $p<0.05$ by Spearman's correlation). ***Conclusion:*** This study demonstrated a dose-dependent therapeutic effect of [211At]PSMA-5 in the LNCaP xenograft model, with feasible estimation of absorbed doses using a novel semiconductor imaging system. [211At] PSMA-5 is expected to be a next-generation targeted alpha therapy against prostate cancer with the sustainable production using a cyclotron. ***References:*** Watabe T, et al. Eur J Nucl Med Mol Imaging. 2023 Feb;50(3):849-858.

OP-149

Lanatoside C enhanced the At-211 therapy in poorly differentiated thyroid cancers through restoring NIS

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Aim/Introduction: The treatment for poorly differentiated thyroid cancer (PDTC) is challenging due to insufficient sodium iodide symporters (NIS) which makes it refractory to conventional radioactive iodine (RAI) therapy. The objective of study was to investigate whether lanatoside C improved the 211At alpha therapy in poorly differentiated thyroid cancers through restoring NIS. We have also showed the In-Vitro comparison of alpha and beta therapy efficacies after redifferentiation. . ***Materials and Methods:*** A poorly differentiated papillary thyroid carcinoma cell line BHP10-3SCP with RET/PTC rearrangement was chosen for executing the experiments. Firstly, cytotoxicity test was performed for comparing the toxicities of 211At alone and in combination with lanatoside C (1μM). Clonogenic survival of BHP10-3SCp cell line exposed to lanatoside C (50μM) for 48 h followed by treatment with 3.7KBq/100μl of 211At (211At+Lan) for 6 h was monitored for 10 days. Restoration of NIS protein and mRNA was confirmed by western blot and PCR respectively. Furthermore, to compare double strand DNA damage by 211At and 131I was confirmed by confocal imaging of γH2AX.Statistical significance was tested using Mann Whitney test and Kruskal Wallis test. ***Results:*** Cytotoxicity test results showed significantly lowest viability in combination group of 211At+Lan (16.7±14.0%) vs Control (98.4±2.4%) vs lanatoside C only (88±3.5) vs 211At only (50.8±21.2%) ($p= 0.0003$). Total percentage of colonies survived in 211At treated cells after exposure of lanatoside C for 48h was 21.1% whereas in Control it was 100%; in only lanatoside C, 72.8%; in 211At, 48.3% ($p=0.001$). The NIS protein expression was found to be 1.8±0.3 fold more than control ($p=0.03$) in 50μM lanatoside C treated cells for 48h. The mRNA NIS expression was found to be increased by 124±62 ($p=0.01$) fold for 50μM lanatoside C in comparison to control. The maximum relative intensity of γH2AX for 211At treated cells after lanatoside C pre-treatment for 48h was found to be 3.5-fold more than that of non-treated cells whereas in case of 131I it was 1.8-fold. ***Conclusion:*** Our study indicates that lanatoside C can enhance 211At therapy due to restoration of Sodium Iodide Symporters in poorly differentiated thyroid cancers. Additionally, 211At being an alpha emitter is more effective than 131I for therapeutic purposes. However, further investigations are necessitated for in vivo evaluation and clinical application.

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Sunday, October 20, 2024, 15:00 - 16:30
Hall Y4-Y9

Cutting Edge Science Track - TROP Session: Dosimetry Committee: Dosimetry: A Question of Time

OP-150

Understanding Time-Activity Curve and Time-Integrated Activity Variations in Radiopharmaceutical Therapy: Experience from the TACTIC AAPM Grand Challenge 2023

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Aim/Introduction: The process of determining time-activity curves (TACs) for radiopharmaceutical therapy (RPT) relies heavily on user- and site-specific steps, impacting time-integrated activity (TIA) and, effectively, absorbed dose calculations. Despite TIA's clinical significance, there is no consensus on data processing methods nor an understanding of how user-dependent TAC calculation affects personalized RPT dosimetry. In 2023, the TACTIC AAPM Grand Challenge was created to address these challenges. This work presents results and insights from the challenge. ***Materials and Methods:*** Launched in January 2023, the TACTIC challenge consisted of three phases: warm-up (P0),

individual patient-based TAC fitting (P1), and population-based TAC fitting (P2). Participants were provided with pre-processed synthetic biokinetic data of [177Lu]Lu-PSMA-617 (kidney, blood, and tumor) and tasked with modeling the TAC and calculating TIA values for each target organ. Additionally, participants submitted information about the TAC type and parameters used for fit optimization. The best-performing team in P1 and P2 was determined by the lowest total root mean squared error (RMSE) error over the organs. ***Results:*** A total of 132 individuals from over 30 countries registered for the challenge, representing a diverse mix of highly experienced dosimetry groups, industry professionals, and newcomers to RPT dosimetry. Among them, 73 participants requested data, of which 35 (P0), 35 (P1) and 28 (P2) submitted their results. Across the three phases, 13 different fit functions were utilized, with varying advanced model selection criteria and levels of uncertainty incorporation. Notably, the bi-exponential function was most prevalent, utilized in 51% (P1) and 32% (P2) of submissions, while the least square objective function was the primary choice for 40% of submissions (P1). Despite the challenge's nature, only a minority of participants—6 in P1 and 8 in P2—incorporated uncertainty budgets into their TIAC calculations. Population-based information was utilized in only 7 submissions during P2. Interestingly, no correlations were found between choice of fit function, objective function, uncertainty incorporation, or population information use and participants' performance. Winners in each phase employed diverse models and objective functions. However, the top-performing participants consistently integrated uncertainty information when selecting the most suitable TAC model. A decrease in some participants' performance from P1 to P2 when including uncertainty or population-based information suggests that more guidance and training is needed to use them effectively. ***Conclusion:*** The TACTIC challenge results offer insights into global TAC modeling practices, revealing significant variations in result quality. This underscores the importance of education in TAC fitting methodologies.

OP-151

More is not always better: Dosimetry imaging schemes with two versus three timepoints

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Aim/Introduction: The aim was to compare radionuclide-therapy dosimetry for [177Lu]Lu-DOTA-TATE based on two or three imaging timepoints with respect to error variability. Previously (1), a formula was presented for the standard deviation (SD) of the relative error in time-integrated activity-concentration (TIAC) as function of imaging time-points. This study applies the formula for comparison of two versus three timepoints. ***Materials and Methods:*** The previously introduced formula describes the SD in the relative error of the TIAC for a mono-exponential function with a fixed coefficient-of-variation (CV) in estimated activity-concentrations at each imaging time point. A formula for iso-SD-curves was derived for imaging with two time-points. Numerical simulations were performed of TIACs for kidneys and spleen (10000 repetitions), where mean effective half-lives and SDs were obtained from a set of 18 patients (2), assuming log-normal distributions of the biological decay-constant and errors in estimated activity-concentrations. Activity-concentration CVs of 5% and 10%, respectively, were studied. Three different three-timepoint schemes were considered: (a) 24 h, 48 h, 72 h; (b) 24 h, 72 h, 96 h; and (c) 24 h, 96 h, 168 h. 465 two-timepoint schemes were simulated with imaging times ranging from 5 h to 165 h in steps of 5 h, with restriction that timepoints were separated by at least 12 h. The fraction of two-timepoint schemes with a lower TIAC SD than for the three-timepoint schemes were determined. Results from numerical simulations were compared with theoretical predictions from the iso-SD-curve formula. ***Results:*** Mean effective half-lives (CVs) of kidneys and spleens were 55 h (17%) and 76 h (22%), respectively. For kidneys and the activity-concentration CV of 5%, three-time point scheme (a) yielded a higher SD than the two-timepoint schemes in 63% of the cases, and 94% of these schemes were correctly classified by the iso-SD-expression. Corresponding results for (b) and (c) were 10% and 90%; and 0% and 100% respectively. For spleen, corresponding results for (a), (b), and (c) were 77% and 98%; 48% and 97 %; and 0% and 100%. Results were similar when increasing the activity-concentration CV to 10%. ***Conclusion:*** The dispersion of relative errors in time-integrated activity-concentration can be described by a simple analytical formula that agrees well with numerical simulations. Two-timepoint imaging schedules with one early and one late time-point can be more accurate than schemes with three early timepoints. ***References:*** 1. Gustafsson and Taprogge, Submitted manuscript 2., Stenvall et al., 10.1186/s13550-022-00947-2.

OP-152

Machine Learning- Data-Driven Time-Integrated Activity Estimation for [^{177}Lu]Lu-PSMA-I&T Therapy in Prostate Cancer

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Aim/Introduction: The commonly used method for Time-Integrated Activity (TIA) estimation is the fitting of biokinetic data with a mono-exponential function [1]. However, the mono-exponential fitting method often does not provide an adequate TIA estimation. Addressing these challenges, we proposed an estimation of the kidney's TIA for [177Lu]Lu-PSMA-I&T using the Machine Learning algorithm by the Partial Least Squares Regression (ML-PLSR) method. PLSR is used to estimate TIA by reducing dimensionality and handling multicollinearity among predictors, thereby improving the accuracy and reliability of predictions. ***Materials and Methods:*** Biokinetic data of [177Lu]Lu-PSMA-I&T in the kidneys of 1000 patients was simulated using the PBPK model [2] with injected activity of 7.3 GBq. A total of 500 patients were used for each training and testing of the ML-PLSR method with 20-fold cross-validation. Time-activity data was collected at 3, 24, 48, 72, and 168 h post-injection. Physiological parameters of the PBPK model in adult humans were simulated for log-normal parameter distributions using a random number generator. Reference TIAs (rTIAs) were calculated from the simulation using the PBPK model and the physiological parameters. Various combinations of biokinetic dataset sizes (3 to 5 time points) and physiological parameters PP (age, weight and height) were trained with the ML-PLSR model, and corresponding estimated TIA (eTIA-ML-PLSR) were calculated for each combination. Individual mono-exponential function (m-EF) fitting was used to calculate the estimated TIA (eTIA-mono). The performance of ML-PLSR was tested using relative deviation (RD) and root-mean-squared error (RMSE) between eTIA-ML-PLSR and rTIA; m-EF was similarly evaluated by eTIA-mono and rTIA. ML-PLSR method disregards intra-patient variability, instead representing

inter-patient variability through physiological parameters across different individuals. ***Results:*** The ML-PLSR method using the 3-time points dataset at 24, 48, and 168 h post-injection and PP (RD=(3.6±2.7)%, RMSE=4.5%) showed similar performance with ML-PLSR method using 5-time points dataset and PP (RD=(3.6±2.6)%, RMSE=4.5%). ML-PLSR method outperformed the m-EF method based on the performance measure of m-EF of (RD=(5.3±3.3)%, RMSE=6.3%). ML-PLSR Analysis identified the 24 and 48 h time points as critical for estimating TIA. ***Conclusion:*** The ML-PLSR method shows promising results in determining the TIA value of [177Lu]Lu-PSMA-I&T. This method offers a robust alternative for TIA prediction in clinical environments where extensive data collection is challenging. In addition, the ML-PLSR method outperforms the frequently used m-EF method for our population and radiopharmaceutical. ***References:*** [1] Uribe C et al., J Nucl. Med, 62(12):36S-47S, 2021. [2] Begum N.J et al., J Nucl. Med, 59(6):929-933, 2018.

OP-153

Time-Integrated Activity Estimation of [^{177}Lu]Lu-PSMA-617 Using Single-Time-Point Data and a Machine Learning Models

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Aim/Introduction: Individual estimation of time-integrated activity (TIA) is highly desirable in molecular radiotherapy. However, as individual TIA estimation is lengthy and complex, it is challenging to apply in clinical practice. This study aims to evaluate the accuracy of individual TIA estimation in [177Lu]Lu-PSMA-617 radioligand therapy using single-time-point (STP) data and ML models. ***Materials and Methods:*** Biokinetic data of [177Lu]Lu-PSMA-617 radiopharmaceutical (RP) in kidneys were simulated at five different time points TP (TP1=1.8h, TP2=18.7h, TP3=42.6h, TP4=66.2h, TP5=160.3h) using a published non-linear mixed effects (NLME) model [1], considering interindividual variability while omitting intraindividual variability. The biodistribution of the RP was simulated by generating 5,500 virtual patient kinetics, with 5,000 allocated for ML model training and 500 for evaluation. Reference TIAs (rTIAs) were calculated for evaluation based on the analytical solution suggested by the literature [1]. Linear Support Vector Regression (L-SVR), K-nearest neighbour (KNN), and decision tree (DT) ML models were trained to generate estimated TIA (eTIA) with STP data at various TP through multi-stage testing. ML models and TPs were evaluated based on the lowest relative deviation (RD) and root mean square error (RMSE) between eTIA and rTIA. Based on the STP method proposed by Hänscheid et al. [2], the TIA (hTIA), RD, and RMSE were also analysed. ***Results:*** The RD and RMSE of ML with L-SVR, KNN, and DT were similar in each investigated TP, e.g. at TP2, the RD of the models were (14±12)%, (14±12)%, and (14±12)%. TP3 was identified as the best TP for STP TIA estimation in all ML models, with RDs of L-SVR, KNN, and DT of (9.5±8.5)%, (9.8±8.6)%, and (9.8±8.4)%. L-SVR ML and TP3 STP was identified to have the lowest RD and RMSE of 9.5 ±8.5% and 12.7%. ML STP with L-SVR at TP3 outperforms the STP method [2] based on the RD and RMSE of hTIA of (16.0±9.9) and 18.8%. ***Conclusion:*** The result of this study suggests that applying ML in nuclear medicine can potentially improve STP dosimetry. Further investigation and model validation, especially with measured biokinetic data, are needed to verify and investigate the performance of the ML model so it can be applied in routine clinical practice. ***References:*** [1] Hardiansyah et al., J. Nucl. Med. 2024;jnumed.123.266268 [2] Hänscheid et al., J. Nucl. Med. 2018;59:75-81.

OP-154

Time-Integrated Activity Calculation for Benign Thyroid Disease using Single-Time-Point Data and Non-Linear Mixed-Effects Modelling

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Aim/Introduction: This study aimed to evaluate the accuracy of time-integrated activity (TIA) estimation using single-time-point (STP) data with NLME modelling and population-based model selection (PBMS) in 73 patients with benign thyroid disease. Additionally, we conducted a comparative analysis to assess the accuracy of the STP approach employing the PBMS-NLME methodology against the STP approaches in the EANM dosimetry guideline (EJNMMI, 2013). ***Materials and Methods:*** Biokinetic data of 131I in benign thyroid diseases (Graves' disease, toxic nodular goitre, non-toxic goitre) were obtained from seventy-three patients with uptake measurements 2, 6, 24, 48, and 96 (n=53) or 120 (n=20) hours after oral capsule administration of 131I. PBMS with different parameterisations of sum-of-exponentials (SOE) functions, i.e., two to nine parameters, were employed for the analysis. The best SOE function to describe the biokinetic data was determined through a goodness-of-fit assessment and the Akaike weight, which indicates the likelihood of a function accurately representing the data. The best SOE function was then used for conducting single-time-point (STP) dosimetry at different time points (sTIAs). In addition, TIAs (hTIAs) were calculated from STP data according to the EANM guideline, assuming a fixed half-life of 5.5 d for the measurements after 24 and 48 hours. The accuracy of the computed sTIAs and hTIAs was assessed by comparing them with the reference TIAs (rTIAs) obtained from fitting all time points using the best model. This comparison involved calculating relative deviations (RDs) and root-mean-square errors (RMSEs). The total number of patients with absolute RDs of sTIAs and hTIAs higher than 5% (RD5) was also analyzed. ***Results:*** The SOE function with four adjustable parameters was selected as fit function most supported by the data based on the goodness-of-fit test with an Akaike weight of approximately 100%. The mean±standard deviation of RD (RMSE, RD5) of STP dosimetry with the best SOE function for 2, 6, 24, 48, 96, and 120 hours post-administration were 19%±44% (48.0%,58), 12%±34% (35.9%,46), 8%±27% (28.1%,41), 7%±19% (20.8%,38), 4%±8% (8.5%,13), and 2%±4% (4.5%,5), respectively. The mean±standard deviation of RD (RMSE, RD5) of STP dosimetry according to the guideline for 24, 48, 96, and 120 hours post-administration were -2%±26% (26.3%,61), -0%±19% (19.3%,60), 0%±8% (8.2%,28) and 0%±5% (5.0%,9), respectively. ***Conclusion:*** STP dosimetry using NLME modelling generally reduces the number of RD5 deviations compared to the guideline and, in combination with a late measurement, leads to accurate TIAC values in 131I benign thyroid therapy.

OP-155

Outcome-Driven Assessment of Single-Time Point Dosimetry for ^{177}Lu-PSMA-617RPT

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Aim/Introduction: Personalized dosimetry-based treatment planning emphasizes the sue of Multiple-Time-Point Dosimetry (MTPD) to tailoring the applied dose to tumor and organs at risk. However, challenges persist in clinical implementation, necessitating a simplified approach that retains the ability to assess therapy outcomes effectively. In this study, we applied both Single-Time-Point Dosimetry (STPD) and MTPD for 177Lu-PSMA-617 Radiopharmaceutical Therapy (RPT). Analyses were performed in comparing dosimetry methods and evaluating their effectiveness in predicting therapy responses and toxicity indicators. ***Materials and Methods:*** In this retrospective study, we analyzed data from 81 cycles involving 21 patients diagnosed with metastatic castration-resistant prostate cancer (mCRPC) who received multiple cycles of 177Lu-PSMA-617 RPT. Comprehensive quantitative SPECT/CT-based dosimetry measurements are conducted with varying time points, specifically at 2-4 hours post-injection and at least two additional time points within the 1-9 days window. Using a voxel dosimetry module and advanced organ segmentation, organ-wise MTPDose and STPDose were computed, STPDose were generated by Hanscheid method, and quality control by bi-exponential decay fitting model. Therapy outcomes were evaluated including PSA response, overall survival (OS), and relevant toxicity assessment. ***Results:*** The optimal time-points were determined based on minimal RMSE, with Day 1 p.i. identified for organs at risk and Day 3 p.i. for whole-body-tumors, when compared with MTPDose. Significant differences in MTPDose and STPDose of Day 1-3 p.i. were observed among subgroups based on PSA response rates ($p<0.001$). Specifically, in the 3rd- 6th treatment cycles, both MTPDose (3rdcycle HR = 1.18, 4thcycle HR = 1.17, 5thcycle HR = 2.09, and 6thcycle HR = 2.74; all $p < 0.05$) and STPDose (3rdcycle HR = 1.16, 4thcycle HR = 1.10, 5thcycle HR = 1.89, and 6thcycle HR = 1.08; all $p < 0.05$) of whole-body tumors were identified as significant predictors of overall survival using univariate Cox regression analysis. Furthermore, both MTPDose and STPDose demonstrated higher values with increasing hematotoxicity grade ($p<0.001$). ***Conclusion:*** Our findings validate the comparability of STPD with the referenced MTPD, highlighting the clinical feasibility of streamlined dosimetry techniques to facilitate personalized treatment planning and monitoring therapeutic outcomes.

OP-156

Population-Based Model Selection with Nonlinear Mixed-Effects Model (PBMS-NLME) for Renal Dosimetry in [^{177}Lu]Lu-PSMA-617 Therapy using Inter-Occasional and Inter-Individual Variability

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Aim/Introduction: This study aims to optimise the time-integrated activity (TIA) estimation in kidneys by using population-based model selection with non-linear mixed-effects modelling (PBMS-NLME), inter-occasional variability (IOV), and inter-individual variability (IIV) in two cycles of [177Lu]Lu-PSMA-617 therapy. ***Materials and Methods:*** Renal biokinetic data was gathered from a cohort of ten prostate cancer patients who underwent two cycles of therapy utilising [177Lu]Lu-PSMA-617. SPECT/CT scans were performed at 1, 24, 48, 72, and 168 hours post injection. Sums of exponential functions (SOEFs) with up to seven parameters were fitted to the biokinetic data using NLME modelling. Variability due to the treatment cycle and kidneys' site/position (left/right) was described in the model by taking into account the IOV and IIV in the structural model. The PBMS-NLME was done based on the goodness-of-fit criteria and the Akaike weight value to select the SOEF most supported by the data. The performance of the best-fit function integrating IOV and IIV in this study was compared to the best-fit function from the PBMS-NLME method in the literature for [177Lu]Lu-PSMA-617 (Hardiansyah et al. JNM 2024). The performance of the models was evaluated using the relative deviation (RD) between the TIA from the best SOEF in this study and the TIA from the best SOEF in the literature for [177Lu]Lu-PSMA-617, i.e. f6c=A1e-(λ1+λphys)t+A2e-(λ2+λphys)t-A3e-(λ3+λphys)t-(A1+A2-A3)e-(λbc+λphys)t ***Results:*** The SOEF with five parameters f5a=A1e-(λ1+λphys)t+A2e-(λ2+λphys)t-(A1+A2)e-(λ3+λphys)t considering the IOV and IIV was selected as the best-fit SOEF with an Akaike weight of 92%. The RD between the TIA from the best SOEF in this study and the TIA using the literature function for the first and second cycles were -0.2 [-4.1,2.7]% and -0.3 [-5.8,9.4]%, respectively. ***Conclusion:*** Integrating the IOV and IIV into the PBMS-NLME model is beneficial to improve the accuracy of the estimated kidney TIAs in [177Lu]Lu-PSMA-617 therapy, as evidenced by the Akaike weight of 92%. ***References:*** D. Hardiansyah, E. Yousefzadeh-Nowshahr, F. Kind, A. J. Beer, J. Ruf, G. Glatting, and M. Mix, "Single-Time-Point Renal Dosimetry Using Nonlinear Mixed-Effects Modeling and Population-Based Model Selection in [177Lu]Lu-PSMA-617 Therapy," Journal of Nuclear Medicine, Feb. 2024.

OP-157

Single-time-point dosimetry for tumour lesions during [^{177}Lu]Lu-PSMA-617 therapy using non-linear mixed-effects modeling

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Aim/Introduction: The study aimed to calculate the accuracy of tumour lesion dosimetry in [177Lu]Lu-PSMA-617 therapy using single-time-point (STP) imaging data from SPECT/CT, non-linear mixed-effects (NLME) modelling, and the population-based model selection (PBMS) method in a population of 52 patients. ***Materials and Methods:*** Time-activity per volume data for [177Lu]Lu-PSMA-617 in lesions were collected using SPECT/CT at: TP1=(1.8±0.8) h, TP2=(18.7±0.9) h, TP3=(42.6±1.0) h, TP4=(66.3±0.9) h, and TP5=(158.8±22.8) h post-injection. Ten sum-of-exponentials (SOE) functions were fitted to the time-activity per volume data. A PBMS method was employed based on goodness-of-fit tests and Akaike weights. The optimal function derived from the PBMS method and data from all time points was utilised to compute the reference time-integrated activities

per volume (rTIAVs). The parameters of this optimal function were fitted to the STP data for each patient, and these adjusted parameters were then employed to calculate the STP TIAVs (sTIAVs). Additionally, STP dosimetry was conducted using the method outlined by Hänscheid et al. (JNM,2018) to determine the TIAVs (hTIAVs). The accuracy of the computed sTIAVs and hTIAVs was assessed by evaluating the mean and standard deviations (SDs) of relative deviations (RDs), the root-mean-square errors (RMSEs) of the RDs, and the mean absolute errors (MAEs). ***Results:*** The function with four parameters was selected as the best-fit function from PBMS. For STP dosimetry, a solitary SPECT/CT measurement at TP4 exhibited a mean deviation of (0±21)% and a median deviation of 0.6%. The RMSEs for deviations in sTIAVs at TP1, TP2, TP3, TP4, and TP5 were 78%, 30%, 20%, 21%, and 20%, respectively. The RMSE values for deviations in hTIAVs at TP1, TP2, TP3, TP4, and TP5 were 96%, 62%, 33%, 21%, and 28%, respectively. The mean absolute errors (MAEs) of STP TIAVs at TP1, TP2, TP3, TP4, and TP5 were 2.4 %h/mL, 1.5 %h/mL, 1.1 %h/mL, 0.7 %h/mL, and 0.7 %h/mL, respectively. Conversely, the MAEs for hTIAs at TP1, TP2, TP3, TP4, and TP5 were 6.9 %h/mL, 4.6 %h/mL, 2.2 %h/mL, 1.1 %h/mL, and 1.1 %h/mL, respectively. The proportion of deviations less than 10% at T4 was 32/52 (62%) for sTIAVs and 20/52 (38%) for hTIAVs. ***Conclusion:*** Our findings indicate that, a single SPECT/CT measurement at 3 d post-injection could be used to predict tumour lesion TIAVs in [177Lu]Lu-PSMA-617 therapy through NLME modelling. This STP approach outperforms the STP method proposed by Hänscheid et al. for the investigated radiopharmaceutical and patient population.

OP-158

Accuracy of personalised single time point dosimetry for bone marrow and liver dosimetry in Yttrium-90-Anti CD66 radioimmunotherapy

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Aim/Introduction: [90Y]-Anti-CD66 radioimmunotherapy (RIT) is a promising treatment for multiple myeloma and leukaemia. By performing patient-specific dosimetry, the therapeutic dose can be precisely tailored to minimise organ toxicity and maximise treatment efficacy. Our study aimed to evaluate and compare different approaches to estimating absorbed dose from a single time point (STP) imaging in clinical practice in terms of accuracy and effort. ***Materials and Methods:*** Whole-body SPECT/CT was acquired from 28 patients at 24h, 72h, and 96h after administration of [111In]-Anti-CD66 (0.18 ± 0.01GBq) as a surrogate to [90Y]-Anti-CD66 (2.4 ± 0.5GBq). The absorbed dose was estimated using STP methods (M1-M4) and compared against the reference multi-time point (MTP) dosimetry method (M0). The population mean effective half-life (Teff) was used for calculation in bone marrow (BM) (47.35 ±4.30h) and liver(69.84 ±11.55h). M1: The time-integrated activity (TIA) of 24h imaging time point was estimated by a mathematical approximation of measured activity with monoexponential decay function based on Mean Teff; M2: TIA was calculated using the ratio of activity at measurement time and a decay constant; M3: TIA was calculated as a product of measurement time and activity and the factor of 2/0.693, M4: TIA was estimated using an in-house function based on the product of measured time, activity and a ratio of Teff and time and constant The resulting time-integrated activity from these methods is multiplied with organ-based S-value to estimate the dose. ***Results:*** The measured BM and liver absorbed dose (mGy/MBq) was 5.76 ±1.54 and 3.11 ±2.40 (M1); 5.7 ±1.47 and 3.1 ±2.54(M2); 5.68 ±1.54 and 3.08 ±2.34(M3); 6.07 ±1.6 and 3.36 ±2.64(M4); 5.95 ±1.73 and 2.91 ±1.84(M0), respectively. Using STP methods for BM had -2.52 ±6.96%(M1), -2.79 ±10.20%(M2), -2.50 ±6.96%(M3) and 2.67 ±7.06%(M4) difference against M0, while 2.32±12.12%(M1), 1.40 ±16.33%(M2), 2.36±12.12%(M3) and 9.87±12.27%(M4) in liver. In BM, none of the patients have an error of more than 20% with M1 and M3, whereas 3.57% have an error of more than 20% with M2 and M4 in the liver. The percentage of patients with an error of more than 20 % in the liver was lowest (14.29%) with M1 and M3. ***Conclusion:*** STP dosimetry obtained with the M1 for [90Y]-Anti-CD66 RIT using SPECT/CT at 24h led to the lowest error and provided high accuracy in dose estimation. Implementing this finding can reduce patient and department burden and increase dosimetry adoption.

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Sunday, October 20, 2024, 15:00 - 16:30
Hall Z

Clinical Oncology Track - TROP Session: Oncology & Theranostics Committee: Lung

OP-159

Fibroblast Activation Protein targeted Imaging Outperforms FDG-PET/CT in Malignant Mesothelioma: Prospective Single-Center Observational Trial

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Aim/Introduction: Mesothelioma is a rare tumor entity mostly affecting the pleura and is associated with overall poor prognosis. On molecular level, various mesothelioma subtypes have shown expression of fibroblast-activation-protein (FAP) in tumor cells and carcinoma-associated fibroblasts, suggesting FAP as a potential target for imaging and therapy. Therefore, the novel radiolabeled FAP-inhibitors (FAPI) are of interest for future theranostic approaches. The FAPI-PET observational trial (NCT04571086) explores Ga-68-FAPI PET imaging in cancer patients and here we present preliminary data on Ga-68-FAPI in patients with malignant mesothelioma. ***Materials and Methods:*** From April 2020 till August 2023 forty-one patients underwent Ga-68 FAPI-PET imaging, contrast-enhanced CT (Ce-CT), and F-18-FDG PET. The primary aim was to correlate Ga-68-FAPI-PET uptake (SUVmax and SUVpeak) with histopathological FAP expression by spearmen correlation. Secondary objectives included detection rate (rate of PET positive results) and sensitivity (SE), specificity (SP), positive/negative predictive values (PPV/NPV) and accuracy (ACC) compared to F-18-FDG PET validated by histopathology or a compound reference standard (histopathology, alternative imaging or follow-up imaging). Two blinded readers reported Datasets. ***Results:*** A significant moderate correlation was observed between FAPI SUVmax and SUVpeak values and histopathological FAP expression (SUVmax r = 0.49, p = 0.04; SUVpeak r = 0.51, p = 0.03). Overall Ga-68-FAPI showed very good diagnostic

performance (SE 98%, SP 81%, PPV 88% and NPV 97%). Compared to F-18-FDG sensitivity was similar on both per-patient (100.0% vs. 97.3%) and per-region (98.0% vs. 95.9%) basis. Notably, Ga-68-FAPI exhibited higher SP (81.1% vs. 36.8%) and PPV (87.5% vs. 66.2%) in per-region analysis, indicating superior performance. Main reason for this discrepancy were a higher number of false positive regions on F-18-FDG (FAPI, N = 7 vs. FDG, N = 31). ***Conclusion:*** This study validates the correlation between Ga-68-FAPI uptake and histopathological FAP expression in mesothelioma patients. Furthermore, it demonstrates superior detection rate and diagnostic performance compared to F-18--FDG. These findings highlight the potential of Ga-68-FAPI as a valuable diagnostic tool in clinical practice.

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^{18}F-FDG-PET/CT atypical response patterns to immunotherapy in non-small cell lung cancer patients: long term prognosis assessment and clinical management proposal.

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Aim/Introduction: Determine the long-term prognosis of immune-related response profiles (pseudoprogression and dissociated response), not covered by conventional PERCIST criteria, in patients with non-small-cell lung cancer (NSCLC) treated with immune checkpoint inhibitors (ICPIs). ***Materials and Methods:*** 109 patients were prospectively included and underwent 18F-FDG-PET/CT at baseline, after 7 weeks (PETinterim1), and 3 months (PETinterim2) of treatment. On PETinterim1, tumor response was assessed using standard PERCIST criteria. In case of PERCIST progression at this time-point, the study design provided for continued immunotherapy for 6 more weeks allowing to refine the response patterns considering PETinterim2 results: pseudo-progression (PsPD) if response was observed on PETinterim2; confirmed progressive metabolic disease (cPMD) in case of confirmed progression and dissociated response (DR) in case of coexistence of responding and non-responding lesions. Patients were followed up for at least 12 months. ***Results:*** Median follow-up was 21 months. At PETinterim1, PERCIST progression was observed in 60% (66/109) of patients and ICPI was continued in 59/66. At the subsequent PETinterim2: 14% of patients showed PsPD, 11% DR, 35% cPMD, and 28% had a sustained metabolic response. Median overall survival (OS) and progression-free-survival (PFS) did not differ between PsPD and DR (27 vs 29 months, p=1.0; 17 vs 12 months, p=0.2, respectively). The OS and PFS of PsPD/DR patients were significantly better than those with cPMD (29 vs 9 months, p<0.02; 16 vs 2 months, p<0.001), but worse than those with sustained metabolic response (p<0.001). This 3-group prognostic stratification enabled better identification of true progressors, outperforming the prognostic value of standard PERCIST criteria (p=0.03). ***Conclusion:*** These results are in favor of introducing new criteria that consider atypical response patterns to ICPIs (DR and PsPD) after initial metabolic progression. They refine the prognostic stratification of the usual PERCIST criteria and support a "wait and see" strategy after early PET assessment.

OP-161

Head-to-head comparison of the dual heterobivalent tracer [^{68}Ga]Ga-FAPI-RGD and the cyclic RGD homodimer [^{68}Ga]Ga-PRGD2 for PET imaging of lung carcinoma

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Aim/Introduction: Radiolabeled fibroblast activation protein inhibitor (FAPI) and RGD molecules have been investigated for imaging FAP and integrin αvβ3 receptor expression in various tumor types. However, the difference between heterodimers and homodimers has never been compared. In this study, we evaluated the [68Ga]Ga labeled heterodimer [68Ga]Ga-FAPI-RGD and the cyclic RGD homodimer [68Ga]Ga-PRGD2 for the first time in patients with lung neoplasms to compare their clinical performance. ***Materials and Methods:*** This prospective study was approved by the Peking Union Medical College Hospital ethics committee (IRB protocol I-22PJ249) and registered at ClinicalTrials.gov (NCT05543954). All patients provided written informed consent to receive both the [68Ga]Ga-FAPI-RGD and [68Ga]Ga-PRGD2 PET/CT within 1 week. Patients with suspected primary or metastatic lung carcinomas were recruited. All patients underwent [68Ga]Ga-FAPI-RGD PET/CT scan at 85.8 ± 24.0 min and [68Ga]Ga-PRGD2 PET/CT scan at 59.9 ± 10.3 min after intravenous injection. The peripheral normal tissue was considered as background for calculation. The SUVmax was calculated for further analysis. Histopathological findings were used for final diagnostic determinations of all primary tumors. ***Results:*** Twenty-four patients were enrolled in this study (10 men and 14 women; mean ± age SD, 63 ± 9.8 years). All patients tolerated the examination well and no significant adverse events related to the study were reported in any of the patients. There were 22 patients with lung adenocarcinomas and 2 patients with squamous cell lung carcinomas. [68Ga]Ga-FAPI-RGD showed much higher SUVmax (6.02 ± 4.08 vs. 2.81 ± 1.79, $p < 0.001$) than [68Ga]Ga-PRGD2. Compared with [68Ga]Ga-PRGD2, [68Ga]Ga-FAPI-RGD detected 4 more primary lesions (20/24 vs. 16/24). [68Ga]Ga-FAPI-RGD PET/CT also detected more metastases than [68Ga]Ga-PRGD2 PET/CT in 6/8 patients (172 vs. 98 lesions) and showed a higher SUVmax (7.78 ± 2.84 vs. 3.97 ± 1.06, $p < 0.001$). ***Conclusion:*** This pilot study demonstrated the first clinical application of two dimer tracers in lung cancer. [68Ga]Ga-FAPI-RGD showed better performance than [68Ga]Ga-PRGD2, resulting in higher tracer uptake, higher tumor detection rate and improved detection of metastases. Further investigation of the differences between the heterodimer and homodimer tracers in larger clinical trials is warranted.

OP-162

First experience with [^{195m}Pt]cisplatin imaging in lung cancer patients

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Aim/Introduction: Cisplatin as a combination therapy with radiotherapy has proven to be effective in treatment of non-small cell lung cancer (NSCLC) patients. However, treatment with this platinum-based chemotherapy shows heterogeneous response

and there is a risk of nephrotoxicity. Radiolabeled [195mPt] cisplatin has been developed as an imaging tool to determine the biodistribution of cisplatin in vivo and aid in patient selection. The aim of this phase I study was to determine the (radiation) safety, biodistribution, and image quality of [195mPt]cisplatin SPECT/CT scans in NSCLC patients. ***Materials and Methods:*** [195mPt] cisplatin was produced under good manufacturing practice (GMP) with a radiochemical purity of ≥95%. Patients with locally advanced NSCLC received 24 daily fractions radiotherapy with concurrent low-dose cisplatin 1-2 hours before each fraction were included in this study. In the second or third week of treatment 100 MBq [195mPt]cisplatin was given. Planar imaging and SPECT/CT scans were acquired at 1.5, 48, 120, and 168 hours after injection. Image quality was determined by visual inspection. Automated full organ segmentations were made in 3DSlicer (TotalSegmentator), and organ specific activities time-activity curves were generated by fitting mono-exponential curves. Effective and absorbed doses for [195mPt]cisplatin were obtained with S-values from IDAC-Dose 2.1. Any toxicity CTCAE >2 was scored as severe toxicity. ***Results:*** In total, six patients were included (66 years ±4.5, 3/6 male) with an average primary tumor size of 5.2 cm (range 3.0-7.6 cm). Patients received 100.9 ± 3.3 MBq [195mPt]cisplatin at a radioactivity concentration of 11.1 ± 4.9 MBq/ml. No adverse events of grade 3 or higher were observed in any patient. The liver received highest mean [195mPt]cisplatin concentrations with 4.2 ± 0.2 kBq/ml at T=1.5 hours, followed by the kidneys at 3.8 ± 0.8 kBq/ml at T=1.5 hours. The liver and kidneys also showed highest absorbed doses with 48.6 ±7.9 mGy and 38.4 ±7.2 mGy respectively. A mean effective dose of 14.8 mSv ± 1.5 (0.15 ± 0.02 mSv/MBq) was received. Mean tumor to blood ratio was 1.0 ± 0.05, but [195mPt]cisplatin still showed to be suitable for imaging. ***Conclusion:*** [195mPt]Cisplatin is safe to use for imaging in patients with NSCLC, with a mean effective dose of 14.8 mSv ± 1.5 (0.15 ± 0.02 mSv/MBq). The image quality of [195mPt]cisplatin was suitable for imaging, although the tumor uptake was similar to that of blood.

OP-163

Prognostic value of fully-automatic Metabolic Tumor Volume calculation for patients with metastatic lung cancer treated with immunotherapy

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Aim/Introduction: Total Metabolic Tumor Volume (tMTV), assessed by 18FDG PET, is an effective biomarker to estimate tumor burden, and has demonstrated strong prognostic value for non-small cell lung cancer (NSCLC) patients treated with Immune Checkpoint Inhibitors (ICPI). However, tMTV requires manual delineation of all lesions, which limits its adoption in clinical practice. We aimed to assess the prognostic value of automatic tMTV, using a deep learning (DL) model previously trained for this specific task. ***Materials and Methods:*** Patients with metastatic NSCLC were retrospectively included in two different universitary hospitals (Nice and Poitiers, France). 18FDG PET scans were performed before the start of ICPI in monotherapy (PETbaseline) and 6-8 weeks later (PETinterim1). Tumor response was assessed using PERCIST criteria. tMTV was automatically calculated on both time-points using a 3D U-Net model (Dice Score=0.73) initially trained on 700 other multicentric PET/CT studies manually segmented by 4 nuclear physicians. Median follow-up was 45.2 (39.8-NR) months. Uni- and multivariate cox regressions were performed to identify factors associated with 12-months overall survival (OS) and 6-months progression-free survival (PFS), using tMTV thresholds independently determined in a previous publication (DOI: 0.1136/jitc-2023-007628). ***Results:*** 87 patients were included (Nice=26; Poitiers=61). Median OS was 15 [8.7-22.5] months. Mean tMTV was 99±117 mL at PETbaseline, and 109±225 mL at PETinterim1. At baseline, patients with high tMTV (threshold=50mL) had both decreased 12-months OS (HR= 4.2[2-8.6]; p<0.0001) and 6-months PFS (HR= 3.8[2-7.4]; p<0.0001). At PETinterim1, patients with high tMTV (threshold=57mL) had also decreased 12-months OS (HR= 3.3[1.5-7.3]; p=0.003) and 6-months PFS (HR= 6.9[3.1-15]; p<0.0001); According to PERCIST criteria, 55.6% of patients (35/87) had progressive disease on PETinterim1. Patients with PERCIST progression had lower 12-months OS (HR= 2.6 [1.2-5.7]; p=0.01) and 6-months PFS (HR= 5.1 [2.2-12]; p<0.001). Baseline tMTV and PERCIST criteria were independent prognostic factors for 12-months OS (p= 0.0003 and 0.05, respectively) and 6-months PFS (p= 0.0003 and 0.0006, respectively). A score combining these 2 parameters strongly improved the prognostic stratification of patients, with a 12-months OS of 100% in the low-risk group, 49% in the intermediate-risk group and 34% in the high-risk group (p<0.0001). ***Conclusion:*** The fully automatic calculation of tMTV, using a dedicated DL model, is a strong prognostic marker for NSCLC patients treated with ICPI, both before and early after treatment initiation. PERCIST and baseline tMTV are independant prognostic markers and can be combined to achieve a more accurate prognostic stratification of patients.

OP-164

Correlation of PET Imaging with the Somatostatin Receptor Antagonist ^{68}Ga-SSO120 with Immunohistochemistry and Survival for Theranostics of SCLC

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Aim/Introduction: Positron Emission Tomography (PET) using the somatostatin receptor 2 (SSTR2)-antagonist satoreotide trizoxetan (68Ga-SSO120) is a novel promising imaging modality for small-cell lung cancer (SCLC), which holds potential for theranostic applications. Here, we correlate tumour uptake in 68Ga-SSO120 PET with SSTR2 expression in immunohistochemistry (IHC). Moreover, we analyse the prognostic value of SSTR2 expression

at initial staging of patients with SCLC in comparison with other established metrices. ***Materials and Methods:*** We screened our institutional database for patients with SCLC who underwent 68Ga-SSO120 PET/CT during initial diagnostic workup. Mean±standard deviation administered activity and uptake time were 141.8±29.0 MBq and 64±16 min. If available within ±2 weeks before/after 68Ga-SSO120 PET, 18F-FDG PET/CT was considered for comparison. Lesion volumes, SUVmax/SUVmean/SUVpeak and corresponding tumour-to-liver ratios (TLR) were estimated. TLG and MTV were calculated from 18F-FDG PET. SSTR2 expression in IHC was evaluated on a 4-level scale and correlated with 68Ga-SSO120 SUVmax and TLRpeak on a lesion level. PET uptake values, IHC SSTR2 score, and clinical parameters were analysed for association with overall survival (OS) and time to treatment failure (TTF) by univariate and multivariate Cox regression (cut-off values identified on data for best separation). ***Results:*** We included 54 patients (median age 65 years, 30 female/24 male, 21 M0/33 M1 according to TNM classification). In 43 patients with available tumour tissue, hottest lesion SUVmax and TLRpeak showed a good significant correlation with SSTR2-expression in IHC (ANOVA $p<0.001$, Spearman's rho 0.86 and 0.81, both $p<0.001$). High SSTR2 expression in IHC, 68Ga-SSO120 SUVmax and TLRpeak of the hottest lesion per patient, whole-body TLRmean, MTV, TLG, M status, and serum LDH were significantly associated with poorer TTF/OS in univariate analysis. In separate multivariate Cox regression (including sex, age, M stage, and LDH) higher hottest-lesion TLRpeak was significantly associated with shorter OS (HR=0.26, 95%CI: 0.08-0.84, p=0.02) and SSTR2 expression in IHC with significantly shorter TTF (HR=0.24, 95%CI: 0.08-0.71, p=0.001) and OS (HR=0.22, 95%CI: 0.06-0.84, p=0.03). In total, 12 patients (22.2%) showed low (<1), 21 (38.9%) intermediate (≥1 but <2), 14 (25.9%) high (≥2 but <5), and 7 (13.0%) very high (≥5) whole-body mean TLRmean. ***Conclusion:*** SSTR2 expression assessed by 68Ga-SSO120 PET and by IHC showed a good correlation and SSTR2 was associated with poorer survival. More than 75% of patients exhibited higher whole-body 68Ga-SSO120 tumour uptake than liver uptake and almost 40% high or very high uptake, indicating the theranostic potential in combination with 177Lu-SSO110 radioligand therapy.

OP-165

Prognostic Value of Tumor Dissemination (Dmax) Derived from Basal ^{18}F-FDG PET/CT in Patients With Non-Small Cell Lung Cancer

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Aim/Introduction: The aim of the present study was to test whether a parameter reflecting tumor dissemination (Dmax), derived from basal 18F-FDG PET/CT, may predict clinical outcome in patients with advanced non-small cell lung cancer (NSCLC). ***Materials and Methods:*** Seventy-eight patients (55 men, 23 women) with stage III and IV NSCLC who had undergone whole-body 18F-FDG PET/CT scan at diagnosis were included in the study. Imaging parameters including SUVmax, SUVmean, MTV and TLG of primary lung tumors along with total MTV (MTVTOT) and whole-body TLG (TLGWB) of all malignant lesions were determined by using an automated contouring program setting an absolute threshold for SUV at 2.5. Moreover, the largest distance between two ^{18}F-FDG avid lesions (Dmax) in each patient was measured. Univariate and multivariate analyses of clinical and imaging variables were performed using Cox proportional hazards regression whereas Kaplan-Meier method and log-rank tests were used for survival analysis. ***Results:*** A total of 441 lesions were analyzed including 78 primary tumors, 174 metastatic lymph nodes and 189 distant metastases. In primary tumors, average values of SUVmax, SUVmean, MTV and TLG were 11.80 ± 5.73, 5.37 ± 2.09, 60.61 ± 102.57 mL and 340.36 ± 558.40 g, respectively, whereas mean values of MTVTOT, TLGWB and Dmax were 155.90 ± 176.94 ml, 851.08 ± 1032.17 g and 29.98 ± 20.98 cm, respectively. Univariate analysis was performed including age, gender, histology, stage, MTVTOT, TLGWB, Dmax and imaging parameters derived from 78 primary lung tumors. Overall survival (OS) was predicted by MTVTOT (p=0.0145), TLGWB (p=0.0518), Dmax (p=0.0031) and stage (p=0.0130). Then, these predictive variables along with age were included in multivariate analysis and only Dmax was retained in the model ($\chi2=7.3130$, p=0.0068). By Kaplan-Meier method and log-rank test, patients with Dmax ≤ 8.8 cm had significantly better OS as compared to patients with Dmax > 8.8 cm ($\chi2=5.8673$, p=0.0154). ***Conclusion:*** Dmax by reflecting tumor dissemination can predict overall survival in NSCLC patients.

OP-166

Assessment of 68-Gallium-Fibroblast Activation Protein Inhibitor (FAPI) PET/CT and ^{18}F-Fluorodeoxyglucose (FDG) PET/CT in Non-Small Cell Lung Cancer: A Comparative Analysis

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Aim/Introduction: Lung cancer presents a significant global health burden, necessitating accurate staging for effective management. While ^{18}F-FDG PET-CT has been a cornerstone in staging, the emergence of 68Ga-FAPI PET-CT offers a promising alternative due to its distinct targeting of cancer-associated fibroblasts. This study aims to compare ^{18}F-FDG PET/CT and 68Ga-FAPI PET/CT in evaluating Non-small cell lung cancer (NSCLC). ***Materials and Methods:*** This single-centre study recruited 21 newly diagnosed treatment-naive NSCLC patients. All the participants underwent 68Ga-FAPI and ^{18}F-FDG PET/CT imaging within one week for baseline staging. Primary lesions, lymph nodes and distant metastases were assessed and compared between the two tracers. Semi-quantitative parameters like Standardised Uptake Value Maximum (SUVmax) based on body surface area and Tumour-to-Background Ratio (TBRmax) were measured and analysed using Paired T-tests. The tumours were staged using the 8th edition of TNM classification of lung cancers. ***Results:*** Among the participants (mean age 57.3 ± 10 years; 13 males, 8 females), 68Ga-FAPI PET/CT identified more metastases in lymph nodes (80 vs 69), bone (142 vs 128), liver (7 vs 5), pleura (19 vs 13), lung (36 vs 31), and brain (1 vs 0) compared to ^{18}F-FDG PET/CT. Additionally, 68Ga-FAPI demonstrated higher SUVmax in primary lesions (4.7±1.6 vs 3.7±1.4, p=0.002) as well as lymph nodes (3.2±1.3 vs 2.2±1.2, $p<0.001$), skeletal (3.7±1.7 vs 2.1±0.9, $p<0.001$), liver (5.3±2.5 vs 2.5±0.6, p=0.04), pleural (2.1±0.9 vs 1.3±0.7, $p<0.001$), and adrenal (3.3±1 vs 2.2±0.5, p=0.009) metastases. The TBRmax was significantly higher in 68Ga-FAPI scans across all these lesions ($p<0.05$). 68Ga-FAPI improved metastasis visualisation in bone, brain, and liver compared to ^{18}F-FDG due to reduced background uptake. No statistically significant differences were found in the SUVmax (2.0±1.0 vs 1.8±0.9, p=0.054) and TBRmax (3.8±2.1 vs 3.3±1.7, p=0.052) of lung metastases. The 68Ga-FAPI PET/CT scan resulted in the upstaging of the N stage in three patients

and, in two cases, led to an upstaging of the overall TNM stage. ***Conclusion:*** 68Ga-FAPI PET/CT outperforms ^{18}F-FDG PET/CT in detecting metastatic lesions in lymph nodes, bone, liver, pleura, lung, and brain in non-small cell lung cancer (NSCLC) patients. With higher SUVmax and enhanced tumour-to-background ratio, 68Ga-FAPI may refine NSCLC staging and offer therapeutic potential for metastatic cancers. Furthermore, the on-site generation of Gallium-68 streamlines radiotracer availability for 68Ga-FAPI PET/CT imaging, while its minimal patient preparation requirements improve accessibility and flexibility in clinical settings.

OP-167

[68Ga]Ga-FAPI-46 PET/CT for Staging Suspected/Confirmed Lung Cancer: Results on the Surgically Treated Cohort Within a Monocentric Trial

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Aim/Introduction: To evaluate T&N-staging diagnostic performances of [68Ga]Ga-FAPI-46(FAPI) and ^{18}F-FDG PET/CT(FDG) in a suspected/confirmed lung cancer(LC) surgical cohort. ***Materials and Methods:*** Patients were enrolled in a prospective monocentric trial (EudraCT:2021-006570-23) to perform PET/CT with investigational FAPI, in addition to conventional-staging-flow-chart (including FDG). For the current purpose, only surgical patients were included. PET scans were interpreted by at least three readers (expert in oncological/non-FDG-PET imaging). Visual-positivity-criteria was defined for T&N as uptake higher than mediastinal-blood-pool (MBP) (excluding physiological/paraphysiological). Agreement(%) between FAPI/FDG and histopathology was assessed by TNM-StagingAJCC8thEdition. PET-semiquantitative-parameters were measured for T&N: SUVmax, target-to-background-ratios (TBRs:SUVmaxLesion/SUVmeanBackground) using MBP, liver(L) and pulmonary-parenchyma(P) as backgrounds.FAPI-PET/CT visual and semiquantitative performances (ROC-AUC for SUVmax and TBRs) were analyzed per-patient and per-T&N-regions, compared to FDG-PET/CT, with surgical-histopathology as standard-of-truth. ***Results:*** 63 FAPI were performed out of 64 patients enrolled (26May22-30Nov23). 50/63 patients underwent surgery and were included (mean age:72y[45-87];M:F=33:17). Agreement(%) with histopathological-T&N-StagingAJCC8thEdition (FAPIvsFDG) was: T-66% vs 58%, N-80.4% vs 71.7%. When T&N were dichotomized (0vs1) agreement(%) increased respectively to T-80% vs 80%, N-80.4% vs 73.9%. The results of patients/region-based analyses are presented.Analyses T-per-patient (n=50), Visual (FAPIvsFDG): TN 4 vs 3, FN 2 vs 7, TP 42 vs 37, FP 2 vs 3; sensitivity 95% vs 84%, specificity 67% vs 50%, PPV 95% vs 93%, NPV 67% vs 30%, accuracy 92% vs 80%.Analyses T-per-region (n=59), Visual (FAPIvsFDG): sensitivity 79% vs 66%, specificity 67% vs 50%, PPV 95% vs 92%, NPV 27% vs 14%, accuracy 78% vs 64%. 6/59 resulted benign: 1 actinomyces and 1 granulomatous abscesses (concordant FDG&FAPI-FP), 4 inflammatory nodules (1 FDG-FP/FAPI-TN and 3 concordant-TN); 53/59 resulted malignant: 37 adenocarcinomas (9 concordant FDG&FAPI-FN, predominantly lepidic and in 1 case mucinous; 6 FDG-FN/FAPI-TP; 22 concordant FDG&FAPI-TP-the majority acinar),13 SCC (1 concordant FDG&FAPI-FN; 1 FDG-FN/FAPI-TP; 11 concordant FDG&FAPI-TP), 1 carcinoid (concordant FDG&FAPI-FN).PET-indexes performed similarly, slightly in favour of FAPI, although not significantly different (FAPIvsFDG): SUVmax-AUC=0.65(cut-off=1.3, accuracy=0.85) vs 0.48(12;0.80), TBR-L-AUC=0.62(0.9;0.8) vs 0.47(4.8;0.8), TBR-MBP-AUC=0.61(2.3;0.71) vs 0.50(7.4;0.81), TBR-P-AUC=0.59(6.5;0.66) vs 0.54(3.8;0.73). Analyses N-per-patient (n=46; 34 pN0 and12 pN+:8pN1, 4pN2); Visual (FAPIvsFDG): TN 31 vs 26, FN 6 vs 4, TP 6 vs 8, FP 3 vs 8; sensitivity 50% vs 67%, specificity 91% vs 76%, PPV 67% vs 50%, NPV 84% vs 87%, accuracy 80% vs 74%. ***Conclusion:*** In a suspected/confirmed LC surgical cohort, diagnostic performances for T&Nstaging were slightly in favour of FAPI in all cases (except for N-sensitivity, which remains suboptimal). Further analyses are ongoing (non-surgical-cohort, N-per-region and FAP-expression-IHC).

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Sunday, October 20, 2024, 15:00 - 16:30
Hall Y10-Y12

TROP Session: Thyroid Committee: Radioiodine Therapy in Bengin and Malignant Thyroid Disease: An Evergreen Treatment

OP-168

The effect of radioiodine therapy I-131 in patients with non-toxic nodular goitre

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Aim/Introduction: Simple goitre is defined as the enlargement of the thyroid gland, in the absence of autoimmune thyroid disease, malignancy, or inflammation, still constitutes a major diagnostic and therapeutic challenge. Radioiodine therapy (RAIT) is non-invasive, safe and cost effective method of therapy for reduction of goitre. There is no consensus regarding the optimum treatment of benign non-toxic goitre. Randomised studies have shown that levothyroxine has poor evidence of efficacy and is inferior to radioiodine therapy regarding goitre reduction. The aim of our study was to evaluate the short term efficacy of radioiodine therapy to reduce thyroid volume with minimal risk of hypothyroidism in patients with non-toxic nodular goitre. ***Materials and Methods:*** We treated 980 patients, aged 20-90 years; (76%) of the studied groups were female and (24%) male; the mean radioiodine uptake (RAIU) was 39% and thyroid volume ranged between 44-170ml. Qualification of these patients were based on normal levels of serum fT4, TSH and characteristic appearance on thyroid scans and ultrasound. Malignant changes were excluded in all suspected nodules by fine needle aspiration biopsy. The activity dose was calculated by the use of Marinelli's formula and ranged between 200 -800 MBq. The mean absorbed dose was 199.4 ± 23.8 Gy, and was proportional to thyroid volume. Thyroid ultrasonography, and thyroid scan with RAIU at 24hours was done before and after 12 months of RAIT. Follow up control for the evaluation of fT4, TSH was done every 6 weeks. ***Results:*** After 12 months of radioiodine therapy a mean thyroid volume reduction of 48% was achieved. Approximately half of the effect is obtained within the first 3 months. Euthyroidism persist in 92% of patients, and hypothyroidism develop in 8% of patients. All patients were highly satisfied; with improvement in

obstructive symptoms and exercise tolerance in the majority of patients ***Conclusion:*** Radioiodine is non-invasive, safe and cost effective method of therapy for reduction of the goiter volume and should not be restricted to elderly patients, or to patients with high operative risk, but should be used as first choice in every patient with non toxic nodular goitre with thyroid volume > 40 ml especially in patients with special profession. Surgery should be reserved as first choice if malignancy is suspected. The reduction of thyroid volume with low percent of hypothyroidism, were due to well accurate measurement of administered activity, relatively high effective half-life, & well-organised follow up.

OP-169

Analysis of parameters associated with Graves' disease relapse in patients treated with radioiodine

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Aim/Introduction: Graves' disease (GD) is the most frequent cause of hyperthyroidism due to functional upregulation of the whole gland by autoimmune stimulation. Radioiodine treatment (RAI) is an effective therapeutic option for GD patients allowing a definitive resolution of hyperthyroidism in ~75-85% of patients. Aim of this work is to analyse the parameters associated to GD relapse in patients treated with RAI. ***Materials and Methods:*** GD patients treated with dosimetrically determined activities of 131I between 2010 and 2022 with a minimum follow-up of 2 years were retrieved. Clinical parameters (including gender, age at RAI, FT4 and Thyrotropin Receptor Antibodies (TSHrAb) values at diagnosis, thyroid volume at ultrasound (US) within a month from RAI, 24h uptake of 131I, GREAT score and orbitopathy) were collected. RAI was performed by a dosimetric approach with gamma probe (Capintec Inc.) and the administered activity was calculated to achieve 300Gy to the gland, considering the 24h uptake and thyroid volume according to US. The evidence of GD relapse, defined as clinical and biochemical evidence of hyperthyroidism after RAI, was considered as outcome at multivariate analysis and one-way ANOVA test. ***Results:*** 73 GD patients (16 males and 57 females; median age 55±12 years) treated with RAI were collected. The administered doses of 131I ranged between 256 and 592 MBq (median 333±88.8 MBq). After a mean follow-up of 6.2±3.7 years, 12 patients (16.4%) showed GD relapse. The mean intercurrent time between RAI and relapse was 12±16.6 months. At multivariate analysis, patients with relapsed GD demonstrated significantly higher mean 24h uptake (82.4±10.6% vs 63.1±16.6%; p=0.003), thyroid volume at US (24.7±12.6 ml vs 17.4±9.1 ml; p=0.02) and GREAT score (4±2 vs 2.5±1.7; p=0.01) as compared to non-relapsing patients. Moreover, one-way ANOVA confirmed statistically significant difference in 24h uptake (F=[14.45]; p=0.003), thyroid volume at US (F=[5.28]; p=0.02) and GREAT score (F=[7.00]; p=0.01) among the 2 groups. ***Conclusion:*** our cohort of GD patients treated with RAI confirms the efficacy of this therapeutic approach that allowed a definitive resolution of hyperthyroidism in 83.6% of cases. Patients who showed GD relapse - as expected - were those with the largest thyroid volumes. Surprisingly, we found significantly higher values of 24h thyroid uptake in relapsed patients, leading us to conclude that in glands that are very avid for iodine, predictive dosimetry using gamma probe may sometimes underestimate the 131I activity needed for an effective treatment. These findings deserve confirmation in larger cohorts.

OP-170

The efficacy of radioiodine therapy in patients with toxic adenoma in subclinical hyperthyroidism

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Aim/Introduction: Subclinical hyperthyroidism (SCH) is a state of increased thyroid function with few or no clinical definitive signs or symptoms of hyperthyroidism, characterized by a subnormal serum TSH level, with normal serum levels of free thyroxine (FT4), triiodothyronine (TT3) and/or free triiodothyronine (FT3). The prevalence of endogenous SCH varies considerably, between 0.6 and 16% . SCH is associated with increased risk of coronary heart disease mortality, incident atrial fibrillation, heart failure, fractures and all-cause mortality in patients with serum TSH levels < 0.1 mIU/l (grade 2 SCH). The risk of progression to overt hyperthyroidism (OHT) varies between studies 1-15% / year. The aim of our study was to assess the influence of radioiodine (131I) therapy on the achievement of euthyroidism, prevention of adverse effects on the cardiovascular and prevent evolvement to overt hyperthyroidism. ***Materials and Methods:*** We treated 1950 patients with toxic adenoma (TA) referred to our department during the last 10 years, aged 20-85 years; 88% of them were females and 12% males;. Some of the patients were treated with antithyroid drugs for 1-3 months before radioiodine therapy (120 patients). Malignant changes were excluded in all nodules by fine-needle aspiration biopsy. All the patients had serum TSH levels <0.1 mU/l (grade 2 SCH) and effective T-half was more than 3 days at the time of treatment. The activity dose was calculated by the use of Marinelli's formula and ranged between 200 and 800 MBq. The absorbed dose (Gy) ranged between 180 and 300, and was proportional to thyroid volume. Follow-up control was done every 8 weeks. ***Results:*** Euthyroidism achieved in 99% of patient and 1% of patients develop hypothyroidism. One patients develops Graves' disease and received second dose of radioiodine therapy. In all of the patients, the symptoms and signs of subclinical hyperthyroidism disappeared (palpitation, tachycardia, atrial fibrillation, exercise tolerance improved, the blood pressure normalised and the quality of life improved). ***Conclusion:*** The achievement of euthyroidism and the remission of the symptoms and signs of subclinical hyperthyroidism, were due to good diagnosis, well preparation of the patients; accurate measurement of administered activity, effective half-life, and well-organised follow-up. We recommend early treatment of subclinical hyperthyroidism, and long period of follow-up to evaluate the long-term effect of radioiodine therapy.

OP-171

Autonomously Functioning Thyroid Nodules (AFTN): comparison between use of Radioactive iodine 131I (RAI) in combination with Percutaneous Microwave Thermoablation (PMWT) and Percutaneous Microwave Thermoablation (PMWT) alone.

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Aim/Introduction: In AFTN, RAI is the first-line therapy choice in most of patients,surgery rarely is necessary. Minimally invasive US-guided techniques (RFA,Laser,recently MWT)have become increasingly available in benign thyroid nodular disease, whereas useful in AFTN is debated. Purpose to compare effictiveness and safety of combined RAI/PMWT and PMWT alone in AFTN. ***Materials and Methods:*** From May 2021,25 patients with AFTN(13 F,12 M;aged 51-84;mean 65) divided as follows:GroupA (9/25)received RAI and subsequently PMWTGroupB (16/25) treated with PMWT alone 3/16 of GroupB was moved to PMWT alone after evidence of high dosimetric-previsional RAI activity due to high AFTN volume. Inclusion criteria: clinically symptomatic or laboratory functional-thyroid overactivity,compressive symptoms, cosmetic concerns, solid nodule ≥20%,≥ 2 cm diameter,"hot nodule"target on Thyroid-Scintiscan with99mTc-Pertecnetate;2FNA cytology pathologically-confirmed benign(TIR2sec ITC CS 2014).Group A: mean RAI-activity adminstered after dosimetry (300 Gy target)471,88 MBq of 131 I (range 113-1395),after clinical revaluation,restore of euthyroidsm/persistence of symptoms and/or nodular target the patients move to PMWT,within 3months.GroupA e GroupB: US-guided PMWTA was carry-out under local anesthesia through Microwave antenna: 10-15Wx10-15 minutes.7-10 days after PWTA thyroid-hormon levels was remeasured.Follow-up scheduled at 1,6,12 months through: clinical/thyroid physical examination,rating symptomatology with Compressive Score(CS on a 10cm visual-analog scale),Aesthetic Score (AS from 1-no palpable to 4 palpable/visible in all positions),thyroid-hormone serum levels,US to record Volume of AFTN(V-AFTN) and volume reduction rate%(VRR).Functional therapeutic success defined as restoration of euthyroidism and volumetric therapeutic success as volume reduction ≥50 % ***Results:*** GroupA: no peri-procedural major complications occurred after PMWT 7/9 restore euthyrodism 2/9 hypothyroidism after-RAI.GroupB: 4/16(25%) showed transient increase of hormone levels strictly supervised in ¾ and 1/4 develop 10 days after PMWT atrial fibrillation pharmacologically reverted; in 6 months all the patients restore baseline hormone levels.From baseline to 12 mth follow-up:GroupA: CS from 2,8 to 1,7,AS from 3,4 to 2,1;mean vAFTN from 22,0 mL (range 93-2,8 mL)to 8,8 mL (range 54-0,24 mL)VRR mean of 72,5 %(range 41,9-95%)Functional and volumetric success: 82 and 91 %GroupB: CS from 4,5 to 1,8,AS from 3,4 to 2,5;a mean vAFTN from 32,5 mL(range 216-3 mL)to 18,6 mL(range 160-0,61 mL)VRR mean of 58,93 %(range 30,41-89,75%) Functional and volumetric success: 100 and 75 % ***Conclusion:*** Use of combined RAI/PMWT demonstrated safety, high-successful rate,obtaining restore of euthroidsm and nodule-shrinkin.We underline that in several cases,mainly for large AFTN,should be primarily proposed PWMT with a satisfying security profile too. We encurage a personalized treatment approach,based to every singol centre capability. ***References:*** Giovannella Eur J Nucl Med Mol Imaging.2024.

OP-172

Delaying Initial Radioiodine Therapy Does Affect Response in Intermediate Risk Differentiated Thyroid Cancer in Latin-American Population

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Aim/Introduction: the optimal time of initiating radioactive iodine (RAI) therapy for differentiated thyroid cancer (DTC) patients is controversial. we investigate the relationship between the timing of initiating RAI and the clinical response based on dynamic stratification risk in intermediate-risk DTC patients in the Mexican population ***Materials and Methods:*** we evaluated 132 patients with intermediate-risk DTC who received a dose of RAI to 100-150 mCi and were retrospectively reviewed. the patients were divided into 2 groups agreeable initial therapy (between total thyroidectomy and initial RAI), called time interval therapy (TIT): Group A: TIT < 6 months (n=69), and Group B: TI ≥ 6 months (n=63). Six and twelve months after RAI, we followed up with these patients and evaluated the therapy response with neck ultrasound, whole-body scan SPECT/CT, and measures of thyroglobulin and antibodies anti-thyroglobulin. According to the therapy stratification system, the therapy responses to RAI were assessed as either excellent response (ER), biochemical incomplete response (BIR), indeterminate response (IR) or structural incomplete response (SIR) at every follow-up. We conducted a univariate and multivariate analysis to determine different factors associated with different responses. A $p < 0.05$ was considered to be statistically significant. ***Results:*** Group A had significantly lower BIR rates (14.2 vs 38.2 and 4.7 vs 39.5, all P<0.05, respectively) and higher ER rates (72.8 vs 34.1 and 86.2 vs 44.2, all P<0.05, respectively) than group B during dynamic follow-ups. By univariate and multivariate analyses, prolonged TIT (HR: 5.66, 95%CI: 1.811-22.018, P=0.003), histology aggressive (HR: 7.98, 95%CI: 3.022-21.567, P=0.002), nodal extension (HR: 5.66, 95%CI: 1.199-14.257, P=0.005) were manifested to be independent risk factors for IR, SIR and BIR. Doses of 150 mCi were statically significant in patients with more than two risk factors for higher rates of ER (p=0.0045) ***Conclusion:*** early treatment with RAI is associated with greater biochemical response, and ER. Delayed initial RAI (≥6 months after thyroidectomy) is associated with poor response and poor outcome. Doses of 150 mCi had better response in patients with more than two risk factors.

OP-173

Predicting post-treatment persistent/metastatic disease by ^{131}I whole-body scintigraphy in patients with differentiated thyroid cancer

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Aim/Introduction: In patients with differentiated thyroid cancer (DTC), undergoing 131I therapy after surgery, post-treatment whole-body scintigraphy (WBS) is the method of choice to identify iodine avid local or distant metastasis. A model for predicting persistent/metastatic DTC after surgery based on post-treatment WBS results was developed using a decision tree (DT) algorithm (1). We sought to externally validate this prediction model in a cohort of Italian patients and to compare the obtained results with a further developed internal model. ***Materials and Methods:*** Data were collected from 1994 to 2021 in patients with DTC referred to the Federico II University Hospital of Naples for 131I therapy after surgery. Age, sex, histology, T stage, N stage, risk classes, remnant estimation, thyroid-stimulating hormone, and thyroglobulin (Tg) levels were identified as potential predictors of post-therapy WBS results. For external validation, the variables N stage and Tg cut-off values of 7.1, 23.3, and 35.0 ng/mL were put into the DT model previously developed using the same software package. For constructing the internal model, potential predictors were selected by metrics obtained with DT analysis as well as by multivariable logistic regression analysis using the10-

fold-cross-validation method. ***Results:*** The study population included 836 patients (78% women, age 44±15 years). A total of 99 (12%) patients had positive post-therapy WBS. Among these latter patients, 35 (4%) had positive N stage. In the entire cohort, mean Tg levels were 121±933 ng/mL. We obtained a DT with the first ramification due to Tg cut-off at 35.0 ng/mL. For patients with Tg values below this cut-off, N stage determined a second and last split. No further ramification was found for patients with Tg above 35.0 ng/mL. The area under receiver operating characteristic (ROC) curve for predicting positive post-therapy WBS was 58% (95% confidence interval, CI, 53-62%), and positive and negative predictive values were 0.52 and 0.99. The best internal model was obtained with Tg levels, T stage, N stage, and administered 131I activities as significant covariates at multivariable logistic regression. The area under ROC curve for predicting positive WBS was 75% (95% CI 68-81%), and positive and negative predictive values were 0.90 (95% CI 0.88-0.92 and 0.68-0.99). ***Conclusion:*** In our cohort, the previously proposed DT model, considering only N stage and Tg levels, has a limited value for predicting post-therapy 131I WBS findings. The internal model also including T stage and administered 131I activities demonstrates a higher predictive value. ***References:*** 1)https://doi.org/10.1007/s00259-023-06239-8.

OP-174

Factors Affecting Survival and Prognosis in Bone Metastatic Differentiated Thyroid Cancer

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Aim/Introduction: Bone metastases (BM) occur in 2-13% of patients with differentiated thyroid carcinoma (DTC). BM is the second most common site of distant metastasis after the lung. Multimodal treatment approaches with radioiodine therapy(RAI) are important for disease control. In our study, we aimed to investigate the factors affecting prognosis and survival in the diagnosis-follow-up processes in patients with BM-DTC. ***Materials and Methods:*** Sixty two patients with BM-DTC who were followed up and treated in our clinic between 1990 and 2024 were included in the study.Demographic and clinico-pathologic characteristics of the patients are summarized in Table 1. Biochemical findings during the follow-up period, RAI doses and processes, surgery and radiotherapy (RT) due to BM, use of tyrosine kinase inhibitors (TKI) and bisphosphonate, and follow-up results were recorded. The impact of clinical, pathologic and treatment practices on survival was evaluated using Kaplan-Meier and Cox Regression analysis. ***Results:*** The mean age at diagnosis was 52.6±11.2 years (17M, 45F). BM was present in 49 patients(79%) at diagnosis time. During the follow-up period, 15(24.2%) patients had a single BM, while 47(75.8%) patients had multiple BM.All patients received RAI treatment at least once. Surgical treatment (metastasectomy) was performed in 38(61.2%) and RT in 47(75.8%) patients. The median total RAI dose was 1000(540-1285) mCi. The median number of RAI treatments was 4(1-7). One patient with BM-DTK was cured with RT and RAI treatment and one patient was cured after metastasectomy and RAI treatment. Progression-free survival (PFS) was 102 months (95% CI 76.7-127.3) and overall survival (OS) was 111 months (95% CI 79.2-142.7).When the effect of disease characteristics on mortality and progression was investigated; age, BM at diagnosis, number of BM, postoperative Thyroglobulin (Tg) value were found to be effective on progression and mortality ($p<0.05$). Mortality was found to increase with age and according to ROC analysis, age >53 years was statistically significant in affecting OS. In addition, mortality was found to increase with postoperative Tg, and according to ROC analysis, Tg>36.4 ng/mL was statistically significant in affecting OS.The 5-year PFS was 54%, 10-year PFS 35% and 15-year PFS 30%. In addition, 5-year OS was 57%, 10-year OS was 44% and 15-year OS was 33%. ***Conclusion:*** As a result of the single-center long-term follow-up data; it is thought that long survival times can be achieved with a personalized dynamic approach and treatment at the time of diagnosis and during the follow-up period.

OP-175

Predictors of Disease Recurrence Following Radioactive Iodine Therapy in Pediatric Well-Differentiated Thyroid Cancer

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Aim/Introduction: This study aimed to investigate the relationship between age, gender, tumor size, radioactive iodine dose, multifocality, metastasis status, and histopathological types in patients with recurrence after 131I (RAI) treatment in childhood well-differentiated thyroid cancer. ***Materials and Methods:*** 36 patients (30F, 6M, 4-18 years) who underwent bilateral total thyroidectomy for well-differentiated thyroid cancer, and who received RAI after surgery were included in the study. All patients were classified as low-, intermediate- and high-risk based on post-operative histopathology, tumor size, multifocality, metastatic lymph node status, stimulated thyroglobulin and anti-thyroglobulin values before RAI, and neck USG. Patients over 40 kg were given RAI doses determined by the empirical method applied to adults according to risk assessment. Patients under 40 kg, 30-50 MBq/kg for ablation in the low-risk group, 51-100 MBq/kg for adjuvant treatment in the intermediate-risk group, and 101-200 MBq/kg for neo-adjuvant treatment in the high-risk group. 18F-FDG PET/CT scan was performed for the high-risk group before RAI. Tg, anti-Tg, TSH values, and neck USG were followed up at least 8 months after RAI, and treatment efficacy was evaluated. ***Results:*** 2 follicular carcinoma (FC), 1 NIFT-P, 18 papillary thyroid carcinoma (PTC), 6 PTC-FC, 8 PTC-microcarcinoma and 1 PTC-microcarcinoma-NIFT-P histopathology were treated with RAI. 14 patients had multifocal foci. Recurrent disease was detected in 6 patients in the post-RAI period. Linear regression analysis showed that Tg and Anti-Tg level elevations in the pre-RAI period after total thyroidectomy predicted disease recurrence and formed a connection model (Tg R2:0.120 $p=0.052$, Anti-Tg R2:0.099 $p<0.05$). The correlation between tumor diameter, number of metastatic lymph nodes, post-RAI Tg, Anti-Tg, and TSH values was evaluated with Spearman's rho correlation test in all groups which were found to be homogeneously distributed. Tumor diameter was significantly correlated with Tg positivity and recurrence in the post-RAI period and central and lateral neck lymph node dissection was significantly correlated with the number of metastatic lymph nodes ($p<0.05$). Histopathological poor variant type or multifocal disease was insufficient to predict recurrence. ***Conclusion:*** In the risk classification of RAI treatment planned after total thyroidectomy in well-differentiated thyroid cancer in the pediatric group, histopathological tumour diameter formed a positive model in predicting recurrence. We suggest higher empirical radioiodine doses in this group. In addition, routine application of central lymph node dissection is important for

preventing local and lateral lymph node recurrences and should be taken into account for risk stratification before RAI treatment.

OP-176

Pediatric Papillary Thyroid Carcinoma: 14 Years Of Clinical Experience

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Aim/Introduction: Differentiated thyroid carcinoma (DTC) is rare in children (<1% of tumors), representing 2% of all DTC cases, and has an excellent prognosis. Nevertheless, it's usually diagnosed at more advanced stages, and associated with higher recurrence rates compared to adults. Among risk factors, we find radiation exposure, thyroid nodules and autoimmune thyroiditis, other autoimmune diseases, and family history. This study presents clinical features and outcomes over 14 years of experience with Papillary Thyroid Carcinoma (PTC) in children. ***Materials and Methods:*** Retrospective analysis of pediatric patients with PTC treated in an oncologic institution between 2010 and 2023. ***Results:*** Thirty-five patients were included in this study, 27 of whom were female, with a mean age of 15 years at the time of diagnosis [10-17]. Nineteen patients had at least one risk factor (mostly family history), 11 children presented symptoms leading to diagnosis (mainly cervical mass) and 4 patients had previous thyroid pathology (hypothyroidism and goiter). Regarding staging, 18 tumors were classified as T1, eight T2, eight T3, and one T4. Ten patients presented lymph node involvement. Seven patients underwent surgical conservative treatment (hemithyroidectomy), and 28 patients were submitted to total thyroidectomy, complemented by lymph node dissection in 7 cases. After surgery, 12 patients remained in surveillance, all of them classified as ATA low risk, and 23 underwent radioactive iodine therapy (RAI). The majority received only 1 treatment [1-5] and mean activity administered per cycle was 3.5 GBq [1.8 - 6.1]. Eight patients reported mild symptoms after RAI, most commonly nausea, effectively managed with antiemetics. Four patients (20%) in the RAI group were upstaged, due to pulmonary metastasis detection at post-therapy scintigraphy. The average follow-up time for the group (n=35) was 8 years [1-14]. According to medical records, there were no medium/long-term side effects until this date. All patients remain alive, with three presenting persistent but stable disease (1 cervical, 1 pulmonary, and 1 elevated Tg without structural evidence of disease, after 2, 5, and 4 RAI cycles, respectively). ***Conclusion:*** In comparison to adults, children have higher recurrence rates and longer follow-up time. This study confirms excellent survival in pediatric PTC and reinforces RAI's role in remnant ablation, treatment, and disease upstaging in post-therapeutic scintigraphy. Metastatic pulmonary unknown disease was detected in 4 patients, 3 cured with RAI. RAI treatment was effective in the majority of patients, with no recurrence case registered to date, while maintaining a very favorable toxicity profile.

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Sunday, October 20, 2024, 15:00 - 16:30
Hall G2

Joint Symposium 2 - Oncology & Theranostics Committee / EAU - Prostate Cancer Radionuclide Therapy in the Post Vision-Era

OP-177

Systemic treatment landscape of Prostate Cancer

B. Tombal;
Cliniques Universitaires Saint-Luc, Brussels, BELGIUM.

OP-178

Oncological therapeutic options in Advanced Prostate Cancer

S. Gillessen;
EOC, Bellinzona, SWITZERLAND.

OP-179

PSMA radionuclide therapy: where do we stand?

L. Emmett;
Theranostics and Nuclear Medicine Department, St Vincent's Hospital Sydney, Sydney, AUSTRALIA.

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Sunday, October 20, 2024, 15:00 - 16:30
Hall F

e-Poster Presentations Session 3: Inflammation & Infection Committee: Best e-Posters on Infection & Inflammation

EPS-043

The diagnosis of inflammatory cardiac diseases:the role of ^{18}F-FDG PET/MRI compared to pet and MRI alone

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Aim/Introduction: PET/MRI is an emerging multimodality technique allowing the synchronous acquisition of MRI anatomical and functional data and PET metabolic activity, with excellent spatial correlation. Our aim was to evaluate the added value of integrated 18F-FDG-PET/MRI systems, compared with MRI and PET performed separately, in the diagnosis of inflammatory cardiac diseases. ***Materials and Methods:*** We retrospectively enrolled all consecutive patients who underwent 18F-FDG-PET/MRI at our department for clinical suspicion of myocarditis or endocarditis and with an inconclusive echocardiography from September 2022 to January 2024. Exclusion criteria included patients with electrical devices and valve prostheses deemed unsafe for 3Tesla MRI, claustrophobic patients, pregnant women, and patients with pre-exam glucose concentration >200 mg/dL. Before the examination, all patients must follow a carbohydrate-free fat-rich diet, which is necessary to suppress the physiological myocardial 18F-FDG

uptake. 18F-FDG-PET/MRI scans were performed with a hybrid PET/MRI tomograph enabling simultaneous acquisition of PET and 3Tesla-MRI images. Contrast-agent was injected intravenously. MRI and PET images were initially evaluated separately by the Radiologist and the Nuclear Medicine physician and then PET/MRI analysis was performed with a multidisciplinary approach. ***Results:*** Overall, 20 patients were included, 9 with suspected myocarditis and 11 with suspected endocarditis. In patients with suspected myocarditis MRI was negative in 2/9 and inconclusive in 7/9. PET was negative for active inflammation in 9/9. The review of the hybrid PET/MRI images confirmed the absence of ongoing inflammation, suggesting an old inflammatory process in the MRI imaging, reclassifying 7/9 (78%) cases. In patients with suspected endocarditis MRI was positive in 1/11 and inconclusive in 10/11. PET was positive in 4/11 although was limited to assess anatomic extent and functional information, negative in 6/11 and inconclusive in 1/11. The review of hybrid PET/MRI images was useful in 10/11 (90.9%) cases, especially to locate the uptake area (foci of active inflammation), determine their extent, and evaluate their repercussion on valvular and ventricular function. ***Conclusion:*** Synchronous acquisition of 18F-FDG-PET and MRI with hybrid PET/MRI tomograph provides added value compared to MRI and PET alone in patients with inflammatory cardiac diseases. In particular, PET confirms/excludes the presence of foci of active inflammation in cases of inconclusive MRI, and MRI provides anatomical/functional information in cases of positive/inconclusive PET.

EPS-044

A comparison of simultaneous ^{18}F-FGD PET/MRI with conventional MRI in the diagnosis and assessing treatment response in patients with spondylodiscitis

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Aim/Introduction: The aim was to evaluate the additive diagnostic value of ^{18}F-FDG PET/MRI compared to MRI of the spine in diagnosing spondylodiscitis and its complications, as well as early and late assessment of response to antibiotic therapy. ***Materials and Methods:*** In this prospective single-center study, 13 (thirteen) patients admitted to Rigshospitalet, Copenhagen with culture verified and/or imaging suspected spondylodiscitis were included between February 2019 and January 2024. Routinely, patients with clinical suspect spinal infection underwent a contrast enhanced MRI of the entire spinal column around the time of admission to verify the diagnosis. In this study, all patients additionally underwent concomitant ^{18}F-FDG PET/MRI scheduled for three time points: at the earliest possible time point after admission (baseline), after approx. 2 weeks of intravenous antibiotic therapy (early follow up) and late follow up at 4-6 months after termination of antibiotics. Board certified specialists reported the stand-alone MRI and concomitant PET/MRI independently while blinded to other scan results. ***Results:*** All 13 patients underwent a baseline scan. 9 patients underwent the baseline and early follow up scan and 6 patients were investigated at all three time points. On the baseline scan spinal infection with or without complications was shown in 11 patients on PET/MRI and in 10 cases on MRI. Discrepancy between the modalities was reported in 2 cases which influenced clinical management: in one patient spondylodiscitis was not diagnosed on MRI due to metal artefacts from aorta stent and in the second case the result was equivocal on MRI due to sacrum fracture and surrounding edema where spondylodiscitis was excluded on PET/MRI. In further 5 cases spondylodiscitis was diagnosed on both modalities but minor additional changes were shown on PET/MRI in 4 cases and in one case on MR. These did not influence treatment regime. On both the early and late follow-up time points, additional PET was helpful in two cases showing metabolic response in the morphological unchanged areas on MRI. Concomitant infection was not found on PET/MRI in any case. ***Conclusion:*** PET/MRI may be helpful in equivocal or selected cases in diagnosing spondylodiscitis and assessing treatment response, but this modality has not yet been recommended in daily clinical practice. Further investigation to demonstrate a clear benefit is needed. ***References:*** PET/MR Imaging in Musculoskeletal Precision Imaging - Third wave after X-Ray andMR. Hancin EC et al. PET Clin. 2020 Oct;15(4):521-534.

EPS-045

Early experience with hybrid $^{[18F]}$-FDG PET/MRI for identification of musculoskeletal pain generators

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Aim/Introduction: Chronic pain is the most common reason for patients to seek medical care. However, up to 79% of patients believe their pain is inadequately treated. This treatment failure is partly due to our inability to accurately identify pain generators with conventional anatomical imaging. Hybrid imaging with ^{18}F-FDG PET/MRI visualizes both structural changes and tissue metabolism, which is potentially more sensitive for identifying inflammation in the context of pain. This study describes our early experience with $^{[18]}$F-FDG PET/MRI in two patient groups often presenting with musculoskeletal pain of unknown origin: chronic low back pain (LBP) or persistent pain after total hip replacement (THR). ***Materials and Methods:*** Patients aged 18-75 years with chronic LBP or hip pain after THR with unknown origin were referred by their physician. Study participants were randomized in either the control arm comprising of standard clinical care or the intervention arm consisting of $^{[18]}$F-FDG PET/MRI. Potential pain generators were identified by increased FDG uptake on PET and/or structural abnormalities on MRI. Findings were discussed with the referring physicians and changes in clinical management and patient outcomes were recorded. ***Results:*** 27 patients were included, 15 LBP and 12 with pain after THR. Thirteen patients were randomized to the PET/MRI group. PET-MRI provided new diagnostic insights in 12 patients (86%), which led to multiple changes in clinical management including targeted treatment and subsequent symptom relief in a subset of patients. Low Back Pain Increased FDG uptake (SUVmax 1.0-3.6) corresponding with the pain location was seen in 5 patients (83%), leading to targeted treatment in four patients. In the control group, none of the patients underwent additional diagnostic imaging and only three patients (33%) underwent nerve root injection. Pain after Total Hip Replacement Abnormal FDG uptake (SUVmax 1.0-6.4) corresponding with the pain location was seen in all 7 THR patients (100%). Additional diagnostic imaging or procedures were performed in 6 patients, and THR revision in two patients. Two control group patients (40%) underwent additional diagnostic imaging not leading to new insights. One participant underwent THR revision. ***Conclusion:*** In our early experience, $^{[18]}$F-FDG PET/MRI can reveal previously unidentified pain generators in patients with chronic LBP or persistent pain after THR, leading

to changes in clinical management including targeted treatment with favorable outcome in a subset of patients. Future evaluation in a larger cohort will further determine the added value of [18] F-FDG PET/MRI in terms of patient outcomes.

EPS-046

Aortitis as Predictor of Aortic Dilatation in Giant Cell Arteritis

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Aim/Introduction: Aortic dilation has been reported both in the early and late course of GCA, and patients with GCA who develop aortic dilation have an increased mortality. This retrospective study aimed to assess aortic inflammation and identify predictors of aortic dilatation in a longitudinally monitored cohort of patients with newly diagnosed GCA. ***Materials and Methods:*** This was a retrospective study on prospectively collected data of consecutive patients diagnosed with GCA in two European centers (Reggio Emilia/Italy and Wurzburg/Germany). Patients with a new diagnosis of GCA confirmed by temporal artery biopsy or imaging, who underwent PET/CT or MRI or CT at diagnosis and after at least 6 months of follow-up were included. Aortitis was determined by increased FDG uptake (visual score ≥ 2) on PET/CT or wall thickening on CT or MRI. Aortic dilation was defined by specific diameter thresholds. ***Results:*** A total of 157 patients were included. At diagnosis, 43 (27.4%) patients underwent aortic MRI, and 114 (72.6%) PET/CT. Aortitis was present in 92 (58.6%) patients, and aortic dilation in 31 (19.7%). Aortitis was present in 70.3% of PET/CT and 32.6% of MRI, p<0.0001, and aortic dilation in 22.7% and 14% respectively, p=0.420. At univariate logistic regression analysis, significant predictors of baseline aortic dilation were male sex [OR 5.37 (95% CI 2.33 to 12.40)], fever [OR 2.02 (95% CI 0.90 to 4.55)], hypercholesterolemia [OR 0.35 (95% CI 0.13 to 0.90)], and aortitis [OR 2.56 (95% CI 1.02 to 6.42)]. At multivariate analysis, predictors of aortic dilation were aortitis [OR 3.65 (95% CI 1.25 to 10.71)] and male sex [OR 8.33 (95% CI 3.13 to 22.18)]. There was a significant increase in aortic diameters between the first and last imaging [mean change (95% CI) 1.1 (0.6 to 1.6) mm at the ascending aorta, p<0.0001; 0.9 (0.6 to 1.2) mm at the aortic arch, p<0.0001; 0.9 (0.4 to 1.4) mm at the descending aorta, p<0.0001; 0.2 (-0,003 to 0.4) mm at the suprarenal aorta, p=0.099]. At follow-up imaging, 12 (9.8%) patients developed a new aortic aneurysm. Cox proportional hazards regression analysis did not show a significantly higher risk for incident aortic aneurysms in patients with baseline aortitis (sex- and age-adjusted HR 1.65 (95% CI 0.59 to 5.62). ***Conclusion:*** Aortitis and aortic dilation were common findings in patients with newly diagnosed GCA, and baseline aortitis was associated with higher aortic diameters.

EPS-047

[18F]FDG-PET/CT in Giant Cell Arteritis. Which vascular segmental quantitative parameter is most useful?

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Aim/Introduction: To analyze the diagnostic performance of several quantification methods of [^{18}F]FDG-PET/CT in the assessment of vasculitis secondary to giant cell arteritis (GCA) in different vascular segments, as well as to determine the most frequently affected segment. ***Materials and Methods:*** Retrospective study of 48 patients with GCA (according to ACR/EULAR 2022 criteria), who had a [^{18}F]FDG-PET/CT. Visual assessment (concentric and homogeneous hypermetabolism in the vascular wall was considered positive) and quantitative evaluation of SUVmax and its normalization to target-to-background ratio (TBR) of liver (TBR-H) and superior vena cava blood pool (TBR-SVC) in 10 vascular segments were performed: aortic root (AR), ascending aorta (AscA), aortic arch (AA), thoracic descending aorta (TDA), suprarenal aorta (SRA), infrarenal aorta (IRA), common iliac arteries (right: RCIA and left: LCIA), and common carotids arteries (right: RCCA and left: LCCA). The area under the curve (AUC), cut-off point, sensitivity (Sen), and specificity (Spe) of the 10 quantified vascular segments were calculated using ROC curves. ***Results:*** 28 patients (58%) had a positive study by visual assessment. The frequency of affected segments was: AA 25, TDA 24, AscA 23, SRA 21, AR 20, IRA 18, RCCA and RCIA 12, and LCCA and LCIA 10. In 7/10 segments, TBR-H was the parameter with the highest AUC, with AR being the segment with the highest diagnostic accuracy (AUC: 0.914, cut-off: 0.96, Sen: 80%, and Spe: 96%). TBR-SVCn was superior in IRA and RCIA. SUVmax was the parameter with the lowest AUC in 9/10 segments. The mean and cut-off range for SUVmax, TBR-H, and TBR-SVC were 2.93 (2.52-3.44), 0.91 (0.85-0.96), and 1.48 (1.31-1.65), respectively. ***Conclusion:*** Quantification of [^{18}F]FDG-PET/CT using TBR-H showed a higher diagnostic performance than using TBR-SVC or SUVmax, consequently, it could be used as a supportive tool for the visual assessment of vasculitis secondary to GCA. The aortic arch was the most frequently affected segment.

EPS-048

Clinical usefulness and diagnostic performance of ^{18}F-FDG PET/CT in IgG4-related disease

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Aim/Introduction: IgG4-related disease (IgG4-RD) is characterized by plasma cell infiltration, tissue fibrosis, and elevation of serum IgG4 that can affect practically all organs, showing frequently non-specific symptoms that makes its diagnosis difficult. Our objective was to evaluate the clinical usefulness and diagnostic performance of ^{18}F-FDG PET/CT (PET/CT) in the detection of inflammatory activity in patients with suspicion or diagnosis of IgG4-RD. ***Materials and Methods:*** This retrospective study included 31 consecutive patients (25 women, age: 55±14, 25-87 years) with clinical suspicion (27 patients) or known IgG4-RD (4 patients) referred for ^{18}F-FDG PET/CT for diagnosis or assessment of inflammatory activity. A visual analysis of images was performed. Findings were considered positive when there were areas of hypermetabolism suggesting inflammatory process. The definitive diagnosis was established by histological analysis (16

patients) and/or clinical/biochemical criteria (15 patients). ***Results:*** PET/CT was positive in 17/31 patients (54.8%). The final diagnosis was IgG4-RD (true positive result) in 12/17 patients (70.6%), 6 with histological confirmation. A multi-organ involvement was observed in 7 of them, being the organs more frequently involved the thoracic aorta (8 patients), the lymphatic nodes (4) and the salivary/lacrimal glands (3). Other affected organs were the orbit, thyroid, pancreas, lung, and pleura. In 1 of these patients a metastatic lymph node involvement for a previous cervical cancer was also detected. In 5/17 patients with a positive PET/CT (29.4%) the final diagnosis was a non IgG4-RD condition (false positive): pancreatitis, pancreatitis plus lung cancer, interstitial pneumonia, panniculitis, and cutaneous B-cell lymphoma (4 with histological confirmation). PET/CT was negative in 14/31 patients (45.2%). The result was true negative in 13 (being the final diagnosis other benign conditions in 9, lymphoma in 1, and ovarian carcinoma metastasis in 1) and false negative in 1 (IgG4-RD confirmed by bronchial biopsy). The accuracy, sensitivity, specificity, positive and negative predictive value were 80.7%, 92.3%, 72.2%, 70.6% and 92.9%, respectively. In 8 patients a follow-up PET/CT was performed. In 4 patients with clinical/biochemical worsening PET/CT showed increased inflammatory activity, and in 4 patients with good clinical response PET/CT confirmed a decrease in inflammatory activity. ***Conclusion:*** ^{18}F-FDG PET/CT showed a good accuracy to confirm or exclude the presence of IgG4-RD, helping in the differential diagnosis with other pathologies with similar clinical course, with a high negative predictive value. PET/CT was also very useful as a guide for biopsy, and for the evaluation of the extend of the disease and treatment response.

EPS-049

Dynamic Whole-Body FDG PET for Evaluation of Vasculitis and Polymyalgia Rheumatica

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Aim/Introduction: Vasculitis and polymyalgia rheumatica (PMR) are autoimmune diseases which frequently overlap within rheumatic inflammatory conditions. Static FDG-PET has been demonstrated to be an accurate imaging method in the diagnostic workup (DOI: 10.2967/jnumed.122.265016). This study investigated the value of a dynamic whole-body acquisition of F^{18}-Fluorodeoxyglucose-positron-emission-tomography (PET) in comparison to state-of-the-art static PET parameters. ***Materials and Methods:*** Following Institutional Ethics Committee approval and informed consent, a total of 39 patients with suspected vasculitis or PMR were prospectively enrolled in this single-center study. Dynamic whole-body PET images were obtained with a conventional PET scanner using a multi-bed multi-pass dynamic whole-body acquisition approach (dPET). Patients underwent imaging prior to start of treatment. Activity was injected on the scanner bed, and a single bed over the heart was acquired simultaneously (10 minutes), followed by 11 whole-body dynamic frames (46 minutes, 5 beds, 50 seconds/bed), followed by a static acquisition at 60 minutes postinjection (1.5 minutes/bed). Reconstructed images, together with an aortic input function (IF), were used to generate MR-FDG images based on traditional Patlak (11 frames, full IF). MR-FDG image data sets of dynamic acquisition and SUV image data sets of static acquisition were reviewed. In case of pathologic FDG uptake, VOIs were placed in vessel walls and joints for quantitation. The target-to-background ratio (TBR) was defined as the ratio of measured uptake in VOIs of pathologic vessel walls or joints (maximum values), to VOIs in blood pool (in vasculitis), or to VOIs in physiologic muscles (in PMR) (mean values). ***Results:*** 16 patients showed pathologic FDG uptake, 11 patients were diagnosed with vasculitis, and 11 patients with polymyalgia rheumatica (six patients both diagnosis). TBR of dPET in vasculitis (MR-FDG_max_vessel_wall / MR-FDG_mean_blood_pool) was 44.4 (range 3.4-127), and TBR of static PET (SUVmax_vessel_wall / SUVmean_blood_pool) was 2.1 (range 1.2-3.1). TBR of dPET in PMR (MR-FDG_max_joint / MR-FDG_mean_muscle) was 10.2 (range 4.1-23.8), and TBR of static PET (SUVmax_joint / SUVmean_muscle) was 6.6 (range 2.1-14.7). The difference of TBR of dPET and static PET was significant in both diseases (TBR dPET vs. TBR static PET p=0.005, and p=0.005 respectively). ***Conclusion:*** The detectability of vasculitis and of PMR was significantly better in the dPET images. Patlak graphical analysis allows separating metabolized FDG from unmetabolized tracer in the blood pool and tissue. Dynamic PET may thus have the potential to increase sensitivity in detection of vasculitis and PMR. ***References:*** Role_of_^{18}F-FDG_PET/CT_in_Large_Vessel_Vasculitis_and_Polymyalgia_Rheumatica, JNM 2023 (DOI: 10.2967/jnumed.122.265016).

EPS-050

Diagnostic performance of digital [18F]FDG PET-CT in patients with suspected vasculitis. Experience in a tertiary center.

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Aim/Introduction: To assess the diagnostic performance of digital tomography [18F]FDG PET-CT in patients with suspected first episode of vasculitis. ***Materials and Methods:*** We retrospectively enrolled 41 patients with clinical and/ or radiological suspected vasculitis who underwent [18F]FDG-PET-CT at our department from February 2022 to January 2023 (17 men, 24 women; median age: 74 years; 15 with previous diagnosis of polymyalgia rheumatica [PMR]). Patients previously diagnosed of vasculitis were excluded. To interpretate PET findings, we used the Meller visual score as recommended by EANM guidelines in the assessment of vasculitis, considering a Meller score 2 and 3 as PET positive. Final diagnosis for large vessel vasculitis (LVV) was established using the 2022 ACR/EULAR Vasculitis Classification Criteria, and clinical-analytical and imaging criteria for other types of vasculitis. The minimum time of follow-up was 1 year, in which we collected clinical-analytical and imaging information to verify evolution. ***Results:*** 12 of the 41 patients had a positive [18F]FDG PET-CT, 9 (75%) of which were finally considered vasculitis: 5 as LVV, 2 as solitary infectious aortitis and 2 isolated temporal arteritis. 3/12 did not obtain a final diagnosis. All 12 patients were treated with corticosteroids, showing clinical improvement, except one of the solitary infectious aortitis. Of the 29 patients with negative [18F] FDG PET-CT, only 3 (10%) met ACR/EULAR vasculitis criteria and were diagnosed and treated as LVV with improvement. Of the remaining 26, the majority were also treated with corticosteroids without significant clinical improvement. 17 of the 41 patients in this study had radiological imaging (CT with contrast and/or temporal ultrasound) with findings compatible with vasculitis. 10/17 (59%) did not present pathological uptake in [18F]FDG PET-CT and none were considered as vasculitis. Of the 15 patients with a previous diagnosis of PMR or with symptoms of arthralgia,

93% presented a PMR pattern on [18F]FDG PET-CT. ***Conclusion:*** [18F] FDG PET-CT is useful in the diagnosis of vasculitis as well as in the assessment of associated PMR. Negative [18F]FDG PET-CT makes the presence of vasculitis highly unlikely. [18F]FDG PET-CT appears superior to radiological imaging for the detection of vasculitis.

EPS-051

Role and diagnostic performance of [18F]FDG PET/CT in patients with suspected ventricular assist device infection.Experience in a dedicated cardiac PET/CT center

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Aim/Introduction: The implantation of ventricular assist devices (VAD) has increased exponentially over time as a bridge or destination therapy. One of the most common complications is infections of the VAD. The aim of this work is to assess the role and diagnostic performance of PET/CT with [18F]FDG in patients carrying VAD with suspected underlying infectious processes. ***Materials and Methods:*** Retrospective study of 11 patients (p) carrying VAD assessed by PET/CT with [18F]FDG with suspected infection between July 2018 and March 2024. Demographic variables, baseline pathology, VAD purpose and PET/CT findings were analyzed. Diagnostic yield values were calculated between concordance of PET/CT diagnosis and definitive diagnosis agreed by consensus in the scientific committee. ***Results:*** 11p with a total of 20 scans were analyzed, 6 men, 4 women and 1 transgender woman. Mean age 60 years [31-77], 3p with dilated cardiomyopathy and 8p ischemic. 5p were VAD carriers as destination therapy and 6p as bridge therapy. In 12/20 PET/CT scans the findings were suggestive of infection (10 in the extrathoracic tract, 1 in the ventricular device and 1 in the intra/extrathoracic tract), with a definitive diagnosis of infection. In 1/20 PET/CT scan the findings were not conclusive of infection, nevertheless a diagnosis of probable infection was decided in committee. 7/20 PET/CT scans were not suggestive of infection and infectious involvement of the VAD was ruled out; these patients had respiratory, skin and bone infections. The sensitivity of the [18F]FDG-PET/CT was 92% [78-100], specificity and PPV was 100%, NPV 88% [65-100]. The median SUVmax of patients with extrathoracic infection (cutaneous entry and subcutaneous tract) was 2.8 g/ml vs. 1.83 g/ml in relation to the rest of patients without infection. The SUVmax in intrathoracic infections was 4.33 g/ml vs. 3.6 g/ml in the rest of the patients without infection. ***Conclusion:*** The [18F]FDG PET/CT is a useful noninvasive method for detecting VAD-related infection or raising other differential diagnoses. The [18F]FDG PET/CT has an optimal diagnostic performance for diagnosing VAD infection, with a therapeutic benefit for patients and has an important role in clinical and therapeutic decision making in complex patients.

EPS-052

New post-INVEAT era: contribution of ^{18}F-FDG PET/CT in the study of infective endocarditis. Our experience.

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Aim/Introduction: The Next Generation EU funds, channeled in Spain through the INVEAT plan (spanish acronym for "investment in high technology") have allowed the renewal and/or expansion of diagnostic equipment in many hospitals. In the study of infective endocarditis (IE) [18F] FDG-PET/CT has recently been included within the major diagnostic criteria defined by the European Society of Cardiology (SEC). Our objective is to describe the experience obtained in this field after the recent acquisition of a digital PET/CT. ***Materials and Methods:*** All patients referred to our Service for suspected IE between July 2023 and March 2024 for whole body [18F] FDG-PET/CT, with specific protocol for myocardial FDG suppression. Among the variables included were age, sex, qualitative and quantitative assessment of the test, incidental findings and discordances with the ultrasound study. Finally, the diagnostic validity was analyzed considering the final diagnostic decision agreed upon by the multidisciplinary endocarditis committee as the Gold Standard. ***Results:*** Twenty-nine patients were included, 12 women (41.4%) and 17 men (58.6%), mean age 72.06 (35-89). Regarding clinical suspicion of IE, 13 were on native valves, 9 prosthetic and 7 on implantable medical devices. The test was considered negative in 17 patients, positive in 9, discarding 3 due to inadequate myocardial suppression. Of the studies with positive results, FDG distribution was focal in 44.4%, heterogeneous in 55.6%, mean SULmax value of 3.79 (2.98-4.51). The most frequent microorganism isolated in blood cultures was S. Aureus (3), followed by S. Gallolyticus-Pasteurianus (2). In addition to the cardiac evaluation, the test showed embolisms or septic processes in 5 patients: liver (1), lung (1), spleen (1), spondylodiscitis (2). The validity of the study compared with the defined Gold Standard showed values of S 100%, E 94%, PPV 89% and NPV 100%. Regarding the ultrasound study, the [18F] FDG-PET/CT was able to clarify the diagnosis in three equivocal cases and modify it in seven, four with positive ultrasound and three negative for IE. In addition to the objective of the study, a patient was identified with an intestinal hypermetabolic lesion compatible with colorectal neoplasia, subsequently confirmed by colonoscopy. ***Conclusion:*** Our preliminary results with [18F] FDG-PET/CT, possible thanks to the INVEAT plan, corroborate the important role of this diagnostic technique in the study of IE, acknowledged by recent guideline updates. ***References:*** Delgado V et al. ESC Guidelines for the management of endocarditis 2023;44(39):3948-4042. https://doi.org/10.1093/eurheartj/ehad19.

EPS-053

Assessing the prognostic potential of ^{18}F-FDG PET/CT in acute spinal cord: a pilot investigation.

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Aim/Introduction: Utilizing magnetic resonance imaging (MRI) as the gold standard for evaluating soft tissue injuries, particularly spinal cord lesions, is a conventional approach. However, patients experiencing acute traumatic spinal injuries often require stabilization through surgical intervention involving

the placement of paramagnetic metallic implants. Unfortunately, these implants introduce artifacts that significantly compromise MRI image quality, impeding accurate prognostic assessment. Hence, we sought alternative methods for evaluating spinal cord damage. Our aim was to establish a correlation between glucose metabolism and the functional neurology of patients with spinal cord trauma. While similar studies have been conducted on animal models, particularly rats, demonstrating promising outcomes, we aimed to ascertain if glucose metabolism rates at the lesion site and adjacent areas correlate with neurological function in human subjects. This endeavor holds potential for facilitating comparative analyses of therapeutic strategies and interventions. ***Materials and Methods:*** Our cohort study comprised patients with acute trauma-induced spinal cord injuries, manifesting motor or sensory deficits, who underwent surgical intervention at our institution. We assessed their neurological status using the ASIA Impairment Scale shortly postoperatively, typically within 3-5 days. Subsequently, we performed FDG-PET scans to evaluate glucose metabolism rates at the injury site, as well as cranially and caudally. Follow-up examinations, including repeat FDG-PET scans, were scheduled six months post-surgery. Data analysis focused on correlating glucose metabolism with functional neurology. ***Results:*** Initially intended for ten patients, our pilot study encountered challenges in follow-up due to patient limitations. Consequently, we revised our primary objective to assess the correlation between FDG PET-CT findings and baseline functional neurology. Nine acutely injured patients were included, exhibiting varying degrees of neurological impairment. Our interim analysis revealed a significant correlation between mean standardized uptake value (SUV) and neurological impairment. Follow-up assessments of three patients at six months post-surgery demonstrated improved neurological function, corroborated by changes in SUV. ***Conclusion:*** This study represents the first endeavor to establish a correlation between FDG PET-CT findings and functional neurology in acute spinal cord injury patients. Our preliminary findings support the utility of FDG PET-CT as a predictive tool for assessing functional neurology shortly postoperatively. Ongoing data collection and analysis, particularly at the six-month follow-up, will further validate our results. Future investigations should explore the efficacy of different rehabilitation strategies to optimize patient outcome.

EPS-054

Detectability of spinal inflammatory lesions in [18F]FDG PET images of patients with chronic pain - pilot study with synthetic lesions

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Aim/Introduction: [18F]FDG PET is a sensitive method to detect metabolically hyperactive lesions in spinal nervous tissues, joints, or bony structures as potential cause of back pain. However, these spinal inflammatory lesions can be difficult to detect given the low level of increased uptake compared to the physiological uptake in the adjacent bone marrow. Automated lesion detection tools could improve assessment by pinpointing potential lesions that show statistically significant increased uptake compared to normal background activity. This study aims to establish a detectability threshold of synthetically inserted lesions in [18F] FDG PET through statistical methods that can inform our future automated lesion detection tool. ***Materials and Methods:*** Three [18F]FDG PET/MRI images without apparent pathological spinal uptake were retrospectively selected through expert consensus. Regions of interest (ROIs) for synthetic lesions were manually drawn in the lumbar spinal canal and a lumbar nerve root, with corresponding ROIs at a subsequent spinal level and the contralateral nerve root as internal reference. Synthetic lesion sinograms were simulated with a range of uniform activity levels (250, 500, 750, 1000, 1250, 1500 Bq/mL), taking into account scanner characteristics, scatter, and attenuation.1 The synthetic sinograms were added to the original sinogram, and PET images were reconstructed from the combined sinograms with EARL2 reconstruction parameters. Standardized Uptake Values (SUV) were calculated and maximum values (SUVmax) were extracted from the ROIs. Differences in SUV distribution between the inserted lesions and the lesion-free image, as well as the internal reference, were tested using one-sided Kolmogorov-Smirnov tests. ***Results:*** SUVmax on lesion-free images ranged from 0.70 to 1.40 in the spinal canal and 1.17 to 1.55 in the nerve root. For the synthetic spinal canal lesions, SUV distribution was significantly different from the lesion-free image in all patients when lesion activity was >500 Bq/mL, corresponding to a mean SUVmax increase of 0.16. For the nerve root the minimum detectable lesion activity was 1000 Bq/mL (mean SUVmax 0.31). Comparison to the internal reference showed statistical differences across all patients for lesions >1000 Bq/mL in the spinal canal and >1500 Bq/mL in nerve roots, corresponding to mean SUVmax increases of 0.47 and 0.51 respectively. ***Conclusion:*** Small increases in [18F] FDG uptake in spinal canal and nerve root lesions are detectable when compared to an internal reference, provided the exact lesion location is known. Future work should include a larger cohort and assess other lesion characteristics and their variability. ***References:*** 1. Wangerin et al. (2017). J Med Imaging.

EPS-055

Usefulness of ^{18}FDG-PET/CT in the management of febrile neutropenia: a retrospective cohort from a tertiaryuniversity

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Aim/Introduction: Febrile neutropenia (FN) is a complication of hematologic malignancy therapy. Early diagnosis would allow optimization of antimicrobials. 18F-FDG-PET-CT may aid in the diagnosis of invasive infections, identify occult infection sites, and help evaluate response to treatment. However, evidence regarding this topic is scarce. ***Materials and Methods:*** We retrospectively analyzed the patients with hematologic malignancies and FN, who underwent 18F-FDG-PET-CT in our university hospital, and compared the results with those obtained from conventional imaging. ***Results:*** 24 patients with FN underwent 18F-FDG-PET-CT, 92% of which also had also been subjected to conventional CT imaging. In 5/24 episodes (21%), the fever was of infectious etiology, either bacterial (2), fungical (2) or parasitic (1). When compared to conventional imaging, 18F-FDG-PET-CT had an added value in 20 cases (83%): it diagnosed a new site of infection in 4 patients (17%), excluded infection in 16 (67%), and helped modify antimicrobials in 16 (67%). Antimicrobials were discontinued in 10 (41.6%). ***Conclusion:*** Available data suggests that ^{18}F-FDG-PET-CT is useful in the management of FN, especially in the diagnosis of unknown infectious foci and in the adjustment of antimicrobial treatment.

EPS-056

Hypermetabolism of Axillary Lymph Nodes Following COVID-19 Vaccination: A Longitudinal Follow-up and Comparison of Vaccines Utilizing Different Technologies

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Aim/Introduction: In the wake of the COVID-19 pandemic, various vaccine technologies such as virus vectors, mRNA, and spike proteins were developed and deployed globally. An increase in hypermetabolism of axillary lymph nodes (HLN) was observed in 18Ffluorodeoxyglucose (FDG) positron emission tomography (PET)/computed tomography (CT), typically used to detect tumors or metastases. This study aims to compare the characteristics of HLN associated with different vaccine technologies. ***Materials and Methods:*** This retrospective single-center study enrolled adult patients (aged ≥18) who had received a COVID-19 vaccination prior to undergoing FDG PET/CT scans between July 2021 and February 2024. A total of 668 patients vaccinated with ChAdOx1 nCoV-19, mRNA-1273, or MVC-COV1901 were included in the analysis. Clinical data, including age, gender, vaccination date, dosage, vaccine type, vaccination site, and the time elapsed between the latest vaccination and the FDG PET/CT scan, were reviewed through April 2024. Metabolic avidity was quantified using SUVmax on FDG PET/CT scans, with values exceeding 1.5 times those of the contralateral axillary node or deltoid muscle considered significant. Statistical analysis involved independent t-tests, Kaplan-Meier analysis, and Spearman's rank correlation coefficient to examine characteristics across different vaccine technologies. ***Results:*** The incidence of HLN was significantly higher in the mRNA vaccine group (26.7%) compared to the virus vector group (19.0%, p=0.03) and was significantly greater in the virus vector group compared to the spike protein vaccine group (19.0% vs. 3.8%, p<0.01). There were no significant differences in the incidence of active deltoid muscle, SUVmax of active axillary lymph nodes, or SUVmax of active deltoid muscle across the three groups. A negative correlation was found between SUVmax and the time interval from vaccination to FDG PET/CT scan (Spearman's coefficient: -0.25, p<0.01). ***Conclusion:*** mRNA vaccines showed the highest incidence of HLN hypermetabolism, followed by virus vector vaccines, while spike protein vaccines had the lowest incidence. There was a notable negative correlation between metabolic avidity and the time elapsed since vaccination, suggesting a decrease in metabolic response over time.

EPS-057

Increased Splenic Accumulation after COVID-19 Vaccination: Is It Specific to mRNA Vaccination or the Reflection of Systemic Inflammation?

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Aim/Introduction: It is important to discuss the safety of mRNA vaccines, which have rapidly spread worldwide as a countermeasure against the COVID-19 pandemic, as relatively strong adverse reactions have been reported compared with conventional vaccines. On FDG-PET/CT imaging, axillary lymph node accumulation has been studied as a local response, while systemic changes have occasionally been reported. This study aimed to investigate a group that developed splenic accumulation after COVID-19 vaccination and to characterize its significance by examining differences from the others. ***Materials and Methods:*** Inclusion criteria were those who underwent FDG-PET/CT between 02/2021 and 11/2022 and whose COVID-19 vaccination history, including information on the month of vaccination, was verifiable. Exclusion criteria were those with definite tumor involvement on axillary nodes. They were divided into three groups: within 1 month, 1-2 months, and >2 months of vaccination, and the frequency of increased splenic accumulation was investigated in each group, excluding the cases with splenic tumor involvement. Location, size, number, and visual scores (following the Deauville five-point scale), and SUVmax of lymph nodes with FDG accumulation were compared between those with and without splenic accumulation. ***Results:*** The vaccination history was confirmed in 1115 patients, and after excluding 59 patients with axillary involvement, the study population consisted of 1056 patients (F:M = 466:590, mean age: 71±11). Reactive splenic uptake was observed in 9 of 451 patients within 1 month of vaccination, while 2 of 280 were present at 1-2 months and none of 325 at >2 months. In contrast, five patients within 1 month of vaccination showed splenic involvement, one at 1-2 months, and four at >2 months, and they were excluded. In the group within 1 month of vaccination, the proportion of lymph node accumulation between the 9 patients with reactive splenic uptake and the remaining 437 patients was 100%:41% in axillary, 67%:23% in subpectoral, 56%:11% in subclavian, and 22%:3% in supraclavicular nodes. The mean node diameter was 5.7±1.7mm:3.4±1.6mm. The percentage of cases with ≥6 lymph node accumulation was 56%:9%. The percentage of cases with visual score≥4 was 56%:12%. All were significantly higher in the splenic uptake group. The mean SUVmax of measurable axillary nodes was 4.5±3.3: 2.5±1.5. One patient with splenic uptake at 1-2 months of vaccination had large vessel vasculitis. ***Conclusion:*** Splenic accumulation after vaccination correlated with the findings in regional nodes, suggesting that it may reflect systemic inflammation rather than being specific to COVID-19 vaccination.

EPS-058

To assess the clinical utility of Gallium68 Citrate PET imaging modality in comparison to other imaging studies for routine management of spinal TB

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Aim/Introduction: Aim: To study clinical utility of Gallium68 Citrate PET imaging modality in response assessment of spinal TB. ***Materials and Methods:*** Patients with proven spine TB based on history, physical examination, laboratory results, radiological evidence of infection and identification of pathogens at site of infection were recruited for study after an informed consent. Patients underwent 68Ga citrate PETCT and scans were interpreted visually by two independent Nuclear Medicine Physicians. Uptake on scan was correlated clinically and were followed up with a second scan after treatment with ATT/debridement for response assessment. ***Results:*** Thirty-five patients with TB spine had baseline Ga68 citrate PET-CT. • 25 showed avid spinal lesions and corresponding CT showed features of infective spondylodiscitis. • Ten showed non-avid spine lesions with corresponding CT images showing infective spondylodiscitis. 4/10 showed avid extra-osseous lesions: Two showed avid lung nodules with mediastinal nodes Two showed foci of muscle uptake (iliacus and

psoas). 15/35 had follow up Ga68 citrate PET CT imaging after 9-12 months of ATT. • Negative on baseline (6/15): All were negative on follow up imaging • Positive on baseline (9/15) Avid spine lesions (7): Six showed good clinical response and resolution of uptake on follow up imaging. One regression of uptake of spine lesion in follow up compared to the baseline study with good clinical response. Avid extra-osseous lesions (2): Two with avid lung and muscle lesions on baseline showed resolution of uptake on follow up imaging. ***Conclusion:*** On follow up, absence of uptake in those with baseline avid lesions correlated well with good clinical improvement at end of ATT treatment. Hence Ga-68 citrate PET CT may be a robust marker of therapeutic response and can be used as a guide for clinicians in deciding the cessation/ continuation of ATT in dubious cases ***References:*** 1. Nanni C, Errani C, Boriani L et al, 68Ga-citrate PET/CT for evaluating patients with infections of the bone: preliminary results, J Nucl Med. 2010 Dec;51(12):1932-6 2. Roivainen A, Jalkanen S, Nanni C. Gallium-labelled peptides for imaging of inflammation. Eur J Nucl Med Mol Imaging. 2012 Feb 1;39(1):68-778 3. Vorster M, Maes A, Jacobs A et al, Evaluating the possible role of 68Ga-citrate PET/CT in the characterization of indeterminate lung lesions, Ann Nucl Med 2014 Jul;28(6):523-30. 4. Vorster M, Maes A, Van De Wiele C et al, 68Ga-citrate PET/CT in tuberculosis: a pilot study, Q J Nucl Med Mol Imaging. 2019 Mar;63(1):48-55.

EPS-059

[^{99m}Tc]Tc-HMPAO-labeled autologous leukocyte scintigraphy in Ukrainian patients injured on the war front

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Aim/Introduction: Despite the limited sample size, [99mTc]Tc-HMPAO-labeled autologous leukocyte scintigraphy proves to be valuable in guiding therapeutic decisions for extremity infections in Ukrainian patients evacuated from the war front. ***Materials and Methods:*** A retrospective analysis was conducted on requests for collaboration to perform [99mTc]Tc-HMPAO-labeled autologous leukocyte scintigraphy in Ukrainian patients treated at the HGDZ for traumatic or prosthetic wound infections in the extremities. Subsequently, the results of [99mTc]Tc-HMPAO-labeled autologous leukocyte scintigraphy were compared with microbiological cultures, and their impact on therapeutic decision-making was evaluated. ***Results:*** Between February 2022, the onset of the Russian invasion of Ukraine, and February 2024, 94 Ukrainian patients were evacuated to the HGDZ for treatment of war-related wounds, presenting potential infections. Eight [99mTc]Tc-HMPAO-labeled autologous leukocyte scintigraphies were performed in patients with clinical suspicion of active infection, aiming to confirm or exclude infection before therapeutic surgical intervention or to optimize antibiotic therapy duration. All scintigraphies (100%) showed findings consistent with an active infectious process. Subsequent cultures were performed in all cases, yielding true positive results in seven cases (87.5%). Identified pathogens included Klebsiella pneumoniae, Klebsiella pneumoniae ESBL, Pseudomonas aeruginosa, extensively drug-resistant (XDR) methicillin-resistant Staphylococcus aureus, Finegoldia, or Serratia marcescens. The scintigraphic findings influenced therapeutic management in 7 out of 8 cases (87.5%), confirming the presence of active infection, with one false positive result observed. ***Conclusion:*** Despite the limited sample size, [99mTc]Tc-HMPAO-labeled autologous leukocytescintigraphy proves to be valuable in guiding therapeutic decisions for extremity infections in Ukrainian patients evacuated from the war front.

EPS-060

Intra and inter-rater variability of white blood cell scintigraphy of hip and knee prosthetic infections

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Aim/Introduction: White blood cell scintigraphy plays a major role in the diagnostic approach to periprosthetic infections (1). Despite the procedure has been well standardized by the publication of several guidelines, the interpretation of this technique may be susceptible to intra-and inter-observer variability. Thus, we aimed to assess the reproducibility of interpretation between different nuclear medicine physicians (inter-variability) and by the same physician (intra-variability). ***Materials and Methods:*** 99mTc-WBC scintigraphy of 59 patients with suspected hip or knee prosthesis infection were retrospectively analyzed by three nuclear medicine physicians, blinded to all patient data. Each WBC study was assessed twice by each reader with a minimum 48h-hour interval between the first and second reading, both visually (positive vs. negative) and, in case of doubt, semi-quantitatively according to guidelines of the European Association of Nuclear Medicine (EANM)(2) by drawing an irregular ROI over the suspected infectious lesion and coping it to the normal contralateral bone. The mean counts per ROIs were used to calculate lesion-to-reference tissue (L/R) ratios for both delayed and late images. An increase in L/R over time (L/Rlate > L/Rdelayed) of at least 20% was considered as indicative of infection. Agreement between readers and between readings was assessed by Gwet's AC1 coefficient. Reading time for each scan was compared between the three readers in both the first and the second reading, by using Generalized Linear Mixed Model. ***Results:*** An excellent agreement was found among all three readers 0.94 for first reading and 0.95 for second reading. Both inter- and intra-variability showed values ≥ 0.90. Eighteen cases were unanimously identified as doubtful by all three readers. Subsequent semiquantitative analysis demonstrated 100% agreement on the results for these cases, indicating consistent drawing of similar ROIs and outcomes among all readers. ***Conclusion:*** Intra- and inter-rater variability studies, such as the present study, contribute to the assessment and improvement of the reliability of nuclear medicine imaging techniques. ***References:*** 1. Erba, P.A., Glaudemans, A.W., Veltman, N.C., Sollini, M., Pacilio, M., Galli, F., Dierckx, R.A., Signore, A., 2014. Image acquisition and interpretation criteria for 99mTc-HMPAO- labelled white blood cell scintigraphy: Results of a multicentre study. Eur J Nucl Med Mol Imaging. 41(4):615-23. 2. Signore A, Jamar F, Israel O, Buscombe J, Martin-Comin J, Lazzeri E. Clinical indications, image acquisition and data interpretation for white blood cells and anti-granulocyte monoclonal antibody scintigraphy: an EANM procedural guideline. Eur J Nucl Med Mol Imaging. 2018;45(10):1816-31.

EPS-061

Radiolabelling of leucocytes with ^{18}[F]fluoro-désoxy-glucose ($^{[18F]}$FDG) for infectious disease imaging

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Aim/Introduction: Radiolabelled autologous white blood cells (WBC) scintigraphy with 99mTc-HMPAO is the gold standard for accurate infections diagnosis. However, the sensitivity can be low for several localizations. Labelling WBC with $^{[18F]}$FDG may be an alternative, combining the excellent sensitivity of PET/CT with the high specificity of WBC-radiolabelling. We aim to investigate the feasibility and safety of $^{[18F]}$FDG-labelled WBC in patients with suspected infectious disease. ***Materials and Methods:*** In total 7 males (67±8 years) with suspected cardiovascular, osteoarticular or soft tissue infections were included and 80-120mL blood were collected from each participant. WBC were isolated and labelled with 800±150MBq of $^{[18F]}$FDG for 20min. Dosimetry measurement of operators (whole body+extremities) was performed during the labelling process. Participants underwent whole-body PET/CT at 2h and 3h post administration of 259±40 MBq of $^{[18F]}$FDG-labelled WBC. PET images were analysed visually and comparison of FDG uptake was performed between suspected lesions and healthy organs. Viability of FDG-labelled WBC, radiolabelling efficacy, stability and operator dose were assessed. ***Results:*** The mean labelling duration was 3.0 ± 0.5 h. Radiolabelling yield and efficiency were found lower with diabetic compared to non-diabetic patients with 62±22% vs 85±5% and 67±24% vs 91±5%. Cell viability was 99±1%. Stability at 2h and 3h after end of labelling was 85±6% and 80±4%. Mean operator dosimetry was 40±12µSv for whole body and 69±26µSv for extremities. 9 (70 %) lesions were found to be true positive, 2 (15 %) true negative and 2 false negative (15%), mostly located in bone. We found higher $^{[18F]}$FDG-labelled WBC in infectious lesions than healthy organs, although they were lower than the reticuloendothelial system (liver, spleen, bone marrow). There was no significant myocardial FDG uptake despite the absence of a dietary preparation. ***Conclusion:*** $^{[18F]}$FDG-labelled WBC offer very good diagnosis performances with limitation when localized in the axial skeleton and the reticuloendothelial system. The labelling procedure ensures high efficacy, strong reproducibility, and operators' radioprotection. Dosimetry can be improved with suitable equipment and radioprotection during the labelling steps. Further analysis of kinetic of $^{[18F]}$FDG-labelled WBC uptake in greater patient numbers and clinical scenarios will be needed.

EPS-062

Quantitative^{99m}Tc-HMPAO WBC SPECT/CT to diagnose Musculoskeletal Infections

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Aim/Introduction: In this prospective study, we report our initial experience on the first 15 patients (4 women, 11 men; median age 59 yrs ± 13.4, range 28-77 yrs) who underwent labelled 99mTc-HMPAO WBC scintigraphy for suspected musculoskeletal infection (2 total hip arthroplasties, 8 total knee arthroplasties, 1 spine device infection, 2 ankle-leg OM). ***Materials and Methods:*** Comprehensive clinical and laboratory assessments (blood counts and ESR/CRP), and 3-phase bone scans, were performed on all patients. Medical history reviews were conducted, with emphasis on recent antimicrobial use. Radiolabelling of autologous WBC with 99mTc-HMPAO was performed in accordance with EANM guidelines, with labelling efficiency >60% and administered activity between 408-705 MBq. Images were acquired at 1 hour (early images, whole-body and planar images), at 4 hours (delayed images), and at 24 hours (late images, planar and SPECT/CT images) according to EANM guidelines. Planar images were acquired with decay-corrected acquisition protocol, whereas for semiquantiative SPECT/CT images we used Siemens Symbia Pro.specta and xSPECT Quant™. The studies were classified as (a) "negative for infection" if stable, decreased or no uptake was observed in delayed and late planar images, and (b) "positive for infection" when at least one focus of abnormal uptake showed increase in radioactivity or size from delayed to late planar images. For semiquantitative analysis, ROIs were drawn over suspected infection areas and copied to normal reference tissue. Mean counts per pixel in ROIs from delayed and late images were recorded to calculate target/background (T/B) ratios. Stable or decreasing T/B ratios indicated a negative scan for infection, while a 20% increase in T/B ratios over time indicated a positive result. For SPECT/CT semiquantitative assessment, SUV values (KBq/ml) in the ROI semiautomatically drawn over suspected infection areas (20% threshold) were used to assess time-dependent changes in absolute uptake, using different values of ΔSUV. ***Results:*** Patients presented negative (n=3) or mild ESR/PCR elevation (n=6) and positive 3-phase bone scan for loosening with associated signs of inflammation in all cases. Semiquantitative analysis of planar and SPECT/CT images showed high concordance in all cases except one patient with a chronic infection, showing positive semiquantitative planar image and negative semiquantitative SPECT/CT. ***Conclusion:*** If confirmed in large series, the use of semiquantitive SPECT/CT will provide reliable quantification and anatomical definition of infection extent, better discriminating between pathological foci and physiological uptake. Furthermore, SPECT/CT offers methodological advantages over planar imaging, including heightened reproducibility and diminished susceptibility to operator influence.

EPS-063

Molecular imaging of acute radiation-induced esophagitis using PET/CT by targeting C-X-C-chemokine-receptor-type-4

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Aim/Introduction: Acute radiation-induced esophagitis (ARIE) is a common side effect and dose-limiting factor of radiotherapy for thoracic tumors and we currently lack established means for the early detection of ARIE. Increased expression of C-X-C-chemokine-receptor-type-4 (CXCR4) was observed in ARIE mice model, suggesting that CXCR4 may serve as a potential biomarker of ARIE. The hypothesis is that non-invasive imaging of 18F labeled polypeptide (QHY-04) targeting CXCR4 enables early detection of ARIE. ***Materials and Methods:*** An ARIE model was constructed using a high-dose single radiotherapy. Small

animal Magnetic Resonance Imaging (MRI) was conducted on day 3, 5, 7 and 15 after radiotherapy. ARIE animals were scanned with [18F]AlF-NOTA-QHY-04 PET/CT and [18F] FDG PET/CT at various time-points post radiotherapy. Dynamic, in vivo blocking study, RNA sequencing analysis, flow cytometry and histopathological studies were performed on the day of peak uptake. Changes of esophageal [18F]AlF-NOTA-QHY-04 uptake were analyzed before and during RT in patients with thoracic tumors. ***Results:*** Enhanced signal intensity of the esophagus and surrounding tissues was observed in ARIE mice compared with normal mice by MRI. Pathological manifestations of radiation induced esophagitis including congestion of blood vessels, detachment of the esophageal epithelium and layer distortion due to necrosis was confirmed by H&E staining. RNA sequencing analysis identified CXCR4 as a potential target of ARIE and significant up-regulation of CXCR4 in the ARIE mice was verified by immunofluorescence staining. Significantly increased [18F]AlF-NOTA-QHY-04 uptake in the irradiated esophagus in comparison with normal esophagus was observed on day 5 post radiotherapy while no obvious [18F] FDG uptake was shown on day 4 to day 8 post radiotherapy. Simultaneously injection with an excess of non-radiolabeled precursor significantly blocked esophagus uptake. The feasibility of [18F]AlF-NOTA-QHY-04 PET/CT imaging for detecting ARIE was further verified in a rat model of ARIE. Immune cell infiltration and flow cytometry identified CXCR4 positive neutrophils and monocytes as the major source of the radiotracer detected by PET. Esophageal uptakes were significantly increased in patients with thoracic tumors after RT compared with esophageal [18F]AlF-NOTA-QHY-04 uptakes before radiotherapy. ***Conclusion:*** [18F]AlF-NOTA-QHY-04 PET/CT can detect ARIE non-invasively and earlier than [18F] FDG PET/CT in experimental animal models. Clinical studies verified its feasibility, suggesting the clinical potential of [18F]AlF-NOTA-QHY-04 as a PET/CT tracer for early monitoring of ARIE.

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Sunday, October 20, 2024, 15:00 - 16:30
Hall G1

Technologists' Track Oral Presentations 1: Technologists Committee: Clinical PET Study Applications

OP-181

Gamifying diagnostics for pediatric patients: the DIVING (Diagnostic ImmersiVe ImagING) project

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Aim/Introduction: The PET-CT diagnostic workflow for pediatric patients is characterized by significant stress and anxiety associated with medical diagnostics, resulting in low compliance during the exams. The DIVING (Diagnostic ImmersiVe ImagiNG) project introduces gamification into the diagnostic workflow to address such issues. This innovative approach hypothesizes that integrating game mechanics into the workflow of medical procedures can significantly improve compliance and maintain diagnostic performance reducing the doses of radiopharmaceuticals. ***Materials and Methods:*** The project introduces a customized Virtual Reality game themed around underwater exploration, delivered to pediatric patients (ages 5-14) during biodistribution of the radiopharmaceutical, a downtime phase of the diagnostic process. This allows divertion of the attention from the medical procedure and engagement of the children, together with their caretakers, in an immersive narrative. Additionally, the narrative is integrated in the rest of the diagnostic workflow, in order to create an immersive and coherent experience from the beginning to the end of the workflow. Most importantly, the game mechanics allow the patient to become acquainted with the PET-CT scan experience and to learn how to stand still in association with specific sounds of the game environments that are later played inside the scanner. ***Results:*** The study evaluates the psychological and clinical impact of gamification on patient experience and compliance, utilizing a pre- and post-intervention survey methodology and comparing results with a control group not exposed to the gamification approach. Expected results include significant decrease in anxiety levels among participants, with improved patient cooperation and reduced motion artifacts during scans. Crucially, the gamified approach is expected to reduction in radiopharmaceutical dosage. ***Conclusion:*** Finally, we expect enhanced satisfaction with the diagnostic process and an improvement in the overall hospital experience for pediatric patients and their caretakers. The paper illustrates preliminar findings on a small group of participants. ***References:*** Schneider, S. M., Kisby, C. K., & Flint, E. P. (2011). Effect of virtual reality on time perception in patients receiving chemotherapy. Supportive Care in Cancer, 19, 555-564.MartÍnez-Lorca, A. Effectiveness of Different Interventions to Reduce Anxiety in Oncological Patients during PET/CT Studies: A Randomized Controlled Pilot Study. Int. J. Psychol. Psychoanal. 2021, 7, 056, doi:10.23937/2572-4037.1510056.Martinez Lorca, A.; Lorca, M.; Criado-Alvarez, J.; Aguado, R.; Baños, M.; Armesilla, M. Using Mindfulness to Reduce Anxiety During PET/CT Studies. Mindfulness 2019, 10, doi:10.1007/s12671-018-1065-2.Wilson, S.; Stuckey, A.; Bradley, Y.; Osborne, D. Anxiety Reduction in PET/CT Imaging by Improving Patient/Technologist Communication. J. Nucl. Med. 2013, 54, 2639-2639.

OP-182

Implementation of a Cardiac PETMRI Training Programme to Meet the Demands of Emergent Hybrid Imaging

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Aim/Introduction: In 2015, a PETMRI scanner was installed at our KCL PET Centre in St Thomas' Hospital. Its primary focus was research imaging in oncology and neurology. In recent years, the use of PETMRI in cardiac research trials has increased in our department. An interest in exploring and developing the use of PETMRI in evaluating patients with cardiac sarcoidosis, amyloidosis and inflammatory diseases, including potential clinical

applications, has gained precedence. Combining this specialty with hybrid imaging adds a layer of complexity that requires the advanced training of staff to provide high quality images, inciting the need to establish a suitable training programme for technologists/ radiographers. The aim was to identify and manage the challenges cardiac MRI presents to the technologist/ radiographer in the PETMRI environment. Establish and implement a training programme for technologists/ radiographers to gain the skills and confidence needed to perform cardiac PETMRI research scans efficiently and competently. ***Materials and Methods:*** In coordinating with the KCL Cardiac MRI service within our trust, learning objectives were identified and a regular rotation of PETMRI staff with senior cardiac MRI radiographers was established. Weekly routine training sessions involved reviewing cardiac anatomy, sequence planning, identifying image artifacts/ resolutions, understanding ECG gating and its role in image acquisition, managing patient noncompliance (i.e. poor breathe hold) and proper patient preparation. Technologists/ radiographers would be evaluated and signed off as competent on their training checklist by a senior radiographer before progressing to cardiac scanning in the PETMRI department. The images for subsequent PETMRI research scans were reviewed by an NM physician and cardiac radiologist and graded for quality. Patient feedback surveys were collected to evaluate patient experience for comfort, efficiency and quality of care received during the procedure. ***Results:*** Two PETMRI technologists/ radiographers have completed the training through the implementation of this programme. Approximately 83 patients across 3 cardiac PETMRI research trials have been successfully scanned. Image quality was assessed by NM physicians and cardiac radiologists as adequate/ optimal and patient feedback surveys were positive for their overall experience. ***Conclusion:*** Though challenging, the investment made to establish a specialised training programme for PETMRI has been successful thereby enabling technologists/ radiographers to gain the skillsets necessary to support the current demands of the service. This undertaking has created a pathway for PETMRI technologists/ radiographers to provide all facets of cardiac PETMRI from radiopharmaceutical administration to cardiac scanning and processing.

OP-183

Diagnostic value of [18F]FDG-PET/CT versus CT-TAP in patients with serious non-specific symptoms and signs of cancer (NSSC): A retrospective study

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Aim/Introduction: To ensure fast-track cancer workup, 25 organ-specific Cancer Patient Pathways (CPP) have been established in Denmark. If a patient presents with serious non-specific symptoms and signs of cancer (NSSC) that does not indicate a specific type of cancer, they can be referred to the non organ-specific NSSC-CPP. Most NSSC-CPP patients undergo a CT scan of the thorax, abdomen, and pelvis (CT-TAP) while some patients undergo an [18F] FDG-PET/CT. Previous studies found [18F]FDG-PET/CT to have higher sensitivity and specificity for identifying cancer compared to CT-TAP (Lebech et al., 2017). This study aims to clarify the diagnostic value of [18F]FDG-PET/CT compared to CT-TAP as a diagnostic tool for diagnosing patients exhibiting NSSC. ***Materials and Methods:*** This retrospective cohort study included all NSSC-CPP patients referred to the Diagnostic Centre in Svendborg in 2022. Scans performed during the patient's investigational course at the Diagnostic Centre or up to 12 weeks prior were included while scans performed after were excluded. We scored the imaging reports of the included patients receiving a scan on how likely the patient was to have a malignant diagnosis based on scan results using a 4-point scale: 1 represented scans with no abnormal findings whereas 2-4 was scans with abnormal findings deemed benign, possible, or probable to represent cancer, respectively. The reference standard was the patients' follow-up diagnosis after six months, which in most cases of cancer were biopsy-verified. Scans scored as 1 or 2 were interpreted as benign while scans scored 3 or 4 were considered malignant. Data and clinical final diagnosis were used to calculate sensitivity, specificity, accuracy, positive and negative predictive values (PPV, NPV). ***Results:*** A total of 995 patients were included who underwent either one or both scans. In total, 1,038 scans were included, 118 [18F]FDG-PET/CT and 920 CT-TAP. Cancer prevalence was 31% for patients undergoing [18F]FDG-PET/CT and 16% for patients undergoing CT-TAP. Sensitivity, specificity, accuracy, PPV and NPV of [18F]FDG-PET/CT were 92%, 72%, 78%, 60%, and 95%, respectively. For CT-TAP, sensitivity, specificity, accuracy, PPV and NPV were 76%, 87%, 85%, 53%, and 95%, respectively. ***Conclusion:*** [18F]FDG-PET/CT had a higher sensitivity and PPV than CT-TAP, whereas CT-TAP had higher specificity and accuracy. NPV were comparable. The study is still ongoing, and further investigation is in progress. ***References:*** Lebech et al. 2017. Journal af Nuclear Medicine, 58(7), 1058-1064.

OP-184

Extravasation of Radiopharmaceuticals in Nuclear Medicine - incidence, causes and reporting events

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Aim/Introduction: Evaluate the occurrence of radiopharmaceutical extravasation in Nuclear Medicine, identify possible risk factors and frequency of events reported. ***Materials and Methods:*** Initial retrospective visual analysis of 722 Bone studies (3 FOV SPECT) between January and June 2023 and respective reports. Extravasation cases were classified into 4 different groups based on severity. Patient demographics (age, weight and gender) and injection methods (cannula/ butterfly, site of injection and injecting technologist) were evaluated. Findings and contributing factors discussed with team. Extravasation audit for Bone studies repeated between January and June 2024. Extravasation with cannula were evaluated on Myocardial Perfusion studies (MPS). ***Results:*** In the initial analysis, extravasation was found in 9.7% (n=68) of patients, of which 41% were administered via a cannula, and only 17% were mentioned on the report. Of the 68 patients, only 12% had severe extravasations affecting image quality. Patient demographics (age, weight and gender) do not appear to influence extravasation rates. After findings were discussed, incidence of extravasation in Bone scans was reduced and no extravasation on MPS was found. This is an ongoing study and results may change. ***Conclusion:*** Our results are consistent with other published investigations. A similar study carried out at the University of Alberta reports an extravasation rate of 15%-20% (McIntosh & Abele , 2016). A review of four studies involving 2613 patients reports an average frequency of extravasation of 17% (Martin et al., 2021). However, this data is not consistent with reported extravasation rates for chemotherapy (0.09%) or IV Contrast (0.24%). This can be explained due to the different criteria used to describe extravasation in other

modalities. The reduction of extravasation in Bone scan may be explained by increased awareness of the problem, which may lead to better technique. No extravasation events in MPS lead us to believe the poor results with cannulas in Bone Scans may be due to poor technique or longer intervals between cannulation and administration, although the difference in volumes administered make to comparisons difficult. ***References:*** McIntosh, C., & Abele , J. (2016). Frequency of interstitial radiotracer injection for patients undergoing bone scan. The Canadian Association of Radiologists.Martin, M., Dilsizian, V., Green, R., Sheetz, M., & Shober, M. (2021). NRC STAFF PRELIMINARY EVALUATION OF RADIOPHARMACEUTICAL EXTRAVASATION AND MEDICAL EVENT REPORTING [Review of NRC STAFF PRELIMINARY EVALUATION OF RADIOPHARMACEUTICAL EXTRAVASATION AND MEDICAL EVENT REPORTING]. Advisory Committee on the Medical Uses of Isotopes Subcommittee on Extravasation.

OP-185

Lung Ventilation and Perfusion scanning using ^{68}Galligas and ^{68}Gallium-MAA - a new application for PET/CT?

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Aim/Introduction: 68Galligas and 68Ga-labeled macroaggregated albumin (MAA) are potential tracers for lung Ventilation and Perfusion (V/P) positron emission tomography (PET) imaging and could display an advantage over conventional V/P imaging in terms of sensitivity and specificity [1,2,3]. Our study aims to reproduce published protocols in order to check reproducibility, analyse the practice and verify advantages and disadvantages in patient care. ***Materials and Methods:*** Our study included a total of 30 patients from whom 5 patients underwent ventilation with 68Galligas and perfusion with 68Ga-MAA. To prepare the 68Ga-MAA kit, we used 68Ga solution from a 68Ge/68Ga Generator which was buffered to a pH of 4. This was always controlled with chromatographic paper. For MAA we used the Pulmocis kit (Curium Deutschland GmbH, Berlin, Deutschland). For optimal reaction, the reagent was mixed and heated for 20 min at 75°C with subsequent thin layer chromatography quality control [2]. Ventilation imaging was performed with 68Ga using the Technegas© generator. An additional protective wall was used due to lead shielding designed for 140 keV from 99mTc inappropriate for 511 keV. In addition, the distance between technician and generator was kept as far as possible. 25 ± 7 MBq of 68Ga-MAA were used for perfusion and 31 ± 7 MBq of 68Galligas were used for ventilation. A thoracic PET with low-dose CT was subsequently acquired. ***Results:*** The quality controls for 68Ga-MAA were within the specified reference range. Due to the low pH value, local pain at the injection site was regularly reported, which briefly disappeared within 10 to 20 seconds after rinsing with 20 ml of 0.9% NaCl solution. At a maximum of 8 minutes, the scan time was significantly shorter than for comparable V/P SPECT/CT with higher image quality. ***Conclusion:*** The 68Ga-marked V/P PET/CT achieves shorter examination times with the possibility of treating more patients and a higher spatial resolution compared to V/P SPECT/CT with the same reliability in terms of quality controls. The disadvantages are the time-consuming kit preparation, the quality control that must be carried out for each individual kit synthesis and, in 68Galligas production, the limited radiation protection of the generator, which requires additional radiation protection measures. ***References:*** 1. Le Roux PY et. al. Semin Nucl Med. 2019;49:71-81.2. Mouse Set. al. Appl Radiat Isot. 2011;69):171-5.3. Ament SJ et al. Recent Results Cancer Res. 2013;194:395-423.

OP-186

Diagnostic Performance of $^{[18F]}$Fluorocholine PET/CT as a First-Line Procedure in Localizing Parathyroid Adenomas Verified By Histopathology

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Aim/Introduction: Accurate localization of potential parathyroid adenomas is crucial prior to surgery. Previous methods have included [99mTc]-sestamibi and [99mTc]-pertechnetate scintigraphy with a detection rate range of 61 - 88 %. Recently a novel imaging technique using $^{[18F]}$fluorocholine PET/CT (FCH) have emerged, and the first findings in the literature indicates improved diagnostic accuracy. Previously, FCH would be second-line after a negative scintigraphy and/or ultrasound. The aim of this study was to evaluate the diagnostic performance of FCH PET/CT when used as a first-step procedure in localizing parathyroid adenomas in patients with biochemically indicated hyperparathyroidism. ***Materials and Methods:*** Patients received 2.5 MBq/kg FCH followed by image acquisition 35 minutes post injection. Imaging was performed on a LSO PET/CT scanner with time-of-flight of 214 ps., 128-slice CT (CarekV on, 120 kV, 110 quality-reference mAs). The scan ranged from the lower mandibula to below aortic arch, thus including most common sites of normal and ectopic parathyroid gland locations. Acquisition time were according to patient BMI, with an acquisition time of 10 min for patients with a Body-Mass-Index (BMI)<30 and 15 min at BMI>30. The nuclear physicians assessed all images for presence of possible adenomas, including size and location relative to the thyroid gland on a 10-regions-map shared between the nuclear physicians and the surgeons. Diagnostic performance was based on detection rates determined by comparing the nuclear imaging results with histopathological findings. ***Results:*** Over a six-month period, 40 patients underwent FCH as a first-line procedure. FCH identified a potential parathyroid adenoma in 33 patients (82.5%). Compared with surgery and histopathology verification the FCH correctly diagnosed 32 parathyroid adenoma, resulting in a per-patient detection rate of 97.0 %. Thirty-four potential adenomas were detected by FCH, one of these was false positive, resulting in a per-lesion localisation rate of 97.1 %. The seven patients with a negative FCH did not undergo surgery, thus calculating sensitivity and specificity is not possible. ***Conclusion:*** Applying $^{[18F]}$fluorocholine PET/CT as a first-line imaging procedure provides a very high histopathology confirmed detection rate in correctly locating parathyroid adenomas. The FCH's higher detection rate improves the surgical planning, reduces the potential number of bilateral neck explorations, thus reducing potential side effects to surgery.

OP-187

Do alterations in surgical borders of glioblastoma correlate with overall survival time? a [^{11}C]Methionine PET, diffusion MRI, and perfusion MRI study

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Aim/Introduction: Glioblastomas (GBMs) are highly aggressive brain tumors with a median survival of only 15-months despite extensive treatment including surgery and chemoradiotherapy.

Recurrence near the surgical site is typical due to tumor cells that evade detection and develop treatment-resistance. Hence tissue alterations in the surgical borders, might predict tumor-recurrence. Conventional MRI has not yet shown to display alterations in the surgical border predictive for tumor growth. Advanced imaging techniques like perfusion-MRI and amino-acid PET, including [^{11}C]methionine-PET, might better indicate tumor activity and proliferation. Therefore, this prospective study evaluates the predictive power of imaging parameters from diffusion-weighted-imaging (DWI), intravoxel-incoherent-motion (IVIM), dynamic-susceptibility-contrast (DSC), and [^{11}C]methionine-PET and overall survival times post-surgery. ***Materials and Methods:*** Twenty-one patients with post-surgery GBM were included in the study. For 16 subjects, the overall-survival-time was available. Thirteen subjects underwent [^{11}C]methionine-PET, all 21 received DWI, 9 received DWI suitable for IVIM, 17 underwent DSC MRI, and 13. Regions of interest (ROIs) with a distance of 0 to 5 mm, 5 to 10 mm, and 10 to 15 mm distance from the edge of the surgical cavity were drawn. In addition, a whole-brain normal appearing white matter region (NAWM) and a sphere with a 10 mm radius contralateral to surgical cavity NAWM where drawn as control regions. The various parameters extracted from DWI, IVIM, DSC, and PET were correlated with overall survival time using a Spearman rank-order correlation coefficient. ***Results:*** Uptake of the PET-tracer [^{11}C]methionine in whole-brain NAWM, expressed as SUVmean, was positively correlated with the overall survival time (r=0.745, p=0.008, N=11), whereas the DWI parameter b1000 of the whole brain NAWM was negatively correlated with overall survival time (r=-0.497, p=0.050, N=16). The IVIM-parameters D*, measured 5-10 mm from the surgical cavity (r=-0.786, p=0.036, N=7) and D, measured 0-5 mm from the surgical cavity (r=0.821, p=0.023, N=7) were significantly negatively correlated with overall survival time. Other parameters either derived from [^{11}C]methionine PET, DWI, IVIM, or DSC were not significantly correlated with overall survival time. ***Conclusion:*** More aggressive tumor left behind after surgery as indicated by [^{11}C]methionine-PET and D*, representing metabolism and high blood flow respectively, thus correlated with poorer survival. In contrast high cellularity represented with D indicated better overall survival, which might hint to a mechanism of better response to radiotherapy as e.g. higher cell density as resulting in more cell divisions and thus better radiosensitivity and treatment response. Further research should help to understand these mechanism.

OP-188

The influence of a saline-flush after administration of Rubidium-82 on myocardial blood flow measurements using PET in a propensity matched cohort

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Aim/Introduction: When performing myocardial perfusion PET imaging using Rubidium-82 (Rb-82), the method of infusion may impact scan outcomes. The influence of a saline-flush after administration of Rb-82 on improving image quality was demonstrated previously. Flushing the remaining activity out of the tubing results in increased activity delivered to the heart1. However, the impact of a flush on quantitative myocardial blood flow (MBF) is unknown. We aimed to study the influence of a saline-flush after administration of Rb-82 on the rest and stress myocardial blood flow (MBF) and myocardial flow reserve (MFR). ***Materials and Methods:*** We retrospectively included 288 consecutive patients who underwent rest and regadenoson-induced stress Rb-82 PET; 150 patients received a saline flush after administration of 740 MBq Rb-82, in both rest and stress; the other 138 patients did not. To ensure comparability of these nonrandomized groups, a propensity score matching (PSM) was carried out, ensuring balance between groups on the following covariates2: age, gender, body mass index, aspirin use, beta-blocker use, statin use, diabetes mellitus, history of myocardial ischemia. The recorded rest and stress MBF and MFR (defined by the ratio of stress to rest MBF) for the myocardium as a whole (global) and the vascular territories (LAD, LCX, RCA) were compared between both groups using an independent sample t-test. ***Results:*** PSM resulted in two matched groups of 138 patients. Mean global MBF was 1.01 (unflushed) vs 1.12 ml/g/min (flushed) (p=0.20) in rest and 2.17 vs 2.34 ml/g/min (p=0.053) in stress. Rest MBF in the LAD was 1.06 vs 1.16 ml/g/min (p=0.024) and in stress 2.21 vs 2.40 ml/g/min (p=0.036). Rest MBF in the LCX was 1.05 vs 1.18 ml/g/min (p=0.008) and in stress 2.20 vs 2.38 ml/g/min (p=0.040). Rest MBF in the RCA was 1.04 vs 1.13 ml/g/min (p=0.055) and in stress 2.34 vs 2.49 ml/g/min (p=0.16). Moreover, MFR did not differ between flushed and unflushed; global MFR was 2.21 vs 2.21 (p=0.98) and for the territories: LAD 2.16 vs 2.17 (p=0.94), LCX 2.17 vs 2.12 (p=0.54), RCA 2.32 vs 2.35 (p=0.68). ***Conclusion:*** Groups were well matched, allowing comparison. A saline-flush after Rb-82 elution results in a marginal, yet significant increase of MBF in rest (global, LAD and LCX) and stress (LAD and LCX), while not affecting MFR values. Consistency in the application of flushing is recommended. Furthermore, MFR may be the preferred parameter to use in Rb-82 PET myocardial perfusion imaging. ***References:*** 1Renaud. https://doi.org/10.1007/s12350-018-1261-4 2Farhad. https://doi.org/10.1093/ehjci/jet068.

OP-189

^{68}Ga-PSMA vs. ^{18}F-PSMA: Technical and metabolic differences

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Aim/Introduction: PSMA provides a promising target for prostate cancer specific imaging. A range of PSMA-based radiotracers is available today that can be based on SPECT or PET radioactive labels. Our retrospective study compares the technical approach and diagnostic performance of 68Ga-PSMA versus 18F-PSMA-PET/CT in patients with PCa. ***Materials and Methods:*** From December 2018 to January 2024, 313 patients were examined for prostate cancer primary staging or follow up (restaging). In the majority of patients (n = 293) 18F-PSMA PET/CT was performed. In 20 patients 68Ga-PSMA was used. The inclusion criteria for the performance of a PSMA PET/CT was performed for staging in biopsy proven prostate cancer prior to (local) therapy or clinical suspicion of recurrence with detectable/rising PSA levels during or following therapy. The decision for 18F-PSMA or 68Ga-PSMA was based on availability. 68Ga-PSMA PET/CTs were performed 60 minutes after administration of 2.2 MBq/kg. 20 mg furosemide were given 20-30 minutes after tracer application. 18F-PSMA-PET/CT was performed not earlier than 2 hours after injection of 4.4 MBq/kg. ***Results:*** PSMA imaging at our institution was, due to availability, performed with 18F-PSMA. Later on, 68Ga-PSMA was available for our institution and we started using both according to daily availability. Studies reporting 18F-PSMA and 68Ga-PSMA show no outstanding advantage of either method, yet there are differences in imaging procedure as well as biodistribution. 68Ga-PSMA has a short half-life, of 68 min, limiting the capacity of

examination, when there is no generator 68Ge-68Ga supply at the place. Therefore, in most cases, in-house production is required. 18F-PSMA may overcome the limitations of the short half-life from 68Ga-PSMA, with a half-life of 110 minutes. Both tracers can be purchased as compounds. The biodistribution of the two tracers is different. The low urinary tracer excretion of 18F-PSMA may offer an advantage over 68Ga-PSMA in terms of evaluation of the primary tumor or local tumor recurrence and iliacal lymph node involvement.Some studies report that 18F-PSMA shows more unspecific focal bone uptake.The choice between 68Ga-PSMA and 18F-PSMA is not influenced by significant differences in the rate of detection, while it is mainly influenced by availability. For this reason, technical as well as medical staff has to be familiar with the differences in imaging protocols and biodistribution. ***Conclusion:*** For enhancing the flexibility of our institution to provide prostate cancer imaging, on short notice, it was crucial to become experienced in performing PSMA-PET/CT with all available PSMA-compounds.

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Sunday, October 20, 2024, 15:00 - 16:30
Hall Y1-Y3

Special Symposium 2: Radiation Protection Committee: Creating a Patient-Centered Care Culture in Nuclear Medicine: Challenges and Best Practices

OP-190
Point of View: Understanding patients' needs and fears in Nuclear Medicine: a comprehensive approach
C. Grana;
IRCCS IEO European Institute of Oncology, Milan, ITALY.

OP-191
Point of View: Patient education strategies for promoting positive outcomes in Nuclear Medicine.
M. Lee;
Patient Representative, Royal Marsden Hospital, London, UNITED KINGDOM.

OP-192
Point of View: Being on the patient's shoes: a personal journey through Nuclear Medicine procedures
E. Briers;
European Association of Urology/ Vice-Chairman European Prostate Cancer Coalition (Europa Uomo), Antwerp, BELGIUM.

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Sunday, October 20, 2024, 16:45 - 18:15
Hall 1

CME 4 - Physics Committee - Clinical Applications of AI

OP-193
Detection and segmentation
V. Andrearczyk;
HES-SO Valais-Wallis, Lausanne, SWITZERLAND.

OP-194
Prediction and prognosis
C. Cheze *Le Rest;*
CHU Milétrie, Nuclear Medicine Department, Poitiers, FRANCE.

OP-195
Dosimetry
J. Tran-Gia;
Department of Nuclear Medicine, University of Würzburg, Würzburg, GERMANY.

OP-196
Future perspectives of AI and potential impact in NM applications
L. Papp;
MedUni Wien, Vienna, AUSTRIA.

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Sunday, October 20, 2024, 16:45 - 18:15
Hall 4

Special Track 4 - Oncology & Theranostics Committee - Round Table: Readiness Session for Radioligand Therapy

OP-197
Optimizing existing Resources
D. Deandreis;
Institute Gustave Roussy, Villejuif, FRANCE.

OP-198
Setting the Stage for Healthcare Readiness
L. Schätz;
Novartis, Basel, SWITZERLAND.

OP-199a
Considerations from Governmental Organisations/ Regulator
N. Sherman;
Nuclear Energy Agency, Paris, FRANCE.

OP-199b
Lessons learnt from Oncology
E. Castro;
Hospital Universitario 12 Octubre, Madrid, SPAIN.

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Sunday, October 20, 2024, 16:45 - 18:15
Hall X9-X12

LIPS Session 4 - Oncology & Theranostics Committee - Residents for Residents - 2024 edition

OP-200
Somatostatin receptor PET/CT NEN: pitfalls and clinical cases
H. Leupe;
Nuclear Medicine and Molecular Imaging, Department of Imaging and Pathology, Nuclear Medicine, University Hospitals Leuven, Leuven, BELGIUM.

OP-201
FDG and DOPA PET/CT in NEN: pitfalls and clinical cases

A. Boucher;
Department of Nuclear Medicine, La Timone University Hospital, CERIMED, Aix-Marseille University, Marseille, FRANCE.

OP-202
PSMA PET/CT in early prostate cancer: pitfalls and clinical cases

L. Schweiger;
Medical University of Innsbruck, Department of Nuclear Medicine, Innsbruck, AUSTRIA.

OP-203
PSMA PET/CT and FDG in late-stage prostate cancer: pitfalls and clinical cases

C. Laschinsky;
Klinik für Nuklearmedizin, Universitätsklinikum Essen (AöR) /Department of Nuclear Medicine, University Hospital Essen, Essen, GERMANY.

OP-204
Studying the role of CAFs in FAP-targeted radionuclide therapy efficacy using a novel near-patient pancreatic cancer 2D co-culture model

C. van der Heide;
Erasmus MC, Rotterdam, NETHERLANDS.

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Sunday, October 20, 2024,16:45 - 18:15
Hall X1-X4

M2M Track - TROP Session: Radiopharmaceutical Sciences + Translational Molecular Imaging & Therapy Committee: Improving FAP Targeting

OP-205
Improving the pharmacokinetics of FAP radiopharmaceuticals - insights from a dose escalation study

A. Bilinska[1], *E. Pilatis[1], E. Menéndez[1], M. Marcel[2], E. Moon[2], T. Läppchen[1], F. Rösch[2], A. Rominger[1], E. Gourni[1];*
[1]Department of Nuclear Medicine, Inselspital, Bern University Hospital, Bern, SWITZERLAND, [2]Department of Chemistry—TRIGA site, Johannes Gutenberg University of Mainz, Germany, Mainz, GERMANY.

Aim/Introduction: Utilizing FAP (Fibroblast Activation Protein) radiopharmaceuticals for pan-cancer targeting stands as a groundbreaking cancer management strategy. Despite their great promise, challenges persist, like elevated blood pool uptake, a common characteristic of FAP-based radiotracers. The main objective of this study is to explore the impact of the administered mass of five radiotracers (monomers and dimers) on their overall pharmacokinetic performance, shedding light on crucial factors influencing their efficacy. ***Materials and Methods:*** DOTA.SA.FAPi, DATA5m.SA.FAPi, DOTAGA.(SA.FAPi)2, DOTAGA.Glu(FAPi)2 and DO3A.Glu.(FAPi)2 were labelled with gallium-68. In a dose-escalation study in PC3 xenografts, the administered mass of all radiotracers was gradually raised from 10 to 1500 pmol, followed by biodistribution and PET/CT imaging at 1 h p.i.. The selectivity towards FAP, PREP, and DDP4, along with their stability in vivo, was examined by biodistribution and metabolite analysis, respectively, in different cohorts of mice. FAP expression in mouse blood and various organs was confirmed through RNA extraction followed by qPCR analysis. ***Results:*** The administered mass of the radiotracers appeared to have a significant impact on blood retention and tumor uptake. By increasing the mass from 10 pmol to the respective optimal dose, blood uptake could be reduced by a factor of 5 to 8. The optimal administered mass ranged from 350 to 600 pmol, resulting in peak tumor uptake between 12 and 19 %IA/g. For example for [68Ga]Ga-DOTAGA.Glu(FAPi)2: blood uptake was 25.8±3.2%IA/g and 3.2±0.5%IA/g, while tumor uptake was 12.5±1.7%IA/g and 16.5±2.3%IA/g at 10 and 600 pmol of injected radiotracer mass, respectively. Further increasing the injected mass of the radiotracers to 1000 to 1500 pmol resulted in a substantial alteration of the pharmacokinetic behavior of the radiotracers. Biodistribution studies validated the in vivo selectivity of all radiotracers towards FAP, even in the presence of PREP and DPP4 inhibitors. All radiotracers also demonstrated remarkable stability in vivo. Metabolite analysis of blood samples taken 10 min p.i., showed a single radioactive peak on HPLC, corresponding to the reference compound. qPCR detected expression of FAP in the bloodstream, along with the simultaneous presence of both murine and human FAP within PC3-tumors. ***Conclusion:*** Our extensive dose escalation study of monomeric and dimeric FAP radiotracers, revealed the critical importance of administering the correct mass for their effectiveness. Despite FAP's presence in the bloodstream, achieving optimal injected mass correlates directly with improved in vivo performance. This systematic investigation offers valuable insights for optimizing the diagnostic and therapeutic efficacy of FAP radiopharmaceuticals.

OP-206
Heterodimerization of Fibroblast-Activation Protein α (FAP) radiotracers as a novel strategy to increase residence time in FAP$^+$ tumors

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Aim/Introduction: Radioligands based on small-molecule FAP inhibitors (e.g. FAPI-46) suffer from insufficient tumor residence time. Homodimerization of small-molecule inhibitors or cyclic peptides (e.g FAP2286) are two efficient strategies to alleviate this issue (1). We aimed to investigate whether a combination of both, i.e. heterobivalency (e.g. FAPI-46 and FAP2286 assembled in a single molecule) is a valuable alternative and if it can further improve the tumor residence time. Based on a click-chemistry platform (2), we developed three heterobivalent ligands containing spacers of increasing lengths: TB28, TB32, TB33. The best ligand was compared to TB60, its small-molecule FAPI homodimer based on the same chemical platform. ***Materials and Methods:*** The derivatives were synthesized following established procedures. They were all functionalized with DOTA and labeled with Lu-177. Their lipophilicity and stability was evaluated. Cellular uptake and distribution were determined in HT1080.hFAP cells up to 4h at 37°C. SPECT/CT images were acquired in HT1080.hFAP and HT1080.wt dual-xenografted mouse model at 4h p.i. Ex vivo biodistribution was performed from 4 up to 120h p.i.. ***Results:*** All radioligands were obtained with radiochemical purities >95%. The spacer length improved hydrophilicity (log D = -1.1±0.1, -1.5±0.1 and -2.2±0.2 for the [177Lu]Lu-TB28, [177Lu]Lu-TB32 and [177Lu]Lu-TB33, respectively). The heterodimer with the longer spacer showed the highest cellular uptake (62% for [177Lu]Lu-TB33 vs. 46% and 39% for [177Lu]Lu-TB32 and [177Lu]

Lu-TB28, respectively). All radioligands visualized FAP+ tumors in SPECT/CT images. In line with the hydrophilicity, [177Lu]Lu-TB28 accumulated mainly in the liver (16.8±5.6%IA/g at 4h p.i)., while [177Lu]Lu-TB33 in the kidneys (19.4±3.6%IA/g at 4h p.i.). The tumor uptake was comparable for all radioligands at 4h p.i. (9-10%IA/g). However, [177Lu]Lu-TB33 showed a persistent tumor uptake at 24h, and the slowest washout 72h p.i. (56% of the uptake at 4h p.i. remained in the tumor). All other heterodimers were washed out faster (15-31% of the uptake at 4h p.i. remained in the tumor). Between the heterodimer [177Lu]Lu-TB33 and its homodimer [177Lu]Lu-TB60, there was a significant difference in the tumor retention, with [177Lu]Lu-TB33 remaining by 46% in the tumor against 11% for [177Lu]Lu-TB60 at 120h p.i.. ***Conclusion:*** Heterobivalent radioligands combining FAPI-46 and FAP2286 binding moieties constitutes a promising approach for increasing radiation dose of FAP+ tumors. In comparison to the homodimerisation, heterobivalency showed advantages regarding tumor residence time. ***References:*** 1. Millul et al. Eur.J.Nucl.Med.Mol.Imaging. 2023;50:3050-3061. 2. Bailly et al. Med.Chem.Lett. 2023;14:636-644.

OP-207

Development of Multivalent OncoFAP Derivatives for the Tumor-Targeted Delivery of Theranostic Radionuclides

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Aim/Introduction: Fibroblast Activation Protein is abundantly expressed in the stroma of most solid tumors. Radiolabelled FAP ligands are routinely used for the detection of various cancers. We recently described OncoFAP, a small organic FAP ligand with rapid accumulation in tumors and low uptake in healthy tissues[1]. To unleash their full therapeutic potential, FAP-targeting compounds must remain at the tumor site for days after administration. Here, we describe the development of OncoFAP-multimers with single-digit picomolar affinity and improved tumor residence time. In addition, we demonstrated that the combination with the clinical-stage immunocytokine L19-IL2 strongly potentiates OncoFAP-based RLTs. ***Materials and Methods:*** In-silico analysis of the FAP structure revealed a wide and deep pocket with distinct hotspots where extra OncoFAP-headpieces bind. In vitro characterization was performed using recombinant FAP and transfected FAP-expressing cell lines. The tumor-targeting properties and therapeutic efficacy of the novel OncoFAP derivatives were investigated in biodistribution and therapy studies, alone and in combination with L19-IL2. The mechanism of action of this combination was studied thanks to proteomic analysis. ***Results:*** As compared to the monovalent counterpart, TriOncoFAP (IC50 = 13pM, also called OncoFAP-23) and TetraOncoFAP (IC50 = 2.4pM) showed a ~43-fold and ~235-fold enhanced inhibitory activity, respectively. 177Lu-TriOncoFAP emerged for its superior biodistribution profile, presenting a very high and prolonged uptake in target lesions at all tested time-points (e.g., 16%ID/g at 96h), with a favorable tumor-to-organ ratio. When compared to 177Lu-FAP-2286, the most advanced FAP-targeted RLT in clinical development, 177Lu-TriOncoFAP exhibited a ~2.7-fold higher overall uptake in tumors, with a ~1.8-fold lower kidney uptake. Despite its superior tumor accumulation, 177Lu-TetraOncoFAP presents some uptake in liver and kidney. Higher-order multimers presented worse in vitro and in vivo performances due to increased steric hindrance. 177Lu-TriOncoFAP exhibited a dose-dependent anticancer activity, with potent efficacy already at 5 MBq/mouse. The combination with L19-IL2 resulted in complete tumor eradication in all treated animals. Proteomic analyses revealed a potent synergistic effect for the combination modality, describing an enhanced activation of the host immune system directed against the tumor mass. ***Conclusion:*** The data presented in this work strongly supports the clinical development of 177Lu-TriOncoFAP. We are launching a Phase I clinical trial to define the 177Lu-TriOncoFAP maximum tolerated dose, evaluating its safety profile, and collecting preliminary signs of efficacy. The compound will be given as single agent or in combination with L19-IL2 in patients with multiple types of FAP-positive tumors. ***References:*** [1] Millul et al., PNAS, 118:e2101852118.

OP-208

Development and evaluation of covalent binding FAPIs for tumor theranostics

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Aim/Introduction: As an unnatural amino acid, fluorosulfate-l-tyrosine (FSY) could bond with specific amino acids (His, Lys, and Tyr) covalently in physiochemical environments[1]. The aim of this study was to evaluate the FSY-modifed FAPI (FMF) tracers for their tumor retention and potential effectiveness of targeted radiotherapy in animals. ***Materials and Methods:*** Ga-68 and Lu-177 radiolabeling of a series of FSY-modified FAPI tracers was carried out. The radiochemical purity (RCP) and radiochemical yield (RCY) of the tracers was examined by high performance liquid chromatography and instant thin layer chromatography. Subsequently, PET/CT imaging and SPECT/CT imaging was conducted in U87MG tumor-bearing mice. Therapeutic experiments were performed on the most promising molecules (FMF-06), with Lu-177 radiolabeled FAPI-04 as a control. ***Results:*** The FAPI tracers were successfully modified with FSY and labeled with gallium-68 and lutetium-177. RCY was tested to be 36.77-98.42%, and RCP was over 95%. PET/CT images demonstrated significant tumor uptake with a tumor-to-organ ratio more than 15.0. For the molecule FMF-06, the tumor uptake was measured at 21.50 ± 6.02 %ID/g at 0.5 h postinjection (p.i.) and maintained stable at 21.67 ± 4.33 %ID/g at 2 h p.i., 11-18 fold to that of FAPI-04. SPECT/CT images suggested that [177Lu]Lu-FMF-06 mainly retained at the tumor sites for over 8 h, and other organs such as the gall bladder and large intestine. Treatment experiments showed significant tumor inhibition after one injection of 1 mCi of [177Lu]Lu-FMF-06, compared to 1 mCi [177Lu]Lu-FAPI-04 ($P < 0.001$, ****). Kaplan-Meier analysis suggested that the survival rate of group treated with 1 mCi [177Lu]Lu-FMF-06 was 85%, while all other groups at a survival rate of less than 50% within 20 days. ***Conclusion:*** FSY-modification strategy on FAPI tracers can significantly prolong their tumor uptake and retention, which further exhibited excellent tumor suppression after Lu-177 labeling upon one injection. ***References:*** Wang N, Yang B, Fu C, et al. Genetically Encoding Fluorosulfate-l-tyrosine To React with Lysine, Histidine, and Tyrosine via SuFEx in Proteins in Vivo[J]. Journal of the American Chemical Society, 2018, 140(15): 4995-4999.

OP-209

Novel FAPi dimers labeled via tetrazine ligation

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Aim/Introduction: Despite the success of diagnostic radiotracers targeting the pan-tumor target fibroblast activation protein (FAP) in many different cancer types, the translation into therapeutic counterparts remains a challenge. In contrast to monomeric FAP inhibitor (FAPi) radiotracers, FAPi dimers with two FAPi targeting vectors demonstrate prolonged tumor retention leading to high tumor doses and promising results in first clinical applications. Current therapeutic FAP-targeting compounds are chelator-based and can thus only be labeled with radiometals. We have developed a technological platform that enables fast tetrazine ligation using the new trans-cyclooctene T4CO to yield only one isomer selectively. This was linked to a FAPi dimer targeting vector and enables easy labeling with various radiohalogens (18F, 123/131I, 211At) alongside radiometals. Thus, the new compounds DUAL FAPi-5, -6 and -7 imply a broad theranostic application. Especially 131I-DUAL FAPi will enable a cost-effective radioligand therapy (RLT) that can keep up with the strongly increasing demands for FAP-RLT in the future. ***Materials and Methods:*** DUAL FAPi-5/6/7 were radiolabeled with 68Ga (60-75°C for 5-10min) in NH4OAc buffer (pH=4.0) and radiochemical conversion and purity was determined via radio-TLC and radio-HPLC. The logD7.4 values were determined via shake-flask method. The excretion profile was investigated by 68Ga-µPET in naïve rats for 90min. The compounds were labeled with 111In under similar conditions and investigated via SPECT and ex vivo biodistribution in U87-MG tumor-bearing mice up to 72h p.i. ***Results:*** [68Ga]Ga-DUAL FAPi-5/6/7 were labeled with high RCC>90% (20-30 GBq/µmol), decay-corrected RCY=70-75% and RCP>97%. 68Ga-µPET showed predominantly renal excretion with fast kidney-washout for the DUAL FAPi compounds. Labeling of [111In]In-DUAL FAPi-5 and -7 gave RCC>90% after 30min (6.6-10 GBq/µmol, RCP>95%, RCY=85-90%). LogD7.4<−3 was determined for all compounds. 111In-µSPECT and biodistribution showed rapid and high tumor uptake 1h p.i. (9.67 ± 0.73 and 8.13±0.96 %ID/g) which was mostly retained after 24h (5.81 ± 3.42 and 8.46 ± 0.26%ID/g) for both compounds. Initial DUAL FAPi liver and kidney uptake was washed out largely after 4h p.i. and accumulation in other healthy organs was low. 131I-DUAL FAPi synthesis is ongoing and preliminary results show RCC=81±9% (n=4) for the 131I-tetrazine labeling which is then clicked to DUAL FAPi. ***Conclusion:*** The novel DUAL FAPi derivatives show high tumor uptake and retention while having faster and predominantly renal excretion that will be beneficial for future therapeutic applications with 131I and 211At. Preclinical studies of 131I-DUAL FAPi using U87-MG xenografts to investigate therapeutic response will start soon.

OP-210

Design, Synthesis and Biological Activity Study of a Novel Trimeric FAPI Diagnosic and Therapeutic Integrated Probe

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Aim/Introduction: To address the current situation of excessive in vivo metabolism of fibroblast activation protein (FAP) inhibitor (FAPI) nuclide probes, we designed and synthesized radio-labelled FAPI trimeric riboprobe [68Ga/177Lu]-FAPI-Trimer, harnessing the polyvalency effect of multimerization in order to enhance tumor uptake and retention, with novel structure and proprietary intellectual property rights. ***Materials and Methods:*** The stable 68Ga/177Lu labelling conditions were explored, the basic properties of the probe were tested by stability and lipid-water partition coefficients, and the specific uptake was verified by in vitro cytological experiments. Human FAP was stably transfected into the human fibrosarcoma cell line HT-1080 using a lentivirus. CDX models were constructed and imaged in PET/CT and SPECT/CT, respectively, and the in vivo distribution and metabolism were explored by biodistribution and blood clarity experiments. ***Results:*** PET/CT imaging of 68Ga-labelled FAPI-Trimer showed stable uptake values at 1-4h on the HT-1080-FAP CDX model with increasing target/native ratios (7.47±1.34 %ID/g, 1 hour after injection; 8.17±1.56 %ID/g, 4 hours after injection), and SPECT/CT imaging of 177Lu-labelled FAPI-Trimer showed stable tumor retention 72-120h after injection. Currently, 177Lu therapeutic experiments are underway, and there has been a significant inhibition of tumor growth in the administered group. ***Conclusion:*** Our FAPI-trimer structure showed higher intra-tumoral uptake compared to monomers such as FAPI-04, significantly prolonged blood clearance half-life and increased radiopharmaceutical tumor retention. These results suggest that [68Ga/177Lu]-FAPI-Trimer has the potential to be a promising tracer for FAP-targeted therapy in the future, and its anti-tumor effect needs to be further research results.

OP-211

[^{68}Ga]Ga/[^{177}Lu]Lu-AAZTA-NI-FAPI-04: a new improved FAP-targeting agent containing nitroimidazole moiety for diagnosis and radiotherapy

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Aim/Introduction: Fibroblast activation protein (FAP) is an attractive target for diagnosis and therapy of cancer. Promising results have been reported for FAP-targeting agents, i.e., [68Ga]Ga-DOTA-FAPI-04, in tumor imaging. But enhancing tumor uptake and retention remains desirable for improvement of clinical applications. In this study, a new ligand, AAZTA-NI-FAPI-04, 1, was developed by incorporating a 2-nitroimidazole (NI) moiety into the core structure of FAPI-04 and utilizing AAZTA as the chelator for [68Ga]Ga(III) or [177Lu]Lu(III). ***Materials and Methods:*** Compound 1 was synthesized and labeled with either [68Ga]Ga(III) or [177Lu]Lu(III). The radiochemical purity (RCP) and in vitro stability of [68Ga]Ga/[177Lu]Lu-1 were determined by radio-HPLC and radio-TLC. In vitro cell uptake studies and competitive binding assays were conducted using HT1080-FAP positive cells. PET/CT imaging and biodistribution studies were performed in mice model bearing U87MG tumor. ***Results:*** [68Ga]Ga-1 and [177Lu]Lu-1 were efficiently labeled under mild conditions (RCP > 95%), and they remained stable in saline and mouse serum for over 120 minutes

and 6 days, respectively. The FAP binding affinity of compound 1 was comparable to that of DOTA-FAPI-04 (IC50, 7.38 vs 3.94 nM). [68Ga]Ga-1 demonstrated higher specific cellular uptake (19.59 ± 0.37 vs 3.18 ± 0.33 %ID/(7 × 105 cells)) and internalization (18.32 ± 0.33 vs 2.81 ± 0.31 %ID/(7 × 105 cells)) as compared to [68Ga]Ga-DOTA-FAPI-04 at 60 min. [177Lu]Lu-1 exhibited similar uptake at 60 min, with values of 29.76 ± 2.01 vs 18.66 ± 0.56 and 26.91 ± 0.88 vs 15.09 ± 0.22 %ID/(8 × 105 cells), respectively. PET/CT imaging with [68Ga]Ga-1 surprisingly revealed higher specific tumor uptake and prolonged retention with rapid clearance from normal tissues resulting in an improved tumor-to-muscle ratio compared to [68Ga]Ga-FAPI-04 (4.40 vs 3.98 and 14.7 vs 4.42 at 60 min and 120 min, respectively). Biodistribution studies further confirmed the superior tumor uptake of [68Ga]Ga-1 over [68Ga]Ga-DOTA-FAPI-04, with respective values of 29.0 vs 6.15 and 27.6 vs 5.72 %ID/g at 60 and 120 min post-injection, respectively. Similarly, [177Lu]Lu-1 exhibited higher tumor uptake compared to [177Lu]Lu-DOTA-FAPI-04 (29.0 vs 17.9 and 28.3 vs 20.5 %ID/g at 60 and 120 min post-injection, respectively). ***Conclusion:*** New FAP-targeting agents, [68Ga]Ga/[177Lu]Lu-1, were prepared and evaluated. By incorporating the 2-nitroimidazole (NI) moiety, [68Ga]Ga/[177Lu]Lu-1 exhibited enhanced tumor uptake and prolonged retention compared to [68Ga]Ga/[177Lu]Lu-DOTA-FAPI-04. Initial experiments suggest that [68Ga]Ga/[177Lu]Lu-1 is a promising FAP-targeting agent. Further human studies are warranted to validate the surprisingly high tumor targeting.

OP-212

Development and evaluation of novel cancer theranostic radiopharmaceutical by targeting FAP

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Aim/Introduction: Fibroblast activation protein (FAP) is a type II transmembrane serine protease with dipeptidyl peptidase and endopeptidase activity, closely related to tumor growth, invasion, metastasis, and prognosis. It selectively overexpresses on the membrane of cancer associated fibroblasts (CAFs) in various epithelial derived malignant tumor stroma, making it an ideal tumor stroma target. Various FAP inhibitors based on quinolines have been developed, but their retention time in tumors is relatively short and not ideal for radioactive therapy. This study utilized an albumin-binding strategy to modify the UAMC1110 framework with high affinity for FAP, improving its pharmacokinetics and pharmacodynamics to enhance tumor targeting and prolong tumor retention. ***Materials and Methods:*** The precursors (HX and HX-AB) were synthesized by adding functional chemical groups (small organic ligands, linkers, albumin binder) and were labeled with 68Ga and 177Lu, respectively. The stability study, partition coefficient and serum albumin-binding property were determined. A series of cell assays was performed to identify the binding affinity and FAP specificity in vitro. PET imaging, SPECT imaging, and biodistribution studies were performed to evaluate the pharmacokinetics in HT-1080-FAP xenograft mice models. The cancer treatment efficacy of 177Lu-HX-AB were evaluated in HT-1080-FAP xenograft mice. ***Results:*** All radiopharmaceuticals were successfully prepared with high purity and stability. 177Lu-HX-AB was stable in PBS (pH 7.4) and saline for at least 96 h. They exhibit excellent stability in vitro, with high protein binding rate and good water solubility. The 68Ga-HX and 68Ga-HX-AB exhibited high FAP-binding affinity and specificity both in vitro and in vivo. Compared with the precursor HX, PET imaging, SPECT imaging, and biodistribution studies of the precursor HX-AB demonstrated their remarkably enhanced tumor accumulation and retention. In radioligand therapy studies, remarkable tumor suppression was observed with the 177Lu-HX-AB in HT-1080-FAP xenograft mice. ***Conclusion:*** An albumin binder-conjugated FAPI radiopharmaceuticals have been developed and evaluated in vitro and in vivo. Significantly improved tumor uptake and retention were observed, compared with the HX without albumin binder. The favorable in vivo pharmacokinetics and excellent treatment efficacy, make it a promising radiopharmaceutical for theranostic applications.

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Sunday, October 20, 2024,16:45 - 18:15

Hall Y4-Y9

Cutting Edge Science Track - TROP Session: Physics Committee: QA / Performance Assessment / Standardisation

OP-213

Impact of fitting technique and number of SPECT-CT time points in Renal Dosimetry Post ^{177}Lu-DOTATATE Therapy

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Aim/Introduction: In the multi-institution prospective single arm OZM-067 177Lu-DOTATATE trial (NCT02743741), 68GaDOTATATE positive patients receive 4 cycles of therapy with individualized dosimetry as assessed using SPECT-CT. This study investigates the impact of fitting algorithm and number of SPECT-CT time point scans post treatment administration. ***Materials and Methods:*** All patients receive an initial dose of 7.4GBq with subsequent dose per cycle (maximum 11.1GBq) based on renal dose tolerance of 23Gy. Dosimetry calculations are based on quantitative SPECT-CT acquired at 4, 24 and 72 hours post injection. A 3-parameter bi-exponential (3PBE) function is fitted as the reference fit to the three points and the area under this curve is used for dose calculation. Other fitting algorithms are compared to this reference fit, namely, mono-exponential (ME), linear fitting from 0 to 24 hours followed by mono-exponential (LME), simplified bi-exponential (2PBE) using only 2 time points (4 and 72 hour only) and single time point (STP) calculation by Hanscheid(2018). ***Results:*** 173 patients were accrued to the study from 4 sites between Aug 2016 & June 2021. 129 patients completed all 4 cycles of treatment and 90 patients completed all 12 SPECT-CT sessions (3 sessions x 4 cycles). Comparing the two mono-exponential results to the 3PBE, the ME model produces absorbed dose values on average 0.60±0.77Gy (13.5±16.5%) higher with a Pearson correlation (ρ) of 0.939, while the LME model resulted in absorbed dose values 0.11±0.53Gy (2.7±13.0%) higher and ρ=0.959. Removing the 24-hour SPECT-CT resulted in a 0.026±0.52Gy (1.0±13.5%) reduction

in calculated absorbed dose (ρ=0.957). This difference was higher when comparing 3PBE to STP where the dose reduction was 0.37±0.50Gy (8.9±11.1%) (ρ=0.964). Using the 2PBE and STP to prescribe the injected activity of subsequent cycles results in an average under treatment of only 0.6±4.0% for 2PBE and 3.4±6.0% for STP with very high correlation of ρ=0.983 and ρ=0.963 respectively. In the case of the 2PBE fit only 3/90 patients received an injected activity in excess of 10% different from the 3PBE while 11/90 patients were outside that window for the STP model. ***Conclusion:*** Removing the 24-hour time point has only a slight impact on injected activity and absorbed dose estimates to the kidneys. One time point dosimetry provided reasonable results with high correlation (r=0.963) with modest bias (8.9 ± 10.7 per cycle 3.4 ± 6.0% overall). The 2 time point BE model can help facilitate wider adoption of internal dosimetry in PRRT treatment protocols.

OP-214

Towards an international audit system for personalised theranostics: Results from a European comparison exercise of dosimetry software

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Aim/Introduction: Despite the introduction of legislation requiring individually planned treatments according to the radiation absorbed doses delivered, its implementation remains challenging; partly due to the wide range of dosimetry methods available and the lack of a robust methodology to validate dosimetry software. The aim of this study was to perform a comparison exercise of commercial and research dosimetry software using a reference imaging dataset to assess the accuracy, variability and uncertainties at each step of the dosimetry workflow. ***Materials and Methods:*** Each participating site was provided with: (i) a Standardised Operating Procedure, (ii) two reference imaging datasets comprised of reconstructed SPECT/CT scans (D1: 1, 4, 24, 40, 72 h; D2: 1, 24, 40, 72, 144 h) of a 3D printed anthropomorphic phantom with a tumour (TU), liver (LV), spleen (SP), kidneys (KB) (left (KL) and right (KR) kidneys, sub-divided into medulla (KLM, KRM) and cortex (KLC, KRC), filled according to a clinically realistic biokinetic model for 177Lu-DOTATATE [2]; and (iii) a dedicated reporting template adapted from the IAEA Radiotracer Biodistribution Template (RaBiT). Participants were asked to report details on their workflows, and results on the volume, activity, cumulated activity, fitting parameters of the time-activity curve, time integrated activity coefficient and absorbed dose to each region, amongst other parameters. Uncertainty analysis was performed centrally [3]. ***Results:*** 23 submissions (D1=12, D2=11) from 10 sites were received. Preliminary results show a large variability in absorbed doses calculated for each organ (KB: 21%; KL: 18%; KR: 19%; KLC 29%; KLM: 34%; KRC: 34%; KRM: 23%; LI: 62%; SP: 73%; TU: 42%), and significant deviations from the true absorbed doses (KB: -21%; KL: -15%; KR: -19%; KLC: -14%; KLM: 66%; KRC: -33%; KRM: 68%; LI: 22%; SP: 56%; TU: -11%). Major parameters affecting the results include the delineation method and time-activity curve fitting. No statistically significant differences were observed between D1 and D2, or between voxel and organ-based methods. The uncertainty analysis identified software bugs including misuse of DICOM tags that resulted in an underestimation of calculated absorbed doses in a software package. ***Conclusion:*** The results highlight the need to establish robust international quality assurance system using traceable reference datasets to audit and validate dosimetry software for post-therapy verification and personalised theranostics treatment planning. ***References:*** [1] Robinson et al. Physica Medica 109 (2023) 102583. [2] Brolin et al. Phys Med Biol 2015; 60(15): 6131-49. [3] Gear et al. EJNMMI 2018; 45(13): 2456-74.

OP-215

3D Printing of Anthropomorphic Phantoms with Non-uniform Activity Distributions for the Evaluation of Quantitative SPECT

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Aim/Introduction: SPECT-based activity quantification of 177Lu is challenging for small, non-uniform, and irregularly shaped objects. Our aims were to 3D-print anthropomorphic phantom inserts that mimic these difficulties in SPECT images and use them to assess accuracy in estimation of activity-concentration based on experimental measurements and Monte Carlo simulations. ***Materials and Methods:*** Two kidney and five tumour inserts were 3D-printed. For kidneys, non-uniform activity distributions were constructed with a grid-based technique that utilized the limited spatial resolution of SPECT, results in an apparently lower mean-activity concentration (Ac) in a region. The kidneys were designed based on XCAT phantom templates, and the tumours on patient 68Ga-PET-images. Kidneys encompassed cortex, medulla and renal pelvis. The medulla was printed using the grid technique resulting in a lower mean Ac for that region with a total encompassing volume of 126 mL and 136 mL. The tumours were kept hollow to result in a uniform activity distribution with volumes between 3 mL to 15 mL. Phantoms were filled with a 177Lu solution and SPECT images acquired. The Ac in each insert was determined from reconstructed SPECT images by manual delineation of the whole objects. The estimated Ac was compared with the reference Ac and presented as a recovery for each phantom. To validate the grid-based technique, Monte Carlo simulations of the true activity distribution in the kidneys were performed. The simulated SPECT images were compared with the physical measurements both qualitatively and quantitatively. ***Results:*** Recoveries were 85% and 91% for the kidneys and 48%, 69%, 54%, 68% and 72% for the 5 tumours. Measured and simulated SPECT images showed agreement in activity distribution and quantitative profiles, thus confirming the grid-based technique for mimicking non-uniform activity distributions. ***Conclusion:*** 3D-printed grid-based techniques facilitate the production of non-uniform anthropomorphic phantoms that are easy to prepare as they can be filled from a single stock-solution. The phantoms provide clinically realistic and relevant images for the evaluation of quantitative SPECT and are currently used as a method for comparison and validation of activity quantification in a clinical multicentre study.

OP-216

Uncertainty estimations for activity measurements with medical radionuclide calibrators using ^{99m}Tc and ^{18}F

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Aim/Introduction: As a pilot study for the national AKKA-project concerning traceable calibration of medical radionuclide calibrators, uncertainties of routine 99mTc and 18F activity measurements were estimated utilizing a secondary standard radionuclide calibrator. ***Materials and Methods:*** Standard uncertainties (k=1) related to three scenarios for 99mTc and 18F were considered: 1) Geometry specific traceable calibration coefficients would be determined and utilized for each syringe and volume applied in daily practice. 2) One traceable calibration coefficient for one reference geometry would be determined and utilized, and potential deviations related to all other geometries would be included in the uncertainty estimation. 3) Only manufacturer given coefficients for a radionuclide calibrator would be used and all deviations were considered in the uncertainty estimations. Altogether six radionuclide calibrators were included in the estimations. Traceable calibration coefficients were transferred to these calibrators using a 10 ml reference vial with active solution of 2 - 8 g for 99mTc and 4 - 5 g for 18F. Also, a selection of clinically utilized syringes with different volumes was measured. Several factors were included in the uncertainty estimation: calibration coefficients, repeatability, long term stability, linearity and accuracy of display, decay correction and volumes (weights). To minimize dependence on individual measuring sessions, the final uncertainty results were computed by taking into account the worst estimates found for these individual factors for the six calibrators included. In addition, the uncertainties were also computed assuming the linearity to be 5%, which is commonly used as an acceptance criterium. ***Results:*** With measured linearities for the six calibrators, the uncertainties were 3% for both 99mTc and 18F in scenario 1, 4% (99mTc) and 3% (18F) in scenario 2, and 9% (99mTc) and 6% (18F) in scenario 3. When assuming linearity of 5%, the corresponding uncertainties were 4% for both 99mTc and 18F in scenario 1, 5% (99mTc) and 4% (18F) in scenario 2, and 10% (99mTc) and 6% (18F) in scenario 3. These uncertainties were estimated for a selection of geometries and must be updated when introducing e.g. new syringes in clinical use. ***Conclusion:*** As expected, scenario 3 had the largest uncertainties. Scenario 1 would give optimal calibration but is impractical. Also, a vast selection of calibration coefficients could be an error source in clinical work. Scenario 2 with radionuclide calibrator specific calibration coefficients for 99mTc and 18F produced acceptable standard uncertainties of ≤ 5% and would also be applicable in clinical routine.

OP-217

Towards metrologically traceable activity measurements in clinical setting - including ^{15}Oand automatic PET dispensing/infusion systems

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Aim/Introduction: The requirement of metrological traceability for activity measurements performed with radionuclide calibrators in clinically used measurement geometries is challenging to fulfill. One approach is to use Secondary Standard Calibrator (SSC). However, the use of SSC in every nuclear medicine center is not practical and the use of local reference radionuclide calibrator calibrated against SSC is an attractive option.The aim of the study was to measure accuracy of radionuclide calibrators for wide range of clinically relevant radionuclides and geometries using SSC as reference. In addition, feasibility to transfer metrological traceability to local reference radionuclide calibrator was evaluated. ***Materials and Methods:*** Accuracy of activity measurements was defined for the following isotopes: 99mTc, 123I, 131I, 223Ra, 90Y, 18F, 177Lu and 15O, for 12 radionuclide calibrators from two hospitals, by comparing the displayed activity to reference value defined based on the SSC measurements, and calculating their relative difference. Measurements were performed in vial and syringe geometry, 18F was also measured in the geometry of automatic PET dispensing/infusion system and 131I was measured in capsule geometry. The measured activities covered clinically used activity range, from 3MBq to 3.7GBq. Metrological traceability was maintained in all measurement geometries by using activity measured in standardized geometry with SSC, mass of the sample and calculated activity concentration. ***Results:*** Preliminary results are reported. For 15O the difference between the reference value and measured activity was within 2%.Relative difference for 18F activities measured in automatic PET dispensing/infusion systems were <1.6% and <3.2%, for 1ml and 3ml measurement volumes. For all radionuclide calibrators corresponding relative difference for 18F in vial and syringe geometry was -1.4-3.1% and 4.2-5.8%. Relative difference for 99mTcm was less than 3% and less than 1.0% in vial and syringe geometry, respectively. In 177Lu measurements, the relative difference was 4.6-6.2% and -3.4-2.3% for vial and syringe geometry, respectively. For 90Y the relative difference was between 6% and 7% in vial geometry and for 131I capsules within 2.3%.The use of local reference radionuclide calibrator values as baseline provided similar results. ***Conclusion:*** All differences were well below required expanded uncertainty level of 10% (95% confidence level). Metrological traceability was maintained on all measurement geometries, including previously challenging 15O and automatic PET dispensing/infusion systems. The use of calibrated local reference radionuclide calibrator is feasible option for providing metrological traceability for activity measurements. One local calibrated reference meter can be used to calibrate other radionuclide calibrators in nearby hospitals.

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Uncertainty Estimation for Dosimetry from SPECT Image Reconstructions

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Aim/Introduction: A variety of uncertainties exist in patient dose estimation, arising from tasks such as volume delineation, calibration source measurement, and time activity curve fitting. A source of uncertainty typically not accounted for in dosimetry procedures is the uncertainty of reconstructed counts in SPECT images due to Poisson noise in the projection data. We present an iterative reconstruction algorithm to estimate this uncertainty on measured counts within segmented volumes in clinical SPECT images. ***Materials and Methods:*** The algorithm for uncertainty estimation is a modification of a previous algorithm (Qi, 2003) and works for any linear preconditioned gradient ascent algorithm (such as OSEM); it is implemented in the open-source python library PyTomography and is presently validated on Tc99m Jaszczak phantom data (i) simulated via SIMIND and (ii) acquired on a Siemens Symbia T2. The simulated SIMIND Monte Carlo Tc99m Jaszczak phantom contained 6 spheres of radii 0.47 cm, 0.8 cm, 0.95 cm, 1.27 cm, 1.59 cm, and 1.9 cm with activity concentration 1.46 MBq / mL and with a cold background at 1/10th the activity. 4000 separate noise realizations of this data (5 s per projection) were reconstructed in PyTomography (OSEM

10it/8ss) to estimate the true count variance. The real data consisted of a Jaszczak phantom with sphere sizes of 0.635 cm, 0.710 cm, 0.970 cm, 1.110 cm, 1.825 cm, and 2.875 cm filled at a 8:1 source to background ratio. 56 scans (5s / projection) were acquired and rebinned into 70 separate realizations to account for activity decay and yield a 160 kBq/mL activity concentration per realization. ***Results:*** For the simulated data, the estimated uncertainties from the reconstruction of a single noise realization were 6.39%, 1.78%, 1.19%, 0.68%, 0.47%, and 0.34%, while the actual variation in counts in the 6 respective spheres from the 4000 realizations were 6.34+/-0.26%, 1.74+/-0.07%, 1.26+/-0.05%, 0.66+/-0.03%, 0.46+/-0.02%, and 0.35+/-0.01%. For the real data, the estimated uncertainties from a single realization were 22.45%, 15.36%, 7.24%, 3.95%, 2.00%, and 0.68%, while the actual variation in counts from the 70 realizations were 22.27+/-1.89%, 16.45+/-1.40%, 6.81+/-0.58%, 4.53+/-0.39%, 2.05+/-0.17%, and 0.62+/-0.05% ***Conclusion:*** A technique for uncertainty estimation from SPECT reconstructions was developed and validated on Monte Carlo and real Tc99m phantom data. The uncertainties obtained using this technique may be valuable for estimation of patient dose in dosimetry protocols. ***References:*** Qi, Jinyi. "A unified noise analysis for iterative image estimation." Physics in medicine and biology vol. 48,21 (2003): 3505-19. doi:10.1088/0031-9155/48/21/004.

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Determination of calibration factors for ^{177}Lu in digital 3D and conventional dual-head SPECT/CT systems over a wide range of activities

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Aim/Introduction: PSMA-directed radioligand therapies (PSMA-RLT) utilizing 177Lu have been increasingly used in clinics. These treatments usually require post-therapy imaging for dosimetry purposes, which can be conducted a couple of hours and one-week after the treatment. However, given the significant variance in remaining activities in patients at these time points, it becomes essential to assess whether the existing activity level influences the calibration factor of the systems. In this study, we determined the calibration factors for 177Lu in conventional dual-head analog and digital CZT 3D ring-design general-purpose whole-body SPECT/CT systems. Additionally, we evaluated whether these calibration factors remain constant across the range of activity levels. ***Materials and Methods:*** A cylindrical phantom containing 3.70-3.75 GBq of 177Lu was used in the calibration measurements. The phantom was imaged multiple times as the activity decayed, until reaching near-complete depletion. The acquisition protocols were standardized between the systems. The duration of the imaging time in both systems were 20 minutes. The digital 3D SPECT/CT system was capable of detecting both main photon peaks (113 and 208 keV) of 177Lu while 208 keV peak was measured with the conventional SPECT/CT system. The activity and the activity concentration of the phantom were determined for every acquisition. The data were reconstructed in both systems using a basic iterative OSEM algorithm with 6-20 iterations, 6-15 subsets and CT attenuation correction. The total counts were determined with a commercial nuclear medicine processing software using a cylindrical 2001.2 cm3 VOI (with 140 mm in diameter and 130 mm in height). The acquisition times used in the calculation of the calibration factors were determined from the image header. ***Results:*** The mean calibration factor for the conventional SPECT/CT system was 5.74±0.18 cps/MBq and for the ring-design system for 113 and 208 keV peaks 69.79±1.68 cps/MBq (range 67.69-72.45 cps/MBq) and 71.64±2.44 cps/MBq (range 64.61-75.38 cps/MBq), respectively. The calibration factor remained stable from 3700 to 16 MBq in 208 keV peak and from 3700 to 140 MBq in 113 keV peak in the digital 3D SPECT/CT and in the conventional SPECT/CT from 3700 to 24 MBq. The reconstructed sensitivity was 12 times better in the digital 3D than in conventional SPECT/CT system. ***Conclusion:*** The calibration factors remain stable in the clinically used activity range of 177Lu therapies. The digital 3D SPECT/CT system demonstrates a sensitivity enhancement of 12-fold compared to conventional gamma-camera technology, providing a substantial advancement in SPECT/CT imaging capabilities.

OP-220

Automated determination of optimal post-reconstruction filter parameters for EARL accreditation

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Aim/Introduction: Standardized image generation and inter-laboratory standardization are necessary not only for advanced patient care and support for clinical research, but also for consistent image quality as essential to the advancement of artificial intelligence in nuclear medicine. Accreditation programs such as EARL play an important role in promoting quality assurance within nuclear medicine and ensuring the consistency of measurements. This, in turn, facilitates the development of valuable training datasets for deep learning applications. Here, we present a novel tool that fully automates the optimization of PET/CT reconstruction parameters of PET or SPECT phantoms to meet the quantitative criteria for EARL accreditation. ***Materials and Methods:*** The program uses the Python programming language. Initially, PET or SPECT images in DICOM format are imported and SUV-scaled. Using Lie thresholding, the hot spheres are automatically detected and segmented. The recovery coefficients (RCs) for the maximum and mean activity levels within the spheres are determined. With the aid of a scoring function, the variation of FWHM values for the convolution of the phantom images by a Gaussian filter allows for optimal adjustment of the recovery coefficients within the limits of the EARL accreditation requirements. The optimal FWHM can then be applied for post-reconstruction filtering in the routine acquisition protocol for EARL-compliant PET or SPECT image generation. The tool was evaluated in our former PET phantom measurements for the EARL qualification. ***Results:*** The deviation of the VOI segmentation between our tool and commercial ones is approximately 5%. The tool demonstrates robust convergence and good results with deviations of about 10% from the RCs ideally expected for EARL accreditation what was always within the confidence intervals of EARL. The time needed to determine optimal reconstruction parameters is reduced compared to manually varying parameters at the scanner console.Due to the Lie thresholding algorithm, which requires no prior knowledge of the geometries to be segmented, the program can be quickly adapted to additional geometries (such as more and or larger spheres for example for Lu-177 accreditation) and measurement methods (including quantitative SPECT/CT) as well. ***Conclusion:*** By using the

program, the quality assurance process for EARL accreditation is facilitated. This way, the acceptance and spread of such crucial standardization initiatives can be increased. We can suggest the integration of our tool into the EARL portal so that each EARL site can see whether and with which convolution parameter the EARL specifications are met before final image upload.

OP-221

New Total-Body and Long-axial Field-of-view PET Scanner Quality Control and Quality Assurance Protocol Developed at UC Davis

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Aim/Introduction: With their increasing adoption in routine clinical care and a variety of research applications, total-body (TB) and long-axial field-of-view (LAFOV) PET/CT scanners play a key role in high-performance nuclear medicine imaging. With this work we aimed to develop a new generalizable protocol for a stringent and robust quality control (QC) and assurance (QA) on the uEXPLORER TB PET scanner at UC Davis. ***Materials and Methods:*** In total we scanned more than 2,000 participants across 30 different research studies utilizing a broad range of radiotracers (e.g. $^{[18F]}$-Fluorodeoxyglucose, [68Ga]Ga-DOTATATE, $^{[18F]}$Fluciclovine, [^{11}C]-Butanol, [89Zr]-Df-Crefmirlimab) and a therapeutic agent ([90Y]-microspheres) over a 15,000-fold activity range with TB PET over the past 5 years. This work led to a stringent QC and QA protocol. ***Results:*** A. Daily detector check: A 1-minute blank scan can provide a measurement of the average LYSO detector background count-rates of the scanner. This allows a fast and efficient method of daily QC and long-term monitoring of scanner performance.B. Weekly quantification check: A uniform 68Ge cylinder can be utilized to assesses temporal quantitative accuracy as a standardized QC procedure. Acquisitions of this phantom at ≥3 axial locations across the AFOV can check quantification across the AFOV.C. Dose calibrator cross-calibration: A uniform 18F-filled phantom gives the cross-calibration factor; tracking this calibration factor over time provides an assessment of long-term temporal stability.D. Sensitivity monitoring: Measuring scanner sensitivity periodically using a line source which is longer than the scanner AFOV provides a standardized evaluation of long-term scanner performance. E. Time-of-flight QA: Acquisitions of a line source positioned axially off-center can provide an estimate of TOF calibration accuracy and could reveal detector abnormalities that may cause TOF misalignment. This QA assessment can be applied to the line source acquisitions of subsection D or performed as needed.F. Stringent quantitative accuracy and image quality monitoring: Imaging multiple NEMA image quality phantoms spanning the AFOV provides a quantitative investigation of the entire AFOV. Acquisition of this phantom data across a wide range of activity levels (e.g. from 555 to 0.5 MBq) ensures a full and thorough assessment of quantitative accuracy and image quality. ***Conclusion:*** We found that our proposed protocol ensured thorough examination of TB or LAFOV PET scanner performance and stability. We recommend this protocol be implemented on any TB or LAFOV PET scanner to facilitate reliable clinical healthcare and research.

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Clinical Oncology Track - TROP Session: Oncology & Theranostics Committee: Prostate: Staging

OP-222

^{99m}Tc-MIP-1404 SPECT/CT is promising in the detection of local lymph node metastases in subjects with newly diagnosed, high-risk prostate cancer

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Aim/Introduction: Staging at the time of diagnosis is crucial in the care of prostate cancer patients. It is established that prostate-specific membrane antigen (PSMA) PET/CT is more sensitive in detecting metastases compared to bone scintigraphy (BS) and contrast-enhanced computed tomography (CE-CT). Since not all units have access to PSMA PET/CT due to high costs and tracer availability, 99mTc-MIP-1404, a novel PSMA-targeted SPECT radiopharmaceutical, could broaden the access to PSMA imaging. The aim of this study is to prospectively compare the diagnostic performance of 99mTc-MIP-1404 SPECT/CT to conventional imaging in primary staging setting. ***Materials and Methods:*** PROSTAMIP is an ongoing investigator-initiated randomised prospective single-institution Phase III trial conducted in Turku University Hospital (EUDRA-CT 2021-000486-33; NCT06219746). It is designed to demonstrate the superiority of 99mTc-MIP-1404 SPECT/CT (PSMA arm) over CE-CT (control arm) in the detection of local lymph node metastases. Based on the proPSMA study, it was anticipated that local lymph node metastases are found in 9% and 20% of cases in the control arm and the PSMA arm, respectively (1). Using a two-sided alpha of 0.05, a beta of 0.20, and a dropout rate of 5%, a total of 320 subjects with newly diagnosed, high-risk prostate cancer (Gleason ≥4+4, PSA ≥20 and/ or cT≥3a) are randomised 1:1 into the control arm and the PSMA arm. ***Results:*** Here, we report the results of a pre-planned interim analysis conducted in December 2023. The first 100 subjects (control arm n=50, PSMA arm n=50) had a mean(SD) age of 71(8) years and a median(IQR) PSA of 14(29) ng/ml. The majority presented with an ISUP grade group 4 or 5 cancer; 22(22%), 56(56%), respectively, and clinical T3-stage or higher cancer; 54(54%).In the control arm, CE-CT detected 20 local lymph node metastases with a median

(IQR) diameter of 12 (10-13) mm in 10 (20%) subjects. In the PSMA arm, 99mTc-MIP-1404 SPECT/CT detected 48 local lymph node metastases with a median (IQR) diameter of 8.0 (6.0-11) mm in 20 (40%) subjects. ***Conclusion:*** Interim results indicate that 99mTc-MIP-1404 SPECT/CT detects more subjects with local lymph node metastases compared to CE-CT. ***References:*** 1. Hofman MS, Lawrentschuk N, Francis RJ, Tang C, Vela I, Thomas P, et al. Prostate-specific membrane antigen PET-CT in patients with high-risk prostate cancer before curative-intent surgery or radiotherapy (proPSMA): a prospective, randomised, multicentre study. Lancet (London, England). 2020;395(10231).

OP-223

Diagnostic Accuracy of Fully Hybrid PET/MRI with [^{68}Ga] Ga-PSMA-11 and [^{68}Ga]Ga-RM2 for Primary Prostate Cancer Characterization: Results from a Prospective Phase II Clinical Trial

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Aim/Introduction: The primary goal of this study consisted in the head-to-head comparison of the diagnostic accuracy of [68Ga]Ga-PSMA-11 PET, [68Ga]Ga-RM2 PET, and multiparametric (mp)MRI for the preoperative characterization of primary prostate cancer (PCa). ***Materials and Methods:*** Forty-two men with biopsy-proven high-risk PCa (median PSA: 6.66 ng/mL) were enrolled in this prospective phase II clinical trial (EudraCT: 2018-001034-18). All patients underwent [68Ga]Ga-PSMA-11 PET/MRI, with mpMRI, and 36/42 also underwent [68Ga]Ga-RM2 PET/MRI within a median of two days (range: 2 - 16 days). Twenty-five patients underwent radical prostatectomy and extended lymphadenectomy (ePLND), while only 23/36 patients examined with [68Ga]Ga-RM2 PET/MRI underwent surgery. Two Nuclear Medicine physicians reviewed all PET examinations and mpMRI was interpreted by a radiologist using PI-RADS v2 criteria. Histopathological samples gathered at biopsy were used to validate intraprostatic findings, while the histopathological assessment of lymph nodes after ePLND was used as ground truth for regional lymph nodes involvement. Patient level sensitivity was used as primary endpoint for the diagnostic accuracy of imaging modalities at the intraprostatic level, while overall accuracy, sensitivity, specificity, positive predicted value (PPV) and negative predictive value (NPV), along with their 95% CI, were used to evaluate imaging performance for the detection of regional lymph nodes involvement. ***Results:*** [68Ga]Ga-PSMA-11 PET and mpMRI identified at least one intraprostatic cancer lesion in all patients , while [68Ga]Ga-RM2 PET was positive in 33/36 patients. [68Ga]Ga-PSMA-11 PET showed regional lymph nodes involvement in 5/25 patients, 3 confirmed by histology. Five out of 25 patients were also positive at mpMRI for N staging (2 true positives). [68Ga]Ga-RM2 PET identified 2/23 patients with lymph nodes involvement that were later confirmed as true positives by histology. The pathological assessment of the resected lymph nodes showed 5/25, 6/25, and 4/23 false negative findings for [68Ga]Ga-PSMA-11 PET, mpMRI, and [68Ga]Ga-RM2 PET, respectively. Detailed results for N staging in Table 1. ***Conclusion:*** All imaging modalities showed high sensitivity for the localization of primary PCa. [68Ga]Ga-PSMA-11 PET was the most sensitive modality for the identification of pathologic pelvic lymph nodes, while [68Ga]Ga-RM2 PET showed the highest specificity in this setting.

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^{18}F-Flotufolastat PET/MR in suspicious prostate cancer: correlation with histopathological biopsy-results

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Aim/Introduction: Several studies have proven that prostate-specific membrane antigen (PSMA) positron emission tomography/magnetic resonance imaging (PET/MRI) exceeds the results of solo use of multiparametric (mp) MRI in the primary detection of prostate cancer (PC). Therefore, the aim of this retrospective study was to determine the detection efficacy of 18F-flotufolastat (formerly 18F-rhPSMA-7.3) PET/MRI using the recently introduced PRIMARY score for PET assessment of tumour lesions in correlation to results from biopsy. ***Materials and Methods:*** In total, 72 patients (median pre-scan PSA 10.1 ng/mL) undergoing clinically indicated 18F-flotufolastat PET/MRI were included. 18F-Flotufolastat PET and MR-images of the prostate were read independently using the PRIMARY and MR-PIRADS score. Imaging scores on patient-basis were compared to transperineal biopsy results (clinically significant (cs) PC ISUP ≥ 2) performed at a median time interval of 42 days (range 10-265 days) after PET. Diagnostic performance parameters were calculated and ROC-analyses were performed on a patient-basis. ***Results:*** In total, 20 (27.8%) patients were recorded as csPC. Sensitivity, specificity, PPV and NPV were 85.0%, 82.7%, 65.4% and 93.5% for PRIMARY score and 85.0%, 50.0%, 39.5% and 90.0% for MR-PIRADS score, respectively. Using combined PET and MRI, sensitivity, specificity, PPV and NPV were 95.0%, 42.3%, 38.8%, 95.7%, respectively. ROC analysis revealed an AUC of 0.86 (95% CI 0.76-0.93), 0.74 (95% CI 0.62-0.84) and 0.80 (95% CI 0.69-0.89) for PRIMARY score, Pi-RADS-score and combined PET/MRI score, respectively. The comparison of PRIMARY and Pi-RADS to PET/MRI ROC-curves did not reach significance (p=0.14 vs. 0.18) whereas the comparison between both scores was statistically significant (p=0.08). ***Conclusion:*** The PRIMARY score for detecting biopsy-proven primary PC lesions on 18F-flotufolastat PET outperformed sole mpMR imaging using Pi-RADS score showing higher diagnostic performance parameters. Thus, the PRIMARY score should be considered when interpreting intraprostatic PSMA PET images.

OP-225

Pre-operative detection of extraprostatic tumor extension in patients with primary prostate cancer undergoing [68Ga]Ga-PSMA PET/MRI: A post-hoc machine learning analysis of the RAPID trial

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Aim/Introduction: Radical prostatectomy (RP) is widely used as an initial treatment for patients with localized prostate cancer (PCa), of which nerve-sparing surgery patterns are highly recommended to preserve quality of life. However, the precise

pretreatment identification of extraprostatic extension (EPE) is still a huge challenge, often resulting in less than optimal treatment strategies. Machine learning (ML) is emerging as a beneficial tool for improving preoperative EPE detection by integrating various types of data non-invasively or minimally invasively. ***Materials and Methods:*** A post-hoc analysis of the cohort from a prospective clinical trial (NCT02659527) was conducted, which included 131 patients undergoing [68Ga]Ga-PSMA-11 PET/MRI from 2014 to 2019. We gathered comprehensive preoperative data, such as PET-derived features, blood-based markers, histology-derived parameters, and patient demographics. We developed ML models using both non-invasively and invasively acquired features to detect EPE, and compared these models against traditional PET imaging analysis. 100-fold Montre Carlo cross-validation was used to ensure the robustness of ML models. ***Results:*** The cohort comprised 77 patients, 44 of whom (57%) had EPE confirmed by postoperative analysis. The ML models outperformed conventional PET imaging, with the explainable boosting machine (EBM) model reaching an AUC of 0.88. Additionally, the ML model incorporating invasive features showed enhanced predictive accuracy for EPE compared to conventional visual assessments (AUC 0.88 vs. 0.71, p=0.02), while the difference in AUCs between the ML model with non-invasive features and visual assessments was not statistically significant (AUC 0.83 vs. 0.71, p=0.34). ***Conclusion:*** Employing explainable ML models that utilize routinely collected clinical data can significantly enhance the detection of EPE in patients with PCa before surgery, potentially leading to more precise clinical staging, informed treatment decisions, and improved outcomes for patients. ***References:*** 1. Mottet N, van den Bergh RCN, Briers E, Van den Broeck T, Cumberbatch MG, De Santis M, et al. EAU-EANM-ESTRO-ESUR-SIOG Guidelines on Prostate Cancer-2020 Update. Part 1: Screening, Diagnosis, and Local Treatment with Curative Intent. Eur Urol. 2021;79:243-62. 2. Costello AJ. Considering the role of radical prostatectomy in 21st century prostate cancer care. Nat Rev Urol. 2020;17:177-88.

OP-226

Focal unspecific bone uptake on [18F]PSMA1007 PET: evaluation analog PROMISE criteria and validation via PET/CT follow-up

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Aim/Introduction: Focal unspecific bone uptake (UBU) is commonly observed in [18F]PSMA1007 PET/CT, a trend that is escalating with the adoption of advanced digital PET systems and whole-body PET/CT-scanners. Nevertheless, the clinical significance of these findings remains elusive, contributing to uncertainty in many cases, potentially leading to over- or undertreatment of patients. ***Materials and Methods:*** 99 patients (age 69±7 years) with histologically confirmed prostate cancer underwent [18F]PSMA1007 PET/CT for staging with a standardized protocol (3 MBq/kg; 70±14 min p.i.). The prevalence of UBU (defined using miPSMA-score analogous PROMISE criteria) and bone metastases was assessed and correlated with various imaging and clinical parameters such as serum PSA and Gleason score. Subsequently, all patients underwent a follow-up [18F] PSMA1007 PET/CT after 13.0 ± 7.2 months to ascertain the nature of the UBUs. ***Results:*** On initial PET/CT, 230 lesions in 56 patients were classified as UBU (without presence of bone metastasis). 19 patients had bone metastases, while 24 patients had no focal bone uptake. The UBU distribution by site was as follows: ribs 50%, spine 30%, pelvis 15%, and other sites 5%. There were no significant differences in age, Gleason score, injected tracer dose, uptake time, or mean uptake in the spleen and parotid gland between patients with and without UBU. However, serum PSA were significantly higher in both patients with UBU ($p = 0.027$) and patients with bone metastases ($p = 0.014$) compared to patients without focal bone uptake. Mean blood pool uptake was lower in the prevalence of UBU ($p < 0.001$). Follow-up evaluation showed no change in miPSMA-score and CT appearance in 43 patients, regression of miPSMA (without systemic treatment) in 6 cases, and new bone metastases in 7 patients (13%). Patient-specific analysis indicated that 4 bone metastases were newly formed, while 3 initially appeared as UBU. Among patients without focal uptake on initial PET/CT, 4 patients developed osseous metastases on follow-up (17%). ***Conclusion:*** Our study underscores the lack of significant differences between patients with or without UBU concerning various imaging and clinical parameters. Furthermore, only a small fraction of the detected UBUs turned out to be metastases over time (5%). This proportion is lower than the likelihood of developing new osseous metastases, which also appears to be independent of the presence of UBU. Therefore, our data suggest that the presence of UBU, analogous to the PROMISE criteria, does not influence the development of osseous metastases over time.

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PSMA based Indocyanine Green for Image-Guided Enhanced Tumor Theranostics

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Aim/Introduction: We have developed a new nuclear-fluorescence molecular probe based on PSMA and evaluate the ability of this probe to guide prostate cancer (PCa) targeted resection in real-time, objectively, with high sensitivity, and specificity; simultaneously to evaluate whether 177Lu-XY-PSMA-ICG can improve the tumor uptake and therapeutic efficacy of PCa, as well as its toxic side effects. ***Materials and Methods:*** The in vitro PSMA-targeting efficiency of XY-PSMA-ICG, the reference PSMA-617, and their corresponding 68Ga- counterparts were determined in PC3-PIP cells via competitive binding assays (IC50) and dual-tracer radioligand and fluorescence internalization studies. Biodistribution and small-animal PET imaging studies were performed in PC3 and PC3-PIP xenograft-bearing mice, respectively, and complemented by intraoperative far-red fluorescence imaging. Radioligand therapy studies were conducted to systematically assess the therapeutic effect of 177Lu-XY-PSMA-ICG. ***Results:*** No obvious abnormalities were observed through the H&E-stained section of organs after injection of 120mg/kg XY-PSMA-ICG. XY-PSMA-ICG showed high binding affinity (IC50 = 5.871 nM) to PSMA in vitro, which was comparable with that of PSMA-617 (IC50 = 27.49 nM). 68Ca- XY-PSMA-ICG demonstrated excellent uptake in PSMA-positive cells in vitro, with more than 50% internalization at 2 h for each PSMA-positive cell line with uptake correlating to PSMA expression levels. Tumor uptake of 68Ga-XY-PSMA-ICG was higher than 68Ga-PSMA-617 in 1h , 2h, and 4h , but there was no statistically different (all $P>0.05$). XY-PSMA-ICG obviously aggregated in the tumor site of the mouse model, and its fluorescence intensity was stable within 24 h. Meanwhile, compared with the treatment of saline or 7.4 MBq of 177Lu-XY-PSMA-ICG, the groups treated

with 18.5 MBq or 29.6 MBq of 177Lu-XY-PSMA-ICG, respectively, showed remarkable suppression of tumor growth. 177Lu-XY-PSMA-ICG with high specific activity induced superior tumor growth inhibition without subacute hematologic toxicity, the same as the groups of 177Lu-PSMA-617. ***Conclusion:*** We present a novel XY-PSMA-ICG ligand, which showed excellent radiolabeling characteristics, high selectivity towards PSMA receptors in vitro, and favorable tumor accumulation in PSMA positive PC3-PIP tumor-bearing mice. These characteristics make XY-PSMA-ICG have the potential to become an integrated probe for prostate cancer diagnosis and treatment, and pave the way for its further development and clinical application. ***References:*** 1. Kiess AP, et al. Auger Radiopharmaceutical Therapy Targeting Prostate-Specific Membrane Antigen. J Nucl Med 2015; 56(9): 1401-1407.2.Fu H, et al. A novel PSMA targeted dual-function near-infrared fluorescence and PET probe for the image-guided surgery and detection of prostate cancer. Eur J Nucl Med Mol Imaging 2023.

OP-228

Comparison of PSMA-PET/CT and Whole-Body MRI for Staging and Restaging in Prostate Cancer Patients: a Prospective Single-Centre Study

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Aim/Introduction: PSMA-PET and Whole-body MRI (wbMRI) are accurate techniques for local PCa staging and to identify distant bone, lymph node, and visceral metastases. Despite wbMRI efficacy, a lack of robust recommendations for its integration into routine clinical practice still remains. This study aims to compare the diagnostic performance of PSMA-PET-CT and wbMRI in detecting PCa localizations in two patient groups: those with high-risk PCa (staging) eligible for radical treatment and those experiencing biochemical recurrence (BCR) following radical therapies. ***Materials and Methods:*** Prospective single-centre study enrolling PCa patients undergoing both PSMA-PET-CT and wbMRI within a 2-month timeframe for staging or BCR. No PCa treatments were allowed between PSMA-PET and wbMRI. Independent readers reviewed the images: 2 nuclear medicine physicians for PET images and 2 radiologists for wbMRI. The concordance of both techniques in assessing local or residual disease (T-Tr), local (N) and distant (M1a) lymph node, bone (M1b) and visceral (M1c) metastasis was evaluated using Cohen's kappa. In patients subsequently treated with radical prostatectomy (RP), sensibility, specificity, positive predictive value (PPV), negative predictive value (NPV) and accuracy of PSMA-PET and wbMRI were compared, using histopathology as gold standard. ***Results:*** A total of 62 patients were enrolled (median age 70 years): 41/62 (66%) newly diagnosed PCa and 21/62 (34%) BCR. PSMA-PET and wbMRI were performed within a median timeframe of 18 days (IQR 8-29). Overall, PSMA-PET was positive for PCa in 46/62 (74%) patients and wbMRI in 46/62 (74%). PSMA-PET up-staged and down-staged in 5% (3/62) and in 5% (3/62) respectively if compared to wbMRI. The concordance between PSMA-PET-CT and wbMRI for T-Tr, N, M1a, and M1b was 0.84, 0.88, 0.86 and 0.44, respectively (Cohen's kappa). Among the staging cohort, 23/41 (56%) patients underwent subsequent RP. In those patients, PSMA-PET and wbMRI sensitivity for local disease (T) was 96% vs 100% while PPV 100% vs 100%. Furthermore, for pelvic nodes involvement (N) sensitivity was 44% vs 44%, specificity 100% vs 93%, PPV 100% vs 80%, NPV 74% vs 72% and accuracy 78% vs 74%. ***Conclusion:*** Although based on a limited sample size, both PSMA-PET and wbMRI demonstrated high agreement in detecting local disease (T and N) and distant lymph nodes involvement (M1a), while a partial agreement was observed for bone disease. Notably, wbMRI outperformed PSMA-PET-CT for local disease detection, whereas PSMA-PET-CT was superior in nodal metastasis detection showing high specificity, PPV, NPV and accuracy.

OP-229

Comparative whole-body multi-parametric [^{68}Ga]Ga-PSMA-11 and [^{18F}]PSMA-1007 PET/CT: a randomised and prospective intra-individual comparison of tracer dynamics

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Aim/Introduction: This sub-study compares intra-individual [18F] PSMA-1007 and [68Ga]Ga-PSMA-11 for healthy organs and target lesions to see if parametric analysis might reveal insights into in vivo radiopharmaceutical behaviour and in the characterisation of malignant tissues. ***Materials and Methods:*** 10 patients with biochemically recurrent prostate cancer underwent both [68Ga]Ga-PSMA-11 (PSMA-11) or [18F]PSMA-1007 (PSMA-1007) PET/CT in randomised order as part of planned sub-analysis of a prospective comparative imaging trial (NCT05079828); trial entry and exclusion criteria are as previously published. Dynamic scans were acquired from 0 to 60 minutes using a long-axial field-of-view PET/CT with static imaging performed at 2h p.i. Healthy tissue and lesion segmentation was performed by a board certified nuclear medicine physician using 40% iso-contour where appropriate. Following model selection, data were fitted using a reversible two-tissue compartment (2TC) model. Non-specific activity at ganglia and foci of unspecific bone uptake (UBU) were also included. Values were compared using paired t-tests. ***Results:*** Preliminary analysis of the target lesions showed no statistically significant differences in tracer delivery (K1) for any tissue type or organ. Faster (non-significant) binding was observed for K3 for PSMA-11, but also with faster K4, suggesting reversible kinetics. For PSMA-1007 K4 was very low for all lesion types, in-keeping with irreversible kinetics. For all lesions, including UBU, no significant differences were seen for the specific distribution volume (Vs) suggesting that non-specific binding is not the cause of the higher frequency of UBU seen in PSMA-1007 or of ganglia in PSMA-11. For net influx Ki statistical significance was reached for nodal ganglia and borderline higher net influx for local recurrence (p=0.08) for PSMA-11. ***Conclusion:*** Parametric analysis showed no clear differences between specific (e.g. bone metastases) and non-specific (e.g. UBU) findings. Differences in kinetics were seem with reversible kinetics for PSMA-11 and irreversible kinetics for PSMA-1006 with a statistically significant higher net-influx Ki for ganglia in PSMA-11. ***References:*** Alberts I, Bütikofer L, Rominger A, Afshar-Oromieh A (2022) A randomised, prospective and head-to-head comparison of [68Ga]Ga-PSMA-11 and [18F]PSMA-1007 for

the detection of recurrent prostate cancer in PSMA-ligand PET/CT—Protocol design and rationale. PLoS ONE 17(7): e0270269. https://doi.org/10.1371/journal.pone.0270269.

OP-230

Context-Level Machine Learning to Improve the Identification of Lymph Node and Bone Metastases in Prostate Cancer Patients Using F^{18}-PSMA-1007-PET

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Aim/Introduction: Advanced imaging techniques, such as prostate-specific membrane antigen (PSMA)-PET/CT, have improved the detection of primary tumours and metastases in prostate cancer. However, interpreting F^{18}-PSMA-1007 PET/CT scans can be challenging due to the occurrence of aspecific uptake in lymph nodes and bones. Machine learning has proven its suitability to use a large number of features to model complex non-linear relations leading to accurate diagnosis. Our aim was to develop a machine learning method that includes context-level features to better identify lymph node and bone metastases in prostate cancer patients using F^{18}-PSMA-1007 PET. ***Materials and Methods:*** We retrospectively included 110 patients who underwent F^{18}-PSMA-1007 PET/CT, in whom focal uptake was observed by visual evaluation in bone structures (n=290) and lymph nodes (n=273). These uptakes were labelled as either malignant or non-malignant by two experienced nuclear medicine physicians using all available imaging and clinical data and the interpretation of these data at multidisciplinary meetings, as reference. Three machine learning models: Random Forest, Decision Tree, and K-Nearest Neighbors, were trained and evaluated across two levels of features. The first level incorporates basic uptake-specific features, such as SUVmax, the anatomical location of the focal uptake, and the tissue type of the location (bone/lymph node). The second level includes context-level features as well. This method uses, for example, the SUVmax of the primary tumour and the number of uptake regions in bone and lymph nodes to identify a specific metastatic bone lesion and/or lymph node. The diagnostic performance of the models was evaluated using the area under the curve (AUC), specificity, and sensitivity. ***Results:*** The Random Forest (RF) model outperformed the Decision Tree and K-Nearest Neighbors models in at least two of the evaluation metrics ($p<0.001$), for both the basic and context-level approach. The RF-model using context-level features outperformed the RF-basic model in terms of the AUC (0.91 vs 0.96, $p<0.001$), specificity (0.79 vs 0.86, $p<0.001$), and sensitivity (0.85 vs 0.91, $p<0.001$). ***Conclusion:*** We successfully developed a classifier to identify lymph node and bone metastases in prostate cancer patients using F-18-PSMA-1007 PET. The results underscore the potential of leveraging context-level information in machine learning methods to improve identification of metastases, potentially leading to improved diagnosis and ultimately a better treatment strategy for the patient.

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Sunday, October 20, 2024,16:45 - 18:15
Hall Y10-Y12

TROP Session: Inflammation & Infection Committee: FAPI in Inflammation & Infection

OP-231

Role of the Fibroblast Activation Protein as biomarker of fibrotic lung diseases: interim analysis of a prospective exploratory multi-cohort study

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Aim/Introduction: Pulmonary fibrosis entails a spectrum of different clinical entities characterized by irreversible destruction of the alveolar wall, leading eventually to respiratory failure.(1) Despite the development of antifibrotic treatments, overall survival rates remain low and good predictive and prognostic biomarkers are lacking.(2) The aim of this study is to evaluate the value of the fibroblast activation protein (FAP) as a biomarker of fibrotic lung diseases with FAPI PET/CT as noninvasive measurement tool. ***Materials and Methods:*** This is a prospective exploratory multi-cohort study including patients with idiopathic and non-idiopathic progressive pulmonary fibrosis. FAP was measured in blood samples and bronchoalveolar lavage (BAL) specimens of patients starting a treatment or suffering a disease exacerbation. A [18F]FAPI-74 or [68Ga]FAPI-46 PET/CT was performed at different time points. Quantitative PET parameters were compared before and during treatment. Finally, uptake values were compared to the clinical evolution of the patient in terms of pulmonary function tests. ***Results:*** At the time of the interim analysis, 28 patients underwent a baseline FAPI PET/CT which was repeated after treatment initiation in 21 of these patients. A significant negative correlation was found between the SUVmean value and the forced vital capacity (FVC) and diffusing capacity (DL) of the lungs at baseline ($r = -0,47$; $p=0,04$ and $r=-0.52$; $p=0.02$ respectively). SUVmean values were significantly higher in patients suffering from a disease exacerbation compared to patients with stable disease ($p = 0.002$). No significant differences of PET uptake values were detected between the scans at baseline versus at 3 months post-antifibrotic treatment. However, when correlated to the clinical evolution of the patient, a significant strong negative correlation was found between the change in SUVmean and the change in DL after 3 months of antifibrotic treatment (n=8; $r=-0.87$; $p=0.005$). ***Conclusion:*** Preliminary results point out that FAPI PET/CT can be used as a noninvasive tool to monitor disease activity in different clinical entities of the pulmonary fibrosis spectrum, given the correlation of PET uptake values with the lung function of the patient. Further inclusion and follow-up of patients is ongoing to evaluate if PET parameters at baseline can separate progressors vs non progressors, and thus to confirm the prognostic value of FAPI PET/CT. ***References:*** 1. Wijsenbeek M, Cottin V. Spectrum of Fibrotic Lung Diseases. N Engl J Med. 2020;383(10):958-68. 2. Cottin V et al. Presentation, diagnosis and clinical course of the spectrum of progessive-fibrosing interstitial lung diseases. Eur Respir Rev. 2018; 27(150):180076.

OP-232

A Head-to-Head Comparison of [^{68}Ga]Ga-FAPI-04 PET/CT and 2-[^{18F}]FDG PET/CT in Patients with Idiopathic Pulmonary Fibrosis

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Aim/Introduction: Pulmonary fibrosis represents the terminal stage of a group of lung diseases characterized by extensive proliferation of fibroblasts, significant accumulation of extracellular matrix, accompanied by inflammatory damage, and structural tissue destruction. Activated fibroblasts play a pivotal role in the pathogenesis and progression of pulmonary fibrosis. The aim of this article is to explore the value of [68Ga]Ga-FAPI-04 PET/CT in assessing the inflammatory activity status of pulmonary fibrosis and compare it with the clinical PET gold standard 2-[^{18F}]FDG PET/CT, offering a novel approach for evaluating the active status of pulmonary fibrosis and post-treatment efficacy assessment. ***Materials and Methods:*** Twenty-two patients diagnosed with pulmonary fibrosis, with approval from the Ethics Committee of Peking Union Medical College Hospital and informed consent, underwent [68Ga]Ga-FAPI-04 and 2-[^{18F}]FDG PET/CT scans within a week. Dynamic imaging at 1 hour post-injection was performed for the initial five patients with [68Ga]Ga-FAPI-04 PET/CT. All patients received anti-fibrotic treatment, and [68Ga]Ga-FAPI-04 PET/CT follow-up was conducted 3-6 months after treatment. Semi-quantitative analysis was conducted, measuring the mean standardized uptake value (SUV), maximum SUV (SUVmax), and tumor metabolic volume parameters (MTV), comparing the uptake patterns of the two imaging agents within pulmonary fibrotic lesions, and integrating high-resolution CT scans and pulmonary function results for analysis. ***Results:*** Dynamic imaging of the initial five patients revealed that the optimal imaging time for [68Ga]Ga-FAPI-04 PET/CT in pulmonary fibrotic disease was 15-20 minutes post-injection. Significant differences were observed in uptake values between [68Ga]Ga-FAPI-04 and 2-[^{18F}]FDG PET/CT ($P < 0.0001$). Comparing the correlation with HRCT and pulmonary function parameters, the [68Ga]Ga-FAPI-04 PET/CT detection of fibrotic lesion SUVmax exhibited a positive correlation with the FVC pulmonary function parameter ($r = 0.61$, $p < 0.05$), while the 2-[^{18F}]FDG PET/CT detection of fibrotic lesion SUVmax showed a notable correlation with FVC ($r = 0.22$, $p = 0.05$). Among the fifteen follow-up patients, eight showed decreased FAPI PET uptake post-treatment, five exhibited marginal changes in FAPI uptake post-treatment compared to pre-treatment, and two displayed a notable increase in FAPI uptake compared to pre-treatment. For 2-[^{18F}]FDG PET, twelve patients showed minimal changes pre- and post-treatment, while three patients exhibited increased 2-[^{18F}]FDG uptake during the follow-up compared to pre-treatment. ***Conclusion:*** Compared to 2-[^{18F}]FDG PET/CT, [68Ga]Ga-FAPI-04 PET/CT provides a more comprehensive reflection of the active status of pulmonary fibrosis and allows for a better assessment of treatment efficacy.

OP-233

Anatomical pattern of entheseal and synovial fibroblast activation in psoriasis patients and its risk for developing psoriatic arthritis

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Aim/Introduction: To assess the presence and anatomical distribution of activated fibroblasts in the joints and entheses of high-risk psoriasis patients and to test how fibroblast activation visualized by 68Ga-FAPI-04-PET/CT correlates with clinical tenderness, musculoskeletal ultrasound findings and progression to PsA. ***Materials and Methods:*** We conducted a prospective cohort study in patients with psoriasis and arthralgia who underwent clinical and ultrasound evaluation and whole-body PET/CT imaging with 68Gallium-labeled Fibroblast Activation Protein Inhibitor (68Ga-FAPI)-04. 68Ga-FAPI-04 uptake at synovial and entheseal sites was assessed by maximal standardized uptake values (SUVmax) and PET/CT Joint Index (JI); logistic regression models were used to investigate its correlation with clinical and ultrasound findings. Survival analyses were performed on patients with at least 6 months of follow-up. ***Results:*** Thirty-six psoriasis patients were enrolled. 68Ga-FAPI-04 uptake was found in 318 (7.9%) joints and 369 (7.3%) entheses in 29 (80.6%) participants, with a mean SUVmax (SD) of 3.2 (1.8) for joints and 2.9 (1.6) for entheses. Large joints and the lower limbs were predominantly affected. A significant positive relationship was found between 68Ga-FAPI-04-PET/CT signal intensity and the 68 tender joint count (SUVmax: $p < 0.001$; PET/CT-JI: $p < 0.001$) and tender entheses count (SUVmax: $p < 0.001$; PET/CT-JI: $p = 0.002$). No correlations were found with ultrasound findings (SUVmax: $p = 0.969$; PET/CT-JI: $p = 0.720$). Patients with relevant synovio-entheseal 68Ga-FAPI-04 uptake showed a statistically significant higher risk of developing PsA ($p = 0.02$), independent of ultrasound findings ***Conclusion:*** Patients with Psoriasis presenting with arthralgias show localized signs of resident tissue activation in joints and entheses, which are associated with higher risk of developing PsA.

OP-234

68Ga-FAPI PET/CT for non-invasive characterization of ulcerative colitis and Crohn´s disease

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Aim/Introduction: Inflammatory Bowel Disease (IBD), represents a spectrum of chronic inflammatory conditions of the gastrointestinal tract (GIT) including ulcerative colitis (UC) and Crohn´s disease (CD). Management of IBD necessitate the use of various diagnostic modalities to assess disease activity, extent, and complications. Positron Emission Tomography (PET) imaging utilizing fibroblast activation protein inhibitor (FAPI) has emerged as a promising tool for detecting activated fibroblasts. Given the role of fibroblast activation and tissue remodeling in the pathophysiology of IBD, we aimed to explore the potential of FAPI-PET for IBD. ***Materials and Methods:*** PET/CT (1 h post injection) with 68Gallium-labelled Fibroblast Activated Protein

Inhibitors (68Ga-FAPI-PET/CT) were applied in 19 consecutive patients with pathologically confirmed IBD and a gender- and age-matched control group of 11 patients without IBD. Volumes of interest (VOIs) of standardized healthy GIT structures and visually FAPI-avid GIT-lesions were delineated using an isocontour tool. Uptake parameters (SUVmax and SUVmean) were extracted and analyzed with regard to differences between IBD entities and IBD disease activity status of patients (based on coloscopy findings and clinical parameters). ***Results:*** 11 patients had UC, 7 CD and 1 colitis indeterminata. CD patients showed a tendency towards increased uptake in the healthy appearing ileum compared to UC patients and controls. The uptake of the other physiological gastrointestinal structures did not show significant differences between IBD patients and the control group. Visually discernable FAPI-avid lesions of IBD patients showed overall high FAPI-uptake (SUVmax: 5.0 +/- 2.6, SUVmean: 2.6 +/- 1.1). Lesions of CD patients showed higher uptake (SUVmax 5.4 +/- 3.4; SUVmean 2,7 +/- 1.6) than those of UC patients (SUVmax 3.9 +/- 3.6; SUVmean 2.3 +/- 1.7). With respect to localization, ileum lesions showed markedly increased uptake in CD patients (SUVmax 6.9 +/- 3.7; SUVmean 3.5 +/- 1.7) compared to UC patients (SUVmax 2.0 +/- 0; SUVmean 1.2 +/- 0) and similarly colon lesions (CD: SUVmax 6.3 +/- 1.6; SUVmean 2.7 +/- 0.5; UC: SUVmax 3.7 +/- 2.0; SUVmean 2.1 +/- 0.9). Lesions of patients with active IBD showed higher uptake (SUVmax 5.2 +/-2.5; SUVmean 2.7 +/- 1.1). than lesions of patients with clinically inactive disease (SUVmax 3.0 +/- 1.6; SUVmean 1.6 +/- 0.8). ***Conclusion:*** Our findings suggest a potential role for FAPI-PET as a new imaging tool for assessing inflammatory activity in both UC and CD. Further research involving larger cohorts is warranted to validate the clinical value of FAPI-PET in IBD.

OP-235

Assessing Crohn's Disease with^{68}Ga-FAPI-04 PET/CT:in comparison with^{18}F-FDGPET/CT

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Aim/Introduction: Crohn's Disease (CD) is a chronic granulomatous inflammatory disease involving gastrointestinal tract .We performed a prospective cohort study to compare the diagnostic performance of 68Ga-FAPI-04 and 18F-FDG PET/CT, as well as their correlation with disease activity of CD. ***Materials and Methods:*** Seventeen CD patients were included. Gold standard was defined as the gastrointestinal lesion showing positivity on at least two of the diagnostic methods (endoscopy, CTE, ultrasound or PET/CT) was considered as true positive lesion. Quantitative measurement of gastrointestinal lesions was measured as metabolic intestinal lesions volume (MIVFDG for 18F-FDG and MIVFAPI for 68Ga-FAPI-04) and total intestinal lesions uptake (TIUFDG for 18F-FDG and TIUFAPI for 68Ga-FAPI-04). ***Results:*** PET/CT diagnostic performance The sensitivity and specificity of 68Ga-FAPI-04 were 90.0% and 93.0%, while those of 18F-FDG were 85.0% and 88.4% (Table 1). In ROC curves, the AUC and 95% confidence interval (CI) for the detection of affected segments with 68Ga-FAPI-04 and 18F-FDG PET/CT were 0.92 (CI, 0.83-0.97, P<0.001) and 0.87 (CI, 0.78-0.93, P<0.001), respectively. 68Ga-FAPI-04 PET/CT showed slightly better diagnostic performance compared with 18F-FDG(P =0.043). Comparison of the uptake between different types of lesions Among all the affected segments, 22/40 of them were stricture/fistula lesions and 18/40 were non-stricture/fistula lesions. The SUVmax of 68Ga-FAPI in stricture/fistula lesions were significantly higher than those in non-stricture/fistula lesions (10.9±6.7 vs 5.0±3.5, P=0.0002). The same result was also observed in the SUVmax of 18F-FDG (stricture/fistula vs non-stricture/fistula lesions: 9.5±4.9 vs 5.3±1.8, P=0.0016). There were 8 patients received medicine therapy before PET/CT scan, and the remaining 9 patients were without pre-therapy. The SUVmax of 68Ga-FAPI-04 showed no difference between patients with and without pre-therapy (12.1±9.7 vs12.2±4.7, P=0.541). The SUVmax of 18F-FDG was higher in patients without pre-therapy than those with (11.8±3.9 vs 8.6±6.0), but this difference was not statistically significant(P=0.075). Correlations of PET/CT with other biomarkers TIUFAPI and MIVFAPI were significantly correlated with CRP (P=0.045 and P=0.016), and MIVFAPI significantly correlated with simple endoscopic score for CD (SES-CD) (P=0.036). Only TIUFDG and MIVFDG were significantly correlated with SES-CD (P=0.04 and P=0.04). Other biomarkers including ESR, CDAI and simplified CDAI was not correlated with any semiquantitative indexes of PET/CT (P>0.05). None of the semiquantitative parameters in 68Ga-FAPI-04 and 18F-FDG PET/CT showed difference between low disease activity and moderate to high activity groups (P>0.05). ***Conclusion:*** 68Ga-FAPI-04 PET/CT showed slightly better diagnostic performance compared with 18F-FDG.

OP-236

Comparative Assessment of Ga 68 FAPI PET/CT and F^{18} FDG PET/CT in Takayasu Arteritis: Insights into Inflammatory Disease Activity

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Aim/Introduction: Takayasu Arteritis (TA) a rare inflammatory disorder affecting large arteries, presenting with nonspecific symptoms and potential arterial occlusion. Molecular imaging advancements promise in improving the detection and management of Large Vessel vasculitis. F^{18} FDG PET/CT commonly used for evaluating inflammatory conditions, including arterial inflammation. However, its lack of specificity and limited utility in monitoring clinical response has led to interest in novel PET radiotracers targeting immune cells. Fibroblast activation protein (FAP) Alpha, expressed on activated fibroblasts, plays a role in various pathological processes. FAPI, a small molecule inhibitor selectively binding to FAP-alpha and labelled with a radioactive isotope, has shown promise in diagnosing and monitoring inflammatory diseases. This study evaluates Ga 68 FAPI PET/CT's role in assessing TA activity, comparing it with standard techniques. ***Materials and Methods:*** The study involved examination of 20 patients, focusing on demographic information and medical history. F^{18} FDG PET/CT scans done, followed by Ga68 FAPI PET/CT scans within a week for comparison, adhering to the same scan protocol. SUV max of the affected vessels was gathered from both scans. The Wilcoxon signed-rank test was applied to analyze the SUV max from both scans using SPSS software. ***Results:*** The mean age of the patients was 30 years. 15 patients (75%) were female. 8 (40%) patients had disease activity on FDG PET/CT, whereas 15 (75%) patients had vascular uptake on FAPI /PET/CT. We evaluated 9 major arteries in all the patients. 24 out of 180 arteries (13%) showed inflammatory activity on FDG. 35 arteries (19.4%) had uptake on FAPI. The mean SUV max on FDG PET/CT was 3.23 (range: 2.4-4.5, standard deviation [SD]: 0.68), while on FAPI PET/CT, it was 3.44 (range: 1.5-7.88, SD: 1.76). Compared to FDG, FAPI detected arterial involvement in 11 arteries and had 40 % higher SUV max. 12 patients had no disease activity on the F^{18}

FDG PET/CT. 8 (58.8%) showed ongoing fibrosis on FAPI PET/CT, indicating a significant difference (p-value: 0.016). ***Conclusion:*** F^{18} FDG PET/CT is TA's standard of care functional imaging. This study highlighted the superiority of Ga 68 FAPI PET/CT over F^{18} FDG PET/CT in identifying vascular involvement in Takayasu Arteritis. Higher uptake with lower background FAPI uptake results in the detection of more vessels on FAPI. Ongoing fibrosis on FAPI PET was observed in a few patients without inflammatory activity on FDG PET. This phenomenon needs evaluation in prospective studies to assess long-term outcomes.

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Distinct uptake of ^{68}Ga-FAPI and ^{18}F-FDG in the two subtypes of IgG4-related disease

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Aim/Introduction: IImmunoglobulin G4-related disease (IgG4-RD) is a highly heterogeneous autoimmune disease. Recently, two subtypes of IgG4-RD, proliferative type and fibrotic type were defined according to patients' clinicopathological characteristics. As we previously found significant 68Ga-FAPI uptake in IgG4-RD, which might be related to the pathogenesis of fibrosis, we further wonder if there is different manifestation of 68Ga-FAPI and 18F-FDG uptake in these two subtypes of IgG4-RD. ***Materials and Methods:*** We retrospectively selected treatment-naïve newly diagnosed patients with IgG4-RD in our prospectively recruited cohort from March 2019 to February 2024. Patients were classified into proliferative type or fibrotic type according to the involved organs. The SUVs of IgG4-RD lesions were measured and blood pool was regarded as background (TBR=lesion SUVmax/blood pool SUVmax). To compare the 68Ga-FAPI and 18F-FDG uptake in the two subtypes, PET index of certain involved organ was defined as the quotient of the SUVmax or TBR of 68Ga-FAPI and 18F-FDG in the lesion; and PET index of an individual patient were calculated as a sum of PET indexes of the involved organ. ***Results:*** Thirty-six patients with newly diagnosed IgG4-RD were included (28 proliferative subtype, 8 fibrotic subtype). Serum IgG4 levels in proliferative subtype patients was significantly higher than that in fibrotic subtype (Table). When comparing 68Ga-FAPI and ^{18}F-FDG uptake in different involved organs, the SUVmax and TBR of 68Ga-FAPI of the lesions in the pancreas, bile duct/liver, submandibular gland were significantly higher than the SUVmax and TBR in ^{18}F-FDG PET/CT ($p<0.005$). The PET index of pancreato-biliary disease was significantly higher than that of head-and-neck disease or fibrosis/aortitis (3.42±2.07 vs. 1.81±1.11 vs. 1.72±1.02, p=0.01[index calculated by SUVmax]; 5.40±2.89 vs. 2.94±1.77 vs. 2.54±1.54, p=.018 [index calculated by TBR]). When comparing the SUVmax and TBR of the hottest lesions in proliferative subtype and fibrotic subtype, the two groups of patients showed similar ^{18}F-FDG uptake, however proliferative subtype showed significantly higher uptake of 68Ga-FAPI than fibrotic subtype (Table). Furthermore, the PET index of proliferative subtype was also significantly higher than the index in fibrotic subtype (p=0.005, Table), suggesting a more dominant uptake of 68Ga-FAPI in proliferative subtype of IgG4-RD than the fibrotic subtype. ***Conclusion:*** The proliferative subtype of IgG4-RD showed a more dominant uptake of 68Ga-FAPI than the fibrotic subtype, suggesting more activation of fibroblasts in proliferative subtype of IgG4-RD.

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Increased pulmonal uptake of [68Ga]FAPI PET/CT in patients with post-COVID dyspnea and fatigue after ICU discharge

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Aim/Introduction: Long COVID has emerged as a major healthcare problem. Although many pathophysiological pathways have been proposed, a comprehensive mechanism of disease remains to be elucidated. Supposed pathophysiology includes persistent low-grade inflammation and microthrombosis, leading to fibroblast activation and ongoing tissue remodeling. Molecular imaging with [68Ga]FAPI (which binds to fibroblast activation protein (FAP)) PET allows for whole body assessment of in vivo fibroblast activation. The objective of this study was to explore lung FAP activity in former critical COVID-19 patients with persistent dyspnea complaints. ***Materials and Methods:*** A prospective observational study (NCT05981885) was conducted in patients with self-reported complaints of dyspnea more than 3 months after hospital discharge for confirmed SARS-CoV-2 infection requiring mechanical ventilation or high-flow nasal oxygen therapy. Each subject underwent a PET/CT and HRCT on a Biograph Vision or Vision Quadra after i.v. administering of 200 MBq [68Ga]FAPI-46. For quantification lungs and muscle were automatically segmented using TotalSegmentator. To measure the diffuse (homogeneous, non-focal) lung uptake, elevated [68Ga]FAPI uptake areas were extracted using <50% isocontour. Mean standardize uptake value corrected for lean body mass (SUL) was collected. Muscle [68Ga]FAPI uptake was measured in the paravertebral muscles. HRCT was analyzed visually for the presence of ground glass opacities (GGO). Fifteen age- and sex-matched subjects without pulmonary pathology, recruited from two other centers using similar settings, scanned for oncological reasons, were used as controls. An independent samples T-test was used for group comparison. The correlation between clinical markers and [68Ga]FAPI was explored using Pearson's or Spearman's test.

Results: Eighteen long COVID patients were included: 10 males (56%), mean age 61 years (±SD 8), BMI of 36 kg/m2 (mean ±SD 9). Scans were performed at a median of 30 months (IQR 7.5 - 34.3) after hospital discharge. Patients with long COVID showed increased pulmonary uptake of [68Ga]FAPI, with a mean (±SD) SULmean of 1.2 (0.4) compared to 0.7 (0.3) (p = <0.001) in controls. The difference remained after blood pool (vena cava inferior) background correction of the whole lung and diffuse uptake (p = <0.001). The presence of GGO (p = 0.07), time after discharge (p = 0.11) and BMI (p = 0.60) did not correlate with lung uptake. Paravertebral muscle [68Ga]FAPI uptake did not differ between long COVID patients and controls (p = 0.12). ***Conclusion:*** Patients with long-term complaints of dyspnea after hospitalization for severe acute COVID showed increased pulmonary FAP expression, suggesting persistent fibroblast activity.

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^{68}Ga-FAPI-04 PET/CT COVID-19

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Aim/Introduction: Previous research on the COVID-19 pandemic has proved the severe consequence of pulmonary fibrosis due to SARS-CoV-2 infection. However, there have not yet been adequate methods for assessing progressive pulmonary damage in post-COVID-19 patients. Consistent with idiopathic pulmonary fibrosis (IPF), fibroblast activation and expansion contribute to lung fibrosis in SARS-CoV-2 infection. As a novel imaging modality, 68Ga-fibroblast activation protein inhibitor (FAPI) PET/CT has shown potential benefits in the diagnosis of IPF. Therefore, this pilot study investigated the potential of 68Ga -FAPI PET/CT in detecting post-COVID-19 pulmonary fibrosis. ***Materials and Methods:*** This was a single-center prospective pilot study. 29 patients (15 females; age range 30-86 years) with suspected or proven severe COVID-19 pneumonia were recruited from January 2023 to March 2023. The control group included 10 patients (4 females; age range 31-68 years) who were diagnosed with solid tumors without COVID-19 infection or pathologic pulmonary findings. After providing written informed consent, all participants underwent 68Ga-FAPI-04 PET/CT. During the follow-up period, 3 patients had a second 68Ga-FAPI-04 PET/CT scan to assess fibrosis changes after three months of treatment. Clinical characteristics and PET/CT imaging were collected and analyzed. ***Results:*** The average duration between COVID-19 diagnosis and 68Ga-FAPI-04 PET/CT was 51.8 ± 19.2 days. Overall, COVID-19 patients had intense 68Ga-FAPI uptake in pulmonary regions, which showed statistically a significant difference from control groups (SUVmax 4.83 ± 2.4 vs. 1.41 ± 0.47, p< 0.0001; SUVmean 2.78±1.12 vs. 0.70 ± 0.26, p< 0.0001). Additionally, SUVmean of 68Ga-FAPI uptake positively correlated with HUmean in CT of fibrosis lesions (r=0.5864, p<0.0001). Furthermore, follow-up scans of three patients showed gradual resolution of lung lesions and decreased [68Ga]Ga-FAPI uptake, indicating reversible pulmonary damage with appropriate clinical intervention. ***Conclusion:*** This pilot study demonstrated that 68Ga-FAPI PET/CT, as a non-invasive imaging method, is a promising tool for assessing pulmonary fibrosis after SARS-CoV-2 infection, and may have value in monitoring the treatment response in COVID-19 patients.

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TROP Session: Neuroimaging Committee: Epilepsy, Inflammation and Connectivity

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Role of $^{[18F]}$ FDG PET/MRI in drug-resistant epileptic patients (preliminary results)

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Aim/Introduction: The study aimed to analyze the added value of $^{[18F]}$FDG PET/MRI in the localization of the epileptogenic focus (EF) in patients with drug-resistant epilepsy (DRE). ***Materials and Methods:*** Retrospective study of 38 patients (p) with DRE, potential candidates for surgery. These patients underwent the following complementary tests: EEG, MRI, ictal/interictal SPECT, SISCOM, and $^{[18F]}$FDG PET/MRI study for the identification of the EF. The basal PET/MRI studies were performed on SIGNA GE hybrid equipment, 30 minutes after the administration of 148 MBq of $^{[18F]}$FDG. The MRI sequences were 3D Coronal T1, T2 Axial PROPELLER, T2 Coronal FSE Temporal, 3D Axial ASL, and 3D Axial SWAN. A visual assessment of PET/MRI was performed by a nuclear physician and neuroradiologist specialized in epilepsy. PET/MRI was considered positive in patients who showed a focal metabolic alteration on PET images and/or morphological abnormalities on MRI that could correspond to EF. PET/MRI findings were correlated to other complementary studies and with the multidisciplinary board decision. The diagnostic validity of PET/MRI was assessed. ***Results:*** PET/MRI was positive in 13/38p (34%) (7 females; mean age 42 years [17-56]), all of them with metabolic alterations. Ten patients had previous negative MRIs, one had positive MRIs and two did not have previous MRI studies. PET/MRI identified 12 hypometabolic focuses: 3p focal cortical dysplasia (1 previously positive on MRI), 3p mesial temporal sclerosis, 2p focal cortical dysplasia plus mesial temporal sclerosis, 4p nonspecific alterations, and 1 hypermetabolic focus: 1 ganglioglioma. The sensitivity of PET/MRI for diagnosis of EF was 34% (13/38p) compared to the sensitivity of MRI alone which was 28% (10/36p). Therefore, thanks to the use of a hybrid technique (PET/MRI), it was possible to localize the probable cause of the EF in 67% (8/12p) of the patients. Of the 13p with a positive result in $^{[18F]}$ FDG PET/MRI, 10p had concordance with the rest of the complementary studies for the DRE study, which increased the diagnostic confidence. Of these 10p, 6p were candidates for surgery and 4 of them did not meet the criteria for surgery. Three patients are still pending some complementary studies. ***Conclusion:*** PET/MRI improves the diagnostic sensitivity of localizing the EF in DRE. These results have an impact on the clinical and therapeutical management of these patients. The hybrid image assessed together increases the detection capacity of possible EF compared to both techniques (PET and MRI) separately.

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Assessing Refractory Epilepsy Patients with Dynamic ^{18}F-FDG PET: Insights from Kinetic Analysis.

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Aim/Introduction: PET with 18F-FDG is a well-established technique for localizing the epileptogenic zone (EZ) in patients undergoing epilepsy surgery. Typically, image analysis is confined to semi-quantitative strategies, which may not fully exploit the potential of the technique to elucidate specific physiological processes. This study aims to assess the effectiveness of kinetic analysis of dynamic 18F-FDG PET studies compared to conventional quantification methods in identifying characteristic metabolic asymmetries within the EZ. ***Materials and Methods:*** Eight patients (age range 23-52 years, 4 women) underwent prospective evaluation using dynamic interictal PET/CT lasting 60 minutes following intravenous administration of 208 &#177 47 MBq of 18F-FDG. The probable EZ was defined by consensus following comprehensive presurgical evaluation in the institutional Epilepsy Surgery Program. Six patients had temporal lobe epilepsy, and two had extratemporal epilepsies. Three analysis methods were employed: quantification of the area under the curve (AUC) for the complete dynamic PET (60 minutes), AUC of minutes 40-60 post-injection (AUC 40-60), and kinetic analysis using the Patlak method. For Patlak's analysis, proprietary routines developed in Matlab were utilized, incorporating estimation of the input function from dynamic images. The asymmetry index was determined in volumes of interest corresponding to the epileptogenic area compared to the contralateral symmetric region in all cases (2 x [(ipsilateral - contralateral)/(ipsilateral + contralateral)] x 100). The three strategies were compared using Friedman's ANOVA of ranks for repeated measures, with Tukey's test for paired comparison of the groups. ***Results:*** The asymmetry indices obtained were 9.9 &#177 5.1, 11.3 &#177 6.2, and 19.8 &#177 13.5 for AUC, AUC 40-60, and Patlak, respectively (mean ± SD). A significant difference was evident among the different quantification strategies ($p = 0.01$). In paired comparisons, a significant difference was observed between the AUC and Patlak strategies ($p < 0.05$), with the latter demonstrating superior performance in revealing the asymmetry. ***Conclusion:*** Kinetic analysis of dynamic PET with 18F-FDG offers additional insights for identifying metabolic asymmetries in the EZ, potentially enhancing the localization accuracy of the study. These findings suggest the presence of flow-metabolism mismatch in the EZ, with greater emphasis on the metabolic component than on regional cerebral blood flow.

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[^{11}C]Metoclopramide PET can detect a seizure-induced upregulation of cerebral P-glycoprotein in epilepsy patients

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Aim/Introduction: There is a critical need for imaging biomarkers for the delineation of epileptic brain tissue in the presurgical evaluation of drug-resistant epilepsy patients. A large body of evidence shows that epileptic seizures lead to an up-regulation of the efflux transporter P-glycoprotein (P-gp) at the blood-brain barrier (BBB). We hypothesized that drug-resistant epileptic foci can be distinguished from healthy or drug-sensitive epileptic tissues based on regional P-gp function at the BBB as a hallmark of drug-resistant epilepsy. PET with radiolabelled P-gp substrates can be used to measure P-gp function at the human BBB, but previously used radiotracers (e.g. (R)-[^{11}C]verapamil) suffered from several limitations (i.e., low brain uptake, brain-penetrant radiolabelled metabolites), which impeded their clinical applicability in epilepsy patients. In this study, we assessed whether a new radiotracer, i.e. [^{11}C]metoclopramide, can overcome these limitations and detect P-gp up-regulation in epilepsy patients. ***Materials and Methods:*** Eight patients with drug-resistant temporal lobe epilepsy (DRE), 5 seizure-free patients with drug-sensitive focal epilepsy (DSE), and 15 healthy subjects underwent brain PET imaging with [^{11}C]metoclopramide on a fully-integrated PET/MRI system. Concurrent with PET, arterial blood sampling was performed to generate a metabolite-corrected arterial plasma input function for kinetic modelling. The choroid plexus was outmasked on the PET images to remove signal contamination from the neighbouring hippocampus. Using a brain region atlas (N30R83), 10 temporal lobe sub-regions were defined and analysed with a 1-tissue-2-rate constant compartmental model to estimate the rate constants for radiotracer transfer from plasma to brain (K1) and from brain to plasma (k2), and the total volume of distribution (VT = K1/k2). ***Results:*** Peripheral metabolism of [^{11}C]metoclopramide was not significantly different between epilepsy patients and healthy subjects. Whole brain uptake of [^{11}C]metoclopramide in epilepsy patients was approximately two times higher than previously reported for (R)-[^{11}C]verapamil (VT: 1.67±0.26 vs. 0.85±0.17 ml/cm3). DRE patients but not DSE patients showed significantly higher [^{11}C]metoclopramide k2 values and a trend towards lower VT values in several temporal lobe sub-regions located ipsilateral to the epileptic focus as compared to healthy subjects (k2: hippocampus: +34%, anterior temporal lobe, medial part: +28%, superior temporal gyrus, posterior part: +21%). ***Conclusion:*** Our data suggest that [^{11}C]metoclopramide can detect seizure-induced P-gp up-regulation in the epileptic brain. The efflux rate constant k2 seems to be the most sensitive parameter to measure increased P-gp function with [^{11}C]metoclopramide. Seizure-induced P-gp up-regulation measured with [^{11}C]metoclopramide PET may help to better delineate drug-resistant epileptic foci during presurgical evaluation.

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Metabolic correlates of epileptogenic activity in patients with autoimmune encephalitis (AE): visual and voxel-based approach to brain FDG PET

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Aim/Introduction: Pathogenesis of epilepsy in patients with AE may be related to a persisting inflammatory process or to the effect of encephalitic-related damage. FDG-PET-related metabolic patterns might help to disclose the pathophysiology of epileptic activity both in the acute phase and at follow-up. There is a lack of studies correlating the topography of hypo/hypermetabolism with the electroclinical manifestations of seizures in AE, even at baseline. We aimed to evaluate the match between baseline hypo and hypermetabolic patterns and the topography of epileptogenic-activity based on clinical and EEG features. ***Materials and Methods:*** Within all AE patients who performed FDG-PET at baseline between 2013 and 2023, we selected patients with clinics and EEG confirming the presence of epileptiform-activity. Availability of MRI imaging and autoantibodies assay was considered mandatory, although seronegative patients with AE confirmed at follow-up were not excluded. The topography of epileptogenic-activity was defined by the referring-neurologist (clinics/EEG) and the cortical/subcortical origin was classified as: 1 limbic; 2. fronto-insular/vegetative (insular) 3. motor cortex (motor), 4. parieto-occipital (posterior) 5. other regions/diffuse alterations. FDG-PET was evaluated visually by a nuclear medicine physician blinded to clinical/EEG features and then with a voxel-based analysis (SPM12). Hypo and hypermetabolic patterns were fitted in the same 5 subgroups. The topographical match between hypo and hypermetabolism pattern and electroclinical features was assessed. ***Results:*** 27 out of 44 patients with AE showed epileptogenic-activity and were included in the present analyses. Based on autoantibodies assay they were classified as: LGI1 n=9, CASPR2 n=3, GAD65 n=2, NMDAR n=4, SOX1 n=1, MA2 n=2, seronegative n=6. MRI was abnormal in 13/27 pt while PET showed metabolic alterations in 27/27 at visual analysis (20/27 concomitant hyper and hypometabolism and 7/27 hypometabolism) and in 24/27 at voxel-based-analysis (23/27 concomitant hyper and hypometabolism; 1/27 hypometabolism only). Electroclinical data classified epileptogenic-activity as limbic n=12, insular n=7, motor n=1, posterior n=4, other/diffuse n=3. Hypermetabolism matched electroclinical topography in 75% of patients at visual analysis and only in 50% at voxel-based analysis. The capability of hypometabolism to locate the onset of the epileptogenic-activity was poor at baseline (only 2 topographical matches with both analysis). ***Conclusion:*** Visual-analysis is more sensitive than voxel-based approach for the detection of AE-typical features in the patients with seizure. The large topographical overlap between hypermetabolism and epileptogenic activity supports the inflammation-related genesis of seizure at baseline. Collection of follow-up FDG-PET is ongoing to disclose the pathophysiological meaning of persistent seizure after AE.

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Heterogeneity of TSPO-PET Distribution Patterns Among Patients with Temporal Lobe Epilepsy

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Aim/Introduction: Localization of epileptic foci using non-invasive methods is crucial in the diagnosis and treatment of epilepsy. Given the recognized role of neuroinflammation in epilepsy development, burgeoning researches has emerged to investigate its potential in identifying neuroinflammation at epileptic foci. This study aimed to reveal the heterogeneous distribution pattern of translocator protein 18 kDa-positron emission tomography (TSPO-PET) among patients with temporal lobe epilepsy (TLE) and investigate clinical factors affecting the outcome of TSPO-PET scans. ***Materials and Methods:*** Twenty-one patients diagnosed with TLE according to the International League against Epilepsy criteria underwent TSPO-PET scans. Detailed documentation of clinical factors such as age at onset, seizure types, frequency, and interval from last seizure to PET scan was conducted. The hemisphere with the clinically-defined epileptic focus was determined using patients' seizure history, video-electroencephalography (VEEG), and magnetic resonance imaging (MRI). Visual evaluation of TSPO-PET scans was performed by three independent imaging physicians, followed by quantitative analysis of brain regional standardized uptake value ratio (SUVR) using the asymmetry index (AI) formula: [(ipsilateral–contralateral) / (ipsilateral+contralateral)] × 200%. TSPO uptake and AI of each brain region were presented as heat maps. Logistic regression analysis was employed to investigate clinical factors associated with TSPO-PET outcomes. ***Results:*** Visual evaluation revealed increased $^{[18F]}$DPA-714 uptake in fifteen patients, with 57.1% (12/21) involving the lateral temporal lobe. The hemisphere with potential epileptic foci, as clinically defined mainly by VEEG and symptoms, was entirely consistent with visual TSPO-PET evaluation. Quantitative analysis with AI showed that 71.4% of patients had at least one brain area with AI exceeding 15%, predominantly in the temporal lobe (57.1%, 12/21), including the hippocampus and parahippocampus (41.7%, 5/12) and amygdala (66.7%, 8/12). A high AI could also be observed outside the temporal lobe, such as in the parietal lobe (9.5%, 2/21) and occipital lobe (23.8%, 5/21). Logistic regression analysis indicated a significant association between TSPO-PET outcome and interval from last seizure to PET scan (P=0.041, OR=11.073), suggesting a higher uptake rate with a shorter interval. Additionally, patients with more frequent seizures tended to have higher uptake, although not statistically significant (P=0.882, OR=1.113). ***Conclusion:*** The majority of TLE patients exhibit higher uptake of $^{[18F]}$DPA-714 in the ipsilateral hemisphere with the clinically-defined epileptic focus, indicating ongoing neuroinflammation. But its distribution patterns may vary among patients. The outcome of TSPO-PET may be influenced by some clinical factors such as interval from last seizure to PET scan and seizure frequency.

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Subgroups of Metabolic Brain Derangement on FDG PET in Patients with Neuropsychiatric Systemic Lupus Erythematosus

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Aim/Introduction: Neuropsychiatric systemic lupus erythematosus (NPSLE) is the second leading cause of morbidity and mortality in systemic lupus erythematosus (SLE) patients. The pathogenesis of NPSLE is poorly understood and diagnosis is difficult. Advances in neuroimaging show promise, but no patterns specific for the disease have emerged. Exploring the relationships between different metabolic imaging patterns and clinical and laboratory parameters, may lead to improvements in diagnostic accuracy and provide insights into the pathogenesis of NPSLE. ***Materials and Methods:*** Fifty-six patients (n=56) with suspected NPSLE who underwent F^{18} FDG PET-CT at Tygerberg Hospital between December 2016 and January 2023 were screened for inclusion. Seven patients were excluded based on missing data (n=1), not fulfilling the EULAR/ACR classification criteria for SLE (n=4) or absence of NPSLE features on clinical review (n=2). The remaining patients (n=49) exhibited NPSLE features according to the SLEDAI-2K criteria and definitions and were included in the analysis. FDG PET brain DICOMs underwent standard checks for quality before being converted to NIfTI using MRIcroGL and pre-processed in SPM12 (repositioning, warping into standardized MNI space). Using the Brainnetome atlas, mean values in each region were extracted after normalisation for global counts. A hierarchical clustering technique employing Ward's linkage method with an Euclidean distance was performed. Demographic, clinical and laboratory characteristics of the patient clusters were compared using standard statistical tests. ***Results:*** Based on visual analysis an optimal cluster number of 2 was selected, which was supported by the Gap Statistic and the Calinski-Harabasz Index. Comparing imaging features of scans in cluster A (n=23) and cluster B (n=26), scans in the latter group demonstrated significantly higher metabolism in the striata, thalami, midbrain and cerebellum. Patients in cluster B had higher SLEDAI-2K disease activity scores (mean cluster A=19 vs cluster B=28, p=0.001) and were more likely to present with psychosis (p= 0.047) and stroke (p=0.024). Cluster B patients were also more likely to have positive anti-dsDNA and anti-Smith antibodies, as well as higher anti-Smith antibody titres (mean cluster A=31IU/ml vs cluster B=120IU/ml, p=0.031). ***Conclusion:*** Cluster analysis identified a subgroup of NPSLE with common features of hypermetabolism in striata, thalami, midbrain and cerebellum. Patients in this cluster exhibited higher disease activity scores, higher frequencies of several symptoms, and higher levels of certain immune markers. This metabolic pattern may be driven by a common pathological mechanism and could have implications for predicting individual outcomes and prognoses in NPSLE.

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Towards PET-based Atlas of Resting State Brain Networks: Preliminary Results

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Aim/Introduction: Atlases of resting state networks (RSNs) as based on fMRI data have proven useful in research of brain function. Positron emission tomography with ^{18}F-fluorodeoxyglucose (FDG-PET) is known to capture neural function at rest in a more direct way than BOLD fMRI. Of note, RSNs have been successfully identified in FDG-PET data and utilised for diagnostic purposes. The goal of this study was to build an atlas of RSNs using FDG-PET data. ***Materials and Methods:*** We used data of cognitively healthy subjects from the Alzheimer's Disease Neuroimaging Initiative and local institutional databases. The former was divided into two age- and sex-matched groups: 1) n = 62,73.5±6.13 (mean±SD) years old, 2) n = 61, 73.5, ±6.5 years old. The third group included n = 63 subjects of 56.1±4.1 years old. All PET data were available as one image per subject. Independent component analysis (ICA) was applied in the GIFT toolbox to identify RSNs in each group in a data-driven manner. Herewith, we systematically studied the impact of the mode of spatial normalisation (T1-dependent vs -independent) and intensity scaling method (remove mean subject-wise, remove mean voxel-wise, intensity normalisation and variance normalisation). Main outcomes of interest were the percentage of meaningful independent components (IC) and their replicability across the groups. Replicability was measured with dice coefficient. ***Results:*** Overall, the T1w-dependent pipeline produced a higher percentage of meaningful components (40-60%) than the T1w-independent one (30-50%). The highest percentage of meaningful components was produced by the voxel-wise removal across intensity scaling (40-60%), the lowest with the variance normalisation (0-6,7%). Meaningful components produced with T1w-dependent preprocessing, 30 ICs and voxel-wise mean removal scaling method, demonstrated moderate dice coefficient for visual and cerebellar networks (0.40-0.47), and fair dice coefficient for executive and auditory networks (0.31-0.43) across groups.There were 2 midline networks which have not been described in fMRI studies in this form: a network covering the middle and anterior cingulate cortex and a network in the mesial frontal lobe. ***Conclusion:*** According to our preliminary results, the T1w-dependent preprocessing pipeline and voxel-wise mean removal as intensity scaling method produced the highest number of replicable ICs that can be interpreted in terms of RSNs. Two new midline RSNs deserve further investigations.

OP-247

Individual cerebellar metabolic connectome in patients with MTLE and NTLE associated with surgical prognosis

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Aim/Introduction: Patients with mesial temporal lobe epilepsy (MTLE) or neocortical temporal lobe epilepsy (NTLE) share similar clinical pictures, patterns of electroencephalography (EEG) recordings, and magnetic resonance imaging (MRI)-invisible lesions, the divergent surgical outcomes necessitate accurate differentiation between the two types of temporal lobe epilepsy preoperatively to elaborate on tailored surgical strategies. This study aimed to comprehensively explore the different metabolic connectivity topological changes in MTLE and NTLE, as well as their association with surgical outcomes. ***Materials and Methods:*** This study enrolled a cohort of 91 patients with intractable MTLE, 46 patients with intractable NTLE, and 40 healthy individuals with similar age. Each individual's metabolic connectome, as determined by Kullback-Leibler divergence similarity estimation for the 2-18F-fluorodeoxyglucose positron emission tomography (18F-FDG PET) image, was employed to conduct a comprehensive analysis of the cerebral metabolic network in MTLE and NTLE. In addition, alterations in network connectivity were assessed by extracting and evaluating the strength of edge connectivity and weighted connectivity in comparison to the healthy controls. Furthermore, key disparity between MTLE and NTLE groups was identified. By utilizing

these two connectivity strength metrics with the cerebellum, we explored the network properties of connectivity and its association with prognosis in surgical patients. ***Results:*** Both MTLE and NTLE patients exhibited substantial alterations in the connectivity of the metabolic network at the edge and nodal levels when compared to healthy controls (P<0.01, FDR corrected). The key disparity between MTLE and NTLE was observed in the cerebellar regions. In MTLE, there was a predominance of increased connectivity strength in the cerebellum. Whereas, a decrease cerebellar connectivity was identified in NTLE. It was found that in MTLE, higher edge connectivity and weighted connectivity strength in the contralateral cerebellar hemisphere correlated with improved surgical outcomes. Conversely, in NTLE, a higher edge metabolic connectivity strength in the ipsilateral cerebellar hemisphere suggested worse surgical prognosis. ***Conclusion:*** These results suggest that MTLE and NTLE might possess distinct compensatory mechanisms and propagation networks. The cerebellum exhibits distinct topological characteristics in the metabolic network connections between patients with MTLE and NTLE. The hyper- or hypo-metabolic connectivity in the cerebellum may be a prognostic biomarker of surgical prognosis, which might aid in therapeutic decision-making for intractable temporal lobe epilepsy individuals.

OP-248

Correlation of epileptic seizure type with ^{18}F-FDG PET metabolic brain networks

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Aim/Introduction: 18F-fluorodeoxyglucose positron emission tomography (18F-FDG PET) has been widely used for presurgical localization of epileptic foci and prognosis estimation. In recent years, some studies have analyzed the brain metabolic connectivity alterations in epilepsy patients with 18F-FDG PET-based complex network analysis. So far, metabolic connectivity based on 18F-FDG PET using complex network analysis for evaluating different types of epileptic seizures has not yet been studied. The aim of this study was to analyze the pattern of glucose metabolism in the brain of different seizure types of epilepsy using the 18F-FDG PET metabolic brain network, and thus to show the changes in the brain network activity, which would provide a basis for revealing the longitudinal changes in the brain during the progression of epilepsy. ***Materials and Methods:*** 214 epileptic patients with complete clinical data who underwent 18F-FDG PET-CT were were retrospectively included, 214 other patients who excluded neurological diseases and were matched for age and gender were selected as normal control group. The PET images of all patients were spatially normalized into Montreal Neurological Institute space, the brain was segmented into 116 brain regions using 116 anatomical automatic labeling and 18F-FDG uptake values were calculated for each region. Group-level brain metabolic network connectivity was constructed by measuring Pearson's correlation coefficients between each pair of brain regions, and then graph theory-based brain network analysis was used to compare changes in metabolic connectivity between the two groups of epileptic patients. ***Results:*** Comparing patients in the generalized clonic seizure group and the other seizure group separately with the control group, the other seizure group exhibited greater modularity, lower average, overall efficiency, clustering coefficient, and longer path lengths ($P < 0.05$). Patients in the generalized clonic seizure group showed a slight decrease in metabolic network connectivity compared to the HC group, and more brain regions with abnormal metabolic connectivity than the other seizure group. Moreover, Hub nodes of the metabolic network on PET scans were altered in both groups compared with the control group, but the whole-brain connectivity in both groups still had small-world properties. ***Conclusion:*** Cerebral metabolic network connectivity is more severely impaired in patients with generalized clonic seizure epilepsy than in other seizures. The shifting of Hub nodes is expected to be responsive to the process of self-adaptation of brain function during the longitudinal progression of epilepsy, and to be a new marker for assessing the severity of epilepsy.

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Sunday, October 20, 2024,16:45 - 18:15
Hall F

e-Poster Presentations Session 4: Radiopharmaceutical Sciences Committee: Radiochemistry

EPS-064

GLP-1r radioligands, effects of the chelator and synthesis route on receptor binding and competitive displacement in vivo

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Aim/Introduction: The GLP-1 receptor (GLP-1r) is expressed in the duodenum, pancreas, and portal vein, and exhibits a down-regulation in insulin-resistant individuals. Accordingly, its quantification may prove pivotal to the management of type 2 diabetes. Several radioligands for GLP-1r, including DO3A, DOTA and NODAGA derivatives, have been developed for 68Ga labelling, however, their in vivo binding capabilities remain to be evaluated with the exception of DO3A which is no longer commercially available. We have quantified, in vivo, the binding and displacement of DOTA and NODAGA GLP-1r radioligands on the GLP-1r. ***Materials and Methods:*** Twelve female miniature pigs (65 ± 4 kg) received either DOTA or NODAGA exendin-4 radioligands after increasing doses of the GLP-1r agonist (exenatide - 0, 0,5 and 1 µg/kg) during dynamic abdominal PET imaging (GE). [68Ga]DOTA-Exendin-4 (Y25, Pi-chem) and [68Ga]NODAGA-Exendin-4 (Y55, Pi-chem) were synthesized using custom build sequences for an automated platform (Scintomics). Several purification strategies were tested, including hydrophilic-lipophilic balance (HLB) and reversed-phase (light C18 and tC2) routes. The final radioligands were analyzed using a UV-Radio-HPLC method derived from Velikyan et al (1). PET imaging was coupled with high-frequency arterial input function (AIF) measurement achieved within an arterial-venous loop. Radio metabolites and the original fraction were measured 5, 10, and 15 min after injection using radio-HPLC after chaotropic plasma preparation. Target occupancy was calculated as specific volume (Vs) using Pmod compartmental modeling with dynamic images and original fraction corrected AIF as inputs. ***Results:*** The radiochemical purity of the synthesized compound was not different (93, 95, 94, and 98 % for Y25/C18+, Y55/HLB, Y55/C18+, and Y55/tC2, respectively). In contrast, there were significant differences in radiochemical yield (41%, 45%,

19%, and 74% for Y25/C18+, Y55/HLB, Y55/C18+, and Y55/tC2). A significant non-specific uptake in the liver (a GLP-1r free organ) confirmed by the absence of displacement following increasing doses of the agonist was identified for Y25/C18+ and Y55/HLB. Surprisingly, pancreatic Y55/HLB was not displaced by increasing agonist doses with identical Vs before and after Exenatide. In contrast, Y55/tC2 exhibited a classical displacement outcome at both the portal vein and pancreas with increased agonist doses. ***Conclusion:*** The NODAGA-exendin-4 moiety appears superior to DOTA for GLP-1r labeling. In vivo, the calculation of Vs in GLP-1r competitive conditions indicates that the reversed-phase approach is superior to the recently proposed hydrophilic-lipophilic balance. ***References:*** (1) Velikyan et al, Am. J. Nucl. Med. Mol. Imaging 2017.

EPS-065

Development of a radiosynthesis method and a novel quality control system to determine quality of ^{68}Ga-MAA: is a TLC enough to assess radiopharmaceutical quality?

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Aim/Introduction: 99mTc-labeled macroaggregated human serum albumin (MAA) is commonly used for lung perfusion scintigraphy. European Pharmacopoeia describes only the TLC method to assess quality of 99mTc-MAA that differentiates between 99mTc-MAA and free [99mTc]pertechnetate. 99mGa-MAA particles have been recently introduced for lung perfusion PET/CT imaging and literature reports only TLC method to evaluate radiochemical purity (RCP). Although TLC is a very simple and convenient technique, it has low sensitivity and it's rather than a qualitative method. Therefore we spent many efforts to develop a quality control (QC) system including a new radio-UV-HPLC method to assess the RCP of 68Ga-MAA together with an efficient synthesis method. ***Materials and Methods:*** Gallium-68 was obtained eluting a GMP 68Ge/68Ga generator with HCl, collected and pre-purified on a SCX cartridge, using an automated synthesis module. The elute was added to a reactor containing commercially available MAA suspended in NaCl and HEPES buffer. The suspension was incubated scaling up the labelling temperatures (25°-45°-75°-95°C) for 20 minutes. A QC system was developed: Radio-TLC to detect free Ga-68 and a new Radio-UV-HPLC method to detect both free Ga-68 and 68Ga-HSA, to determine RCP of 68Ga-MAA. Microscope analysis and Sprytec laser diffraction system were used to evaluate morphological structure and size distribution of 68Ga-MAA. To eliminate HEPES buffer 68Ga-MAA was filtered from the bottom using a low protein-binding filter (3µm) and then the transferred into the final vial by passing 10 mL of NaCl from the top to the bottom of the filter. ***Results:*** Radio-TLC method detected only Ga-68, while the developed radio-UV-HPLC discriminated both Ga-68 and 68Ga-HSA. 68Ga-MAA obtained at 25°C/45°C revealed both impurities, while at 75° the only impurity was Ga-68. The setup conditions showed that 95°C temperature provided 68Ga-MAA with a RCP of 100%, high specific activity (425.66 GBq/g) and labeling efficiency (>99%), preserved morphological structure and size distribution compared to the original, with a particle diameter range between 25-50µm assuring the diagnostic efficacy. ***Conclusion:*** Our production process of 68Ga-MAA eliminates the need for organic solvents, prewash or final purification steps and it's carried out in a sterile room preserving the sterility of the radiopharmaceutical. Our QC system based on Radio-TLC and the developed Radio-UV-HPLC proved to be efficient and essential to determine the RCP% of 68Ga-MAA. The entire radipharmaceutical production process provides 68Ga-MAA with high efficiency, specific activity and RCP, making them easily accessible for routine use in perfusion imaging using PET/CT.

EPS-066

Comparison of Approaches for Increasing Affinity of Affibody Molecules for Imaging of B7-H3: Dimerization and Affinity Maturation

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Aim/Introduction: B7-H3 is an immune checkpoint protein, which is a promising molecular target for immune therapy of malignant tumours. Sufficient B7-H3 expression level is a precondition for a successful therapy. Radionuclide molecular imaging is a promising technique for visualizing expression levels of molecular targets in vivo. The use of small radiolabelled targeting proteins would enable high-contrast radionuclide imaging of molecular targets if adequate binding affinity and specificity of an imaging probe could be provided. Affibody molecules, small engineered affinity proteins based on a non-immunoglobulin scaffold, have demonstrated an appreciable potential for the use as radionuclide imaging probes. Affinity maturation of anti-B7-H3 Affibody molecules as an approach to improve the binding affinity and targeting properties was recently investigated. In this study, we tested the hypothesis that a dimeric format may be an alternative option to increase the apparent affinity of Affibody molecules to B7-H3 and accordingly improve imaging contrast. ***Materials and Methods:*** Two dimeric variants of anti-B7-H3 Affibody molecules, ZAC12*-ZAC12*-GGGC and ZAC12*-ZTaq_3-GGGC, were produced, characterized and labelled with 99mTc as a commonly used radionuclide for SPECT imaging in clinics. ZTaq is an Affibody originally selected as a binder to Thermus aquaticus (Taq) DNA polymerase, which doesn't interact with any mammalian proteins. Thus, ZAC12*-ZTaq_3-GGGC is a monovalent bi-Affibody. In vitro characterization was performed using B7-H3-expressing cell lines. A head-to-head biodistribution of the dimeric variants of the Affibody molecules and the monomeric SYNT-179 (all labelled with 99mTc) was studied in mice bearing B7-H3-expressing SKOV-3 xenografts. Uptake in B7-H3-negative Ramos xenografts was used as a specificity control. ***Results:*** Both variants were successfully labelled with Tc-99m (99mTc) with high radiochemical yield and purity and demonstrated specific binding to B7-H3-expressing cells in vitro and in vivo. [99mTc]Tc-ZAC12*-ZAC12*-GGGC showed subnanomolar affinity (KD1=0.28±0.10 nM, weight =68%), which was 7.6-fold higher than for [99mTc]Tc-ZAC12*-ZTaq_3-GGGC (KD=2.1±0.9 nM). Head-to-head biodistribution of both dimeric variants of Affibody molecules compared with monomeric affinity matured SYNT-179 in mice bearing B7-H3-expressing SKOV-3 xenografts demonstrates that both dimers have lower tumour uptake and lower tumour-to-organ ratios compared to monomeric SYNT-179 Affibody molecule. ***Conclusion:*** The improved functional affinity by dimerization does not compensate the disadvantage of increased molecular size for imaging purposes.

EPS-067

[18F]F-AIF-NOTA-Octreotide Synthesis Optimization and Patient Response

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Aim/Introduction: [18F]F-AIF-NOTA-Octreotide (OCT) is a radiopharmaceutical developed for the diagnosis and monitoring of neuroendocrine tumors. Aiming to allow large-scale production and supply over long distances, optimizations were carried out to the synthesis process already implemented in order to maintain a high quality standard, synthesis yield, radiochemical purity, reproducibility and stability. ***Materials and Methods:*** Different amounts of sodium ascorbate as an antioxidant were tested (1.5 mg/mL and 3.3 mg/mL), in order to prevent radiolysis observed with higher fluorine-18 activities. Single and dual beam tests were also performed, as well as variations of cyclotron current values (75 µA and 130 µA), with the same irradiation time, which directly impact the amount of fluorine-18 generated. All tests were followed by chromatographic analysis to monitor radiochemical purity parameters and radiolysis status.A clinical study with 38 patients was also carried out in order to examine the impact of the new synthesis protocol on the image quality of the studies, where [18F]F-AIF-NOTA-Octreotide (4 MBq/kg) was applied to detect lesions during staging, restaging and follow-up of grade I and II (Ki67 < 15%) neuroendocrine tumors. ***Results:*** The initial synthesis protocol (1.5 mg/mL of sodium ascorbate; single beam; 37 µA) didn't allow an initial activity of fluorine-18 above 37 GBq, presenting increased radiolysis events and low radiochemical purity (60.38%). The increase in antioxidant concentration, to 3.3 mg/mL, allowed commercial initial synthesis conditions to be achieved with 174 GBq of starting fluorine-18 activity, presenting an average uncorrected yield of 30.72%, 60 GBq of OCT and 98.82% radiochemical purity. Next, dual beam tests with the same irradiation time, and a higher total current (130 µA), were performed to obtain a greater amount of fluorine-18. These tests resulted in a average of 109 GBq of OCT, with averages of 300 GBq starting fluorine-18 activity, uncorrected yield of 25.34% and radiochemical purity of 98.43%.Changes in physiological uptake in target organs and kinectics of tumor uptake, measured by tumor to background ratios 60, 90 and 120 minutes post intravenous injection were not observed between the radiopharmaceuticals produced by both protocols, with maximum tumor to background rations achieved 60 minutes p.i.. ***Conclusion:*** The modifications made to the synthesis protocol throughout the optimization of the process proved to be of great importance in obtaining a greater amount of [18F]F-AIF-NOTA-Octreotide, without affecting its quality or its effectiveness and safety, allowing it's availability to a greater number of patients in a large country.

EPS-068

Labelling of a Bruton's Tyrosine Kinase (BTK) Inhibitor [11C]BIO-2008846 in three different positions and evaluated through PET scans in NHP

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Aim/Introduction: Bruton's tyrosine kinase (BTK) is a key player in the B-cell receptor signaling pathway. BTK inhibitors have garnered attention as potential anti-cancer drugs for B-cell therapies and for treating immunological disorders like rheumatoid arthritis and multiple sclerosis (MS). The development of new BTK inhibitors with reversible binding and improved selectivity is crucial. Currently, there is a need for tools to directly measure BTK receptor engagement. PET imaging of BTK offers a promising noninvasive method to assess target expression and engagement. This study involved radiolabeling BIO-2008846 in three different positions with carbon-11, and PET measurements were conducted in non-human primates using [11C]BIO-2008846-B to assess brain kinetics. ***Materials and Methods:*** Radiolabeling was achieved at three different position via either by [11C]carbonylation ([11C]BIO-2008846-A) or by [11C]methylation ([11C]BIO-2008846-B/C) reaction. NHP underwent two PET measurements on same day. The first PET measurement was performed with [11C]BIO-008846-B followed by the second PET measurement after pretreatment with BIO-008846 (1 mg/kg bw) 7 min prior to injection. The plasma input function corrected for radio-metabolites was measured for each scan. The total volume of distribution (VT) which is equivalent to the equilibrium partition coefficient for the drug between brain and plasma were calculated for a selection of regions. The occupancy was calculated using revised Lassen plot. Radiometabolite in plasma were analysed using gradient HPLC. ***Results:*** [11C]BIO-008846-A/B/C were synthesized successfully with radiochemical purity (>99%), and molar activity >42 GBq/µmol for [11C]BIO-008846-A and >500 GBq/µmol for [11C]BIO-008846-B/C. All the compounds [11C]BIO-008846-A/B/C were found to be stable in sterile saline for 60 min. The distribution of [11C]BIO-008846-B in the primate brain was homogenous and the whole brain uptake was 1.8% ID at baseline and max 3.2% after pretreatment. The lack of conclusive evidence for a change in regional VT values following a pharmacological dose suggest that any specific binding component of [11C]BIO-008846-B is negligible compared to the free and non-specific components in the living brain. Radiometabolite studies demonstrated only more polar radiometabolites were formed with about 10% unchanged radioligand remaining 30 min post injection for both PET experiments. ***Conclusion:*** This study demonstrated good brain uptake. Although there was a minor variability in [11C]BIO-2008846 distribution across various brain regions, the kinetics were consistent with passive diffusion and the free concentration and non-specific binding being the dominating components.

EPS-069

68Ga-labeled novel ACC-targeted probes for precise monitoring of acquired drug resistance in melanoma

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Aim/Introduction: Acquired resistance to BRAF mutation-targeted therapy has become a major clinical problem hindering the treatment of melanoma, and its precise monitoring is the core and key to improve the prognosis, but there is a lack of effective ways of non-invasive monitoring. Our previous study revealed that enhanced fatty acid synthesis is a key mechanism mediating acquired resistance to targeted therapy in BRAF-mutant melanoma. Therefore, this project aims to develop a molecular probe targeting acetyl-coacarboxylase (ACC), a key rate-limiting enzyme in the fatty acid synthesis pathway, to elucidate the quantitative and qualitative relationship between ACC and acquired resistance to targeted therapies and to monitor the evolution of fatty acid synthesis resistance through PET molecular imaging. ***Materials and Methods:*** Probes with different lengths of PEG chains were prepared by using the ACC inhibitor ND630 as the lead compound and modifying the metal chelating groups by

the coupling design method. The 68Ga labeling was performed by conventional metal chelation method. The radiochemical purity and in vitro stability were determined by HPLC. All probes were subjected to in vivo distribution and micro-PET dynamic imaging in tumor bearing mice to determine maximum tumor uptake and optimal imaging time. The probes with the best imaging results were selected for subsequent studies. ***Results:*** Four probes were designed and synthesized, and the chemical purities were than 98% by analytic-HPLC. The 68Ga labeling rate of all four probes was more than 60%. The radiochemical purity was > 98% after solid-phase purification. The in vitro stability in saline and in mouse serum was evaluated at 4 h by radio-HPLC, all probes showed high in vitro stability. The in vivo distribution and micro-PET imaging results in tumor bearing mice showed that all probes could image tumors, with 68Ga-DEACC showing the highest tumor uptake with a SUVmax of 1.1. Modification of the PEG3 chain accelerated the clearance of the probe in vivo, but tumor uptake was also reduced to some extent. In vivo imaging results were similar for different chelating groups NOTA and DOTA. All probes have a high physiological uptake in the heart and liver and are mainly metabolized by the liver and intestines. ***Conclusion:*** A series of 68Ga-labeled ACC-targeting probes were successfully prepared, among which 68Ga-DEACC has the potential to be used to monitor the evolution of fatty acid synthesis resistance, which is worthy of further study, and further probe optimization and evaluation are in progress.

EPS-070

Bn_2DT3A - a novel acyclic chelator for radiolabelling under mild conditions with gallium-68

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Aim/Introduction: Gallium-68 with a half-life of 68 minutes requires fast radiolabelling under mild conditions to allow radiolabelling of tracers with sensitive targeting vectors. The most wide-spread chelator for gallium68 is the cyclic DOTA requiring elevated temperatures and acidic conditions excluding the use of targeting vectors unstable under these conditions. In order to overcome this limitation we developed the hexadentate acyclic chelator Bn2DT3A with improved coordination kinetics for radiolabelling under mild conditions.1 ***Materials and Methods:*** Synthesis of Bn2DT3A was undertaken in 6 steps. Radiolabelling with gallium68 of Bn2DT3A was carried out in phosphate buffer under different conditions and purified via semipreparative column chromatography. Serum stability was tested by incubating purified [68Ga][Ga(Bn2DT3A)(OH)]- with serum at 37°C and analysed via radio-HPLC. in vivo study with [68Ga][Ga(Bn2DT3A)(OH)]- was performed in health healthy Sprague-Dawley rats ***Results:*** Bn2DT3A forms with Ga3+ a hexadentate mer-mer complex with a stability constant of 18.25. Depending on the pH, two different complexes are formed, whereas above pH 5 an additional hydroxy group is coordinating which increases the complex' in vitro and in vivo stability. Labelling with gallium68 gives good radiochemical yields, but different products depending on the pH and temperature. At pH 4 [68Ga][Ga(Bn2DT3A)] is formed, which showed to be unstable upon incubation in fetal bovine serum (FBS) at 37 oC after 30 minutes. Radiolabelling at pH 7.4 and 100 µM ligand concentration gives the hydroxy coordinating complex [68Ga][Ga(Bn2DT3A)(OH)]- in > 90% radiochemical yield (RCY) at room temperature within 15 minutes. Performing the reaction at 60 °C gives a similar RCY within 5 minutes. In addition to its stability in FBS (no decomplexation after 2 h) in vivo administration in healthy rats showed rapid renal clearance and negligible unspecific uptake. ***Conclusion:*** We successful synthesised and radiolabelled Bn2DT3A at pH 7.4 with gallium-68 at room temperature with radiochemical yields up to 90%. The formed complex showed excellent stability over 120 min in FBS (fetal bovine serum) at 37 °C. in vivo experiment showed very promising sstability and fast renal clearance. ***References:*** Price, T. W. et al. Bn2DT3A, a Chelator for 68Ga Positron Emission Tomography: Hydroxide Coordination Increases Biological Stability of [68Ga][Ga(Bn2DT3A)(OH)]-. Inorg. Chem. (2022) doi:10.1021/acs.inorgchem.2c01992.

EPS-071

Research of Al^{18}F-labeled novel cyclic-peptide probe Al^{18}F-FAP-NOX in tumor-targeted molecular imaging

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Aim/Introduction: To develop a novel FAP cyclic peptide imaging agent, Al18F-FAP-NOX, evaluate its in vitro and in vivo properties, and explore its feasibility for expressing FAP in PET/CT of tumors. ***Materials and Methods:*** Al18F-FAP-NOX was manually labeled and synthesized. The in vitro stability of Al18F-FAP-NOX was determined using radio high-performance liquid chromatography (Radio-HPLC). The lipid water partition coefficient Log P, in vitro cell uptake experiments, PET/CT imaging and biodistribution in 293T-FAP tumor-bearing mice were conducted to preliminarily evaluate the pharmacokinetics and biological efficacy of Al18F-FAP-NOX in nude. Simultaneously perform the first-in-human clinical PET/CT imaging. ***Results:*** Al18F-FAP-NOX was successfully synthesized with a yield of 26.28% without attenuation correction. In vitro experiments have shown that Al18F-FAP-NOX exhibits good stability and hydrophilicity in PBS (Log P = -3.02 ± 0.08). In cell experiments, the uptake of Al18F-FAP-NOX in HT1080-FAP cells reached the plateau phase at 15 minutes (at 15 minutes: 7.31 ± 0.53 %ID/mio cells), exhibiting high cellular uptake and retention. The uptake of Al18F-FAP-NOX could be significantly inhibited by DOTA-FAP-2286, indicating that Al18F-FAP-NOX has the ability to bind with FAP with high specificity. The PET/CT results of 293T-FAP tumor-bearing mice in vivo showed that Al18F-FAP-NOX was highly uptaken in FAP-positive tumor tissues (at 60 minutes: 12.47 ± 1.66 %ID/g), while uptake was very low in FAP-negative tumors, with only 0.65 ± 0.57%ID/g at 60 minutes after injection. The drug was mainly excreted through the kidneys. The biodistribution results were similar to the PET/CT imaging results of tumor-bearing mice. The first-in-human experimental imaging showed an abnormal increase in uptake of tumor lesions. ***Conclusion:*** Al18F-FAP-NOX has been successfully synthetized in this study, demonstrating good stability and hydrophilicity. It could be quickly distributed to tumor tissue in vivo. The first-in-human clinical PET/CT imaging showed certain diagnostic ability for lung cancer lesions. It is a promising cyclic peptide agent for PET imaging.

EPS-072

New P2Y12 radioligands for PET imaging of neuroinflammation

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Aim/Introduction: Neuroinflammation (NI) is a common phenomenon to all neurodegenerative diseases. One consequence of NI is the activation of microglia, the primary immune cells of the central nervous system. The expression of P2Y12 receptors at the surface of microglia is modulated during NI and these receptors could thus be used as biomarkers to monitor microglia state in vivo with positron emission tomography (PET) imaging.1,2 To this end, we selected a pyrazolo-pyridazine scaffold presenting a high affinity for P2Y12 receptors3 and prepared precursor derivatives for radiolabeling with carbon-11 or fluorine-18. ***Materials and Methods:*** Eight reference compounds were synthesized and their affinity for P2Y12 receptors was evaluated in vitro by a radioligand binding assay. Their metabolism was examined by in vitro experiments on mice and rat microsomes and mass spectrometry to predict their in vivo biotransformation. These in vitro experiments allowed us to select the best candidates and to implement their radiolabelling. ***Results:*** Radiomethylation was carried out on an iPHASE C-11 Pro2 automate in acetone in basic conditions at 80°C for 3 minutes and the expected radioligand was obtained after 45 min in a 11.8 ± 5.4 % radiochemical yield with a molar activity of 46.7 ± 22.5 GBq/µmol (n = 7, decay-corrected). Radiofluorination was performed on a TRASIS AllInOne automate with dry $K^{[18F]}F$/K222 complex and the radiolabelled ligand was obtained in 50 min in a 25 ± 5 % radiochemical yield with a molar activity of 102 ± 15 GBq/µmol (n = 4, decay-corrected). The purity of the radioligands (over 95 %) and the good radiochemical yields enabled their in vitro study by autoradiography and their in vivo evaluation by PET imaging of a P2Y12 rat model and of non-human primates. ***Conclusion:*** One carbon-11 and one fluorine-18 radiotracer have thus been evaluated in vitro by autoradiography and in vivo by imaging of healthy rat and of a P2Y12 rat model. Although their affinity for P2Y12 was in the nanomolar range, the preliminary in vivo results seem to indicate that the ligands do not cross the blood brain barrier, impeding their further use as radiotracers of neuroinflammation. ***References:*** [1] Villa, A. et al. Theranostics 8, 5400-5418 (2018). [2] Beaino, W., Janssen, B., Kooij, G., Van der Pol, S. M. A., Van Het Hof, B., Van Horssen, J., Windhorst, A. D. and De Vries, H. E. J. Neuroinflammation 14, 259 (2017). [3] Boldron, C. et al. J. Med. Chem. 57, 7293-7316 (2014).

EPS-073

Preparation, characterization, and preclinical evaluation of mucin-targeted radionuclide labeled probes

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Aim/Introduction: MUC1 in the Mucins family is a highly glycosylated transmembrane protein whose overexpression is commonly associated with gastric, breast, ovarian, lung, and pancreatic cancers. In addition, there are differences in glycosylation of MUC1 between tumor and normal tissues. Based on the above two, a MUC1-targeting antibody 16A, labeled with 89Zr, was developed. ***Materials and Methods:*** The radiochemical purity and in vitro stability of 89Zr-16A was analyzed by radio-TLC. Cellular uptake, cellular internalization(4°C and 37°C) and affinity assays were performed in adherent cultured A549, 293T-MUC1 and 293T-COSMCKO-MUC1, B16-OVA-MUC1 and B16-OVA-COSMCKO-MUC1, and SGC79101 cells. Female KM mice (n=3) were sacrificed 2 h, 24 h, 48 h, 72 h, 96 h and 120 h after radiotracer injection to determine the bio-distribution of 89Zr-16A in normal mice. At the same timepoint, micro-PET scans were performed in SGC7901, MKN45, B16-OVA-MUC1/COSMC-knockout group, A549, SW780 and BxPC3 models, and 89Zr-labeled IgG was set as the control group. ***Results:*** 89Zr-16A was obtained with a radiochemical yield of 73.75% and radiochemical purity higher than 95%. It was stable within 120 h in vitro. The uptake of 89Zr-16A in COSMC-knockout B16-OVA-COSMCKO-MUC1 cells was significantly higher than that in wild type B16-OVA-MUC1 cells (20.78±2.79% vs 2.99±0.09%, 4 h). DFO modification had less effect on 16A affinity (expressed as EC50 value) (13.99 nM vs. 31.22 nM). The internalization rate of 89Zr-16A in COSMC-knockout cells was higher than that in wild type cells (4°C: 82.23-60.64% vs. 46.61-28.65%; 37°C: 75.21-56.27% vs. 44.96-24.82%). Both biodistribution and micro-PET imaging results showed that 89Zr-16A was largely cleared from the blood within 24 h and was mainly metabolized by the liver. micro-PET images showed that the maximum standardized uptake value (SUVmax) of 89Zr-16A in the SGC7901 model with high MUC1 expression (9.95) was significantly higher than that in the MKN45 model with low MUC1 expression (2.35). In addition, 89Zr-16A had higher tumor uptake in B16-OVA-MUC1(4.48)/B16-OVA-COSMCKO-MUC1(5.67), A549(6.47), SW780(3.42) and BxPC3(3.12) models. 89Zr-IgG used as a control, the specificity of 89Zr-16A in tumor uptake in SGC7901 and B16-OVA-COSMCKO-MUC1 models was initially demonstrated. ***Conclusion:*** High tumor uptake of 89Zr-16A was observed in lung, bladder, pancreatic, and gastric cancer models. Among them, the tumor specificity was validated in SGC7901 model. Moreover, COSMC-knockout cells showed higher selectivity to 89Zr-16A than wild-type cells, which might be due to the abnormal expression of MUC1 (as in tumor cells). 89Zr-16A has shown potential for clinical translation as a tumor MUC1-targeting PET probe.

EPS-074

A ^{177}Lu-nucleotide Coordination Polymer-incorporated Thermosensitive Hydrogel with Anti-inflammatory and Chondroprotective Capability for Osteoarthritis Treatment

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Aim/Introduction: Osteoarthritis (OA) poses a significant health burden with its cartilage destruction and inflammation. Radiosynoviorthesis (RSO) employing intra-articular radiopharmaceutical injection shows promise in attenuating OA, yet faces challenges due to toxicity and rapid dissipation of radioactive isotopes. This study aimed to develop a novel RSO-based therapeutic strategy by utilizing metal-organic coordination polymers (MCPs) as carriers of radioactive 177Lu, with adenosine monophosphate (AMP) as ligands. Then, the resulting 177Lu-AMP was incorporated into a chitosan/β-glycerophosphate thermosensitive hydrogel matrix to construct 177Lu-AMP@CG hydrogel for effective OA treatment. ***Materials and Methods:*** MCPs were explored as carriers for 177Lu3+, utilizing AMP nucleotides due to their optimal affinity. Molecular dynamics simulations elucidated the binding mechanisms, followed by the fabrication of 177Lu/AMP dispersed within a CS/β-glycerophosphate hydrogel (177Lu/AMP@CG). The sol-gel transition behaviour, rheological properties, and in vitro release kinetics were evaluated. The anti-inflammatory and chondroprotective effects of 177Lu/AMP@CG were assessed in vitro. The local retention of 177Lu/AMP@CG in rat knee joint was investigated using SPECT/CT imaging. Finally, the OA rat model

was constructed to evaluate the in vivo synovial inflammation alleviation, cartilage protection and regeneration, and biosafety of 177Lu/AMP@CG, using [18F] FDG PET/CT imaging and histological analysis. ***Results:*** 177Lu/AMP@CG exhibited controlled release kinetics, prolonged retention, anti-inflammatory effects, and chondroprotective properties. In an OA rat model, 177Lu/AMP@CG demonstrated enhanced retention of 177Lu within the joint cavity, enabling a single-dose intra-articular injection to provide long-term OA treatment without adverse effects. Combining 177Lu-based RSO with the pharmacological properties of chitosan-based hydrogel yields exceptional anti-inflammatory, cartilage repair and protective effects. ***Conclusion:*** In this study, the 177Lu-nucleotide coordination polymer-incorporated thermosensitive hydrogel was successfully prepared and proved to be applicable in OA treatment. We underscored the significant local retention capacity of the 177Lu-AMP@CG hydrogel and the potential of anti-inflammatory and chondroprotective strategy toward OA treatment.

EPS-075

Design of innovative FAP-target modules for simultaneous delivery of CAR T-cell and radiotherapy

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Aim/Introduction: Tumor-targeting therapies based on small molecules targeting tumor-microenvironment (TME)-specific proteases such as the fibroblast activation protein (FAP) have emerged as a suitable target for radioligand therapies[1]. Switchable chimeric antigen receptor (CARs) T-cells such as the Universal CAR-T cells, that can be redirected to FAP-expressing cells of the TME with FAP-specific target modules (TMs), offer a promising approach for enhancing safety and effectiveness in cancer immunotherapy[2]. In this work, we design and synthesize novel small-molecule-based FAP-specific TMs that allows for both UniCAR T-cell therapy and the simultaneous delivery of radioligands and chemotherapeutics. We will accomplish this using pretargeted approaches utilizing the tetrazine ligation[3]. ***Materials and Methods:*** We have developed a dimeric structure to target FAP, with the goal of increasing accumulation and prolonging tumor retention by connecting two UAMC1110 moieties. The fast and selective Copper(I)-catalyzed Azide-Alkyne Cycloaddition (CuAAC) was used to attach the E5B9 peptide epitope, required for the redirection of the UniCAR T-cells. Two different TMs were synthesized, one with a DOTA chelator for 68Ga and 177Lu labeling, and a second with TCO moiety for pretargeted approaches, enabling the use of the 18F and 211At. ***Results:*** The dimeric UAMC1110 was synthesized according to published procedures[4] (overall yield: 68%). After purification, a coupling reaction between the azide-PEG-NHS ester and a free amino group of the linker was performed. After careful optimization of the click reaction, we were able to substantially improve the yield of the intermediate (from 13% to 35%). In the last step, the radiolabeling components were introduced, affording the final compounds. Compound's identity was confirmed by HPLC and LC-MS. Future biological studies will assess the potential of our TMs to redirect UniCAR T-cells to FAP-expressing cancer cells. ***Conclusion:*** Two new UniCAR TMs based on homodimeric UAMC1110 were synthesized. The compounds will be evaluated in vitro for their ability to maximize the anti-tumor effect in the near future. ***References:*** 1. Journal of Medicinal Chemistry, (2014), 3053-3074, 57(7). 2. Cancer Immunology, Immunotherapy, (2019), 1713-1719, 68(10). 3. Biomaterials, (2018), 209-245, 179. 4. Cancers, (2023), 15(6).

EPS-076

A Covalent FAP-Targeted Radiopharmaceuticals Based on ^{99m}Tc-/^{188}Re-Theranostic Ligand

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Aim/Introduction: Fibroblast activation protein (FAP) targeted radiopharmaceuticals have been widely evaluated with 18F, 68Ga, and 177Lu, the currently most commonly used positron and β-nuclide. While 99mTc-based SPECT scans are more widely used and cost-effective in clinical imaging, rare 99mTc labeled FAP-targeted radiopharmaceuticals have been reported and applied clinically. In this study, a covalent group was installed to the 99mTc and 188Re labeled FAP-targeted radiopharmaceuticals to develop a theranostic tandem. ***Materials and Methods:*** A Sulphur (VI)-Fluoride Exchange (SuFEx) chemistry-based linker was employed as the covalent compound. The chelator was fine-tuned for stable labeling with 99mTc and 188Re, both of which were sourced from generators. A series of linkers were screened for the synthesis of hydrophilic tricarbonyl complexes. The obtained complexes were investigated in vitro through binding and competition experiments using HT-1080-FAP and HT-1080 cell lines. The SPECT imaging, biodistribution studies, and therapeutic investigations were conducted in HT-1080-FAP tumor-bearing mice and patient-derived xenografts (PDX) animal models. ***Results:*** The lead candidate, 99mTc-CTR-FAPIs, exhibited specific binding to HT-1080-FAP cells with high affinity. The SPECT imaging of HT-1080-FAP and PDX models demonstrated that 99mTc-CTR-FAPIs had a higher tumor uptake (SUV max = 4.23 ± 0.56 at 3 h post-injection) and clearer background. Additionally, the SPECT imaging revealed prolonged retention of 188Re-CTR-FAPIs in the tumor. The 188Re-CTR-FAPIs was employed for the treatment of HT-1080-FAP tumors, resulting in notable inhibition of tumor growth. ***Conclusion:*** A covalent FAP-targeted radiopharmaceutical, CTR-FAPIs, represents a potent tracer for 99mTc-based diagnostic SPECT scans and 188Re-based radionuclide therapy, both of which are generator-based radionuclides.

EPS-077

Fully Automated Radiosynthesis of [^{124}I]I-AT-01 for Clinical Multi-Centre PET Imaging of Systemic Amyloidosis

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Aim/Introduction: Systemic amyloidosis is a multisystem protein deposition disease caused by aggregation and deposition of various abnormally folded proteins. Most patients present with either cardiac or renal involvement and prognosis is poor in the absence of intervention. Diagnostic biopsies are challenging due to the heterogeneous nature of amyloid deposits. AT-01 is a novel amyloidophilic peptide which electrostatically binds to diverse

forms of human amyloid independent of fibril precursor proteins. Radioiodinated [124I]I-AT-01 has shown uptake in clinically diagnosed organs, and undiagnosed organs correlating with expected systemic amyloid distribution in a first-in-human study [1]. Here we describe development of automated radiosynthesis of [124I]I-AT-01 to facilitate multi-centre clinical PET imaging of systemic amyloidosis. ***Materials and Methods:*** Based on our prior work on 89Zr-automation, automated radiolabelling of AT-01 with 124I, formulation, and sterile filtration was established using a disposable cassette-based synthesis module. Starting activity, peptide amount, and final product volume were optimized to satisfy patient dose requirements avoiding further manual intervention. Quality control was performed on the formulated product to satisfy clinical release and stability criteria over 24 hours. ***Results:*** Radiolabelling reactions were performed in sodium phosphate (0.5M, pH 5) aided by a small amount of ascorbate and Pierce iodination reagent which gave >97% conversion after 10 minutes at ambient temperature. Overall process yield of formulated sterile [124I]I-AT-01 was 64% ± 1% (n=3) at end-of-synthesis (EOS) with a process time of 40 minutes. Product was formulated in a volume of 9mL with maximum total and apparent specific activities at EOS of 71MBq and 68MBq/mg, respectively. Patient dose activity was fixed to 37MBq and corresponding patient protein dose was 555µg ± 11µg (n=3). Radiochemical purity by RP-HPLC and immunoreactive fraction at EOS were 99.6% ± 0.0% (n=3) and 96.4% ± 0.5% (n=3), respectively, and dropped to 97.9% ± 1.0% (n=3) and 92.0% ± 3.2% (n=3), respectively, after storage at 4-8°C for 24 hours. pH of formulated [124I]I-AT-01 was 6.66 ± 0.09 (n=3) and sterility and endotoxin levels passed clinical release criteria. ***Conclusion:*** Fully automated production of [124I]I-AT-01 for clinical use was achieved with minimal exposure to the operator and excellent product stability over 24 hours. This demonstrates feasibility of automated clinical production of peptidic 124I-radiopharmaceuticals for multi-centre studies. ***References:*** [1] Wall, J.S., Martin, E.B., Endsley, A. et al. First in Human Evaluation and Dosimetry Calculations for Peptide 124I-p5+14—a Novel Radiotracer for the Detection of Systemic Amyloidosis Using PET/CT Imaging. Mol Imaging Biol 2022;24(3):479-488.

EPS-078

[18F]FDS: Implementation of an automated production process and its quality control

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Aim/Introduction: [18F]FDS, 2-deoxy-2-[18F]fluorosorbitol, is an experimental radiotracer obtained by reduction [18F]FDG (2-deoxy-2-[18F]fluoroglucose) reduction using sodium borohydride (NaBH4). The pharmacokinetic of [18F]FDS makes it a potentially interesting radiotracer in neurology, infectiology, and nephrology. In this work, we propose a method for automated radiosynthesis of [18F]FDS combined with a quality control (QC) method adapted to clinical research. ***Materials and Methods:*** [18F]FDS radiosynthesis was based on a published process and was adapted on a radiosynthesizer. The modification of the following parameters was studied to optimize the radiosynthesis : [18F]FDG flow rate on the NaBH4 cartridge, addition of an alumina column, kit purge through the cartridges with NaCl and air. QC performed on the preparations included pH measurement, boron determination, radiochemical purity (RCP) by radio high pressure liquid chromatography (rHPLC) and thin layer chromatography (TLC). ***Results:*** Seven automated productions were carried out. The duration of the syntheses was 53±8.5 min and the pH was 6-7. Among the productions, 3 showed [18F]FDG total reduction (TR) associated with a RCP of 100% measured by rHPLC (tR[18F]FDS =3.4 min), 3 showed [18F]FDG partial reduction (PR) (RCP < 70%, tR[18F]FDG =12 min) and 1 reduction was uninterpretable. The 3 PR productions can be attributed to a higher flow rate of [18F]FDG through the NaBH4 cartridge, which does not provide sufficient contact time for effective reduction. The non-decay corrected yields for the TR productions were 55%, 57%, 43%, respectively. In TLC, 14 mobile phases were tested and 2 allowed a better resolution of the [18F]FDS and [18F]FDG peaks: acetone/methanol/water/ammonia (70/20/7.5/2.5), Rf[18F]FDS: 0.7, Rf[18F]FDG: 1.3, and acetonitrile+0.1%TFA/water (80/20), Rf[18F]FDS: 0.8, Rf[18F]FDG: 1.0, associated respectively with an ITLC-SG and silica gel 60 stationary phase. The amounts of boron assayed on 3 samples were 1800 mg/L, 2023 mg/L and 1787 mg/L. To reduce these concentrations, an alumina column has been added and the kit purge avoids the NaBH4 cartridge. ***Conclusion:*** In this work, we have developed an automated production process for [18F]FDS using a simple method of total reduction of [18F]FDG that can be easily implemented. This process was validated using a robust QC method by rHPLC but is still restrictive in routine. The development of the simplified QC method by TLC would favor the use of [18F]FDS in routine. However, the writing of an investigational medicinal product dossier can already be considered. ***References:*** Kit-based synthesis of 2-deoxy-2-[18F]-fluoro-d-sorbitol for bacterial imaging, Mota et al. Nature Protocols, 2021.

EPS-079

Optimization and Quality Control of Automated [68Ga]Ga-Citrate Radiosynthesis with a GAIA® synthesis module

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Aim/Introduction: Positron emission tomography-computed tomography (PET-CT) has emerged as an essential tool in medical imaging, allowing both functional and morphologic imaging with excellent resolution. This method utilizes radiolabeled molecules, with a preference for short-lived positron-emitting isotopes like fluorine-18 and gallium-68. Among these, gallium-68 stands out due to its short half-life, making it an ideal candidate for PET imaging studies. The present study seeks to refine and optimize the automated radiosynthesis process of [68Ga]Ga-Citrate with a GAIA® module (Elysia-Raytest), a radiotracer with applications in inflammation and infection imaging. ***Materials and Methods:*** The research methodology was based on literature-derived methods, which were adapted to accommodate the available equipment. Automated syntheses were carried out on a GAIA® V2 module. Two distinct radiosynthesis strategies were evaluated, each employing different cation exchange cartridges (Accell Plus or PS-H+ cartridge) : 4mL of citrate solution at a concentration of 136mM is passed over each cartridge. To ensure the robustness and reliability of the optimized process, a comprehensive suite of quality control tests was deployed : organoleptic characteristics, pH, radiochemical purity (by TLC and HPLC, measured immediately post-synthesis and subsequently every hour for 4 hours), as well as biological evaluations, aiming to guarantee the safety, purity, and efficacy of the synthesized [68Ga]Ga-Citrate. ***Results:*** Systematic

optimization of the radiosynthesis process focused on adjustment of citrate concentration and volume, and selection of the cation exchange column. These modifications significantly improved synthesis efficiency. Notably, the PS-H+ cartridge demonstrated a remarkable synthesis yield of 72%, in contrast with the suboptimal 16% yield obtained with the Accell Plus cartridge. Quality control results confirmed the success of the optimization process, validating the purity and safety of the synthesized [68Ga]Ga-citrate. Radiochemical purity was found to exceed 99% in both TLC and HPLC, and all other quality controls achieved the required standards. In continuation of these promising results, further syntheses are required to validate the method, ensuring the robustness and reproducibility of the optimized radiosynthesis process. ***Conclusion:*** In this study, the automated radiosynthesis of [68Ga]Ga-citrate was successfully optimized on a GAIA® V2 module. This advancement holds promising prospects for PET imaging in inflammation and infection. Our methodology, grounded in established literature and customized to suit the available equipment, lays foundations for further clinical investigations. Therefore, future efforts could be directed towards the elaboration of an investigational medicinal product dossier (IMPD) follow by exploring its potential applications in clinical PET.

EPS-080

Breakthrough in ^{11}C methylation of biologically interesting molecules: the case of [^{11}C]PiB

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Aim/Introduction: Alzheimer's disease (AD) is a progressive neurodegenerative disorder, the foremost factor in dementia worldwide, resulting in brain atrophy, memory impairment, cognitive decline, and ultimately neuronal death. AD is often associated with amyloidal plaques consisting of β-amyloid (Aβ) peptides that aggregate in different shapes and patterns in specific brain areas. It has been demonstrated through research that these Aβ aggregates can be identified several years prior to the onset of symptoms, enabling the possibility of early diagnosis and risk prediction [1].Concerning the Carbon-11 area, surely the [^{11}C]PiB is the gold standard radiotracer for targeting and detection of Aβ plaques and other Aβ-containing lesions in humans, already successfully used to diagnose AD at early stage. ***Materials and Methods:*** The scientific literature outlines three main radiolabeling methods for [^{11}C]PiB: the use of [^{11}C]CH3I, the use of [^{11}C]CH3OTf and the [^{11}C]CO2 fixation-reduction. Initially, the strategy was to use the [^{11}C]CH3I followed by removal of a protected group. The implementation of [^{11}C]CH3OTf has eliminate the need for deprotection and reduced the synthesis time. Currently the [^{11}C]CH3OTf strategy leads to the best yield and the best Specific Activity of the final product [2].The proposed study aims to present how the full synthetic automatic process of the [^{11}C]PiB using a Trasis AIO 24 synthesizer was developed. Thanks to its unique components the process move from the molecular sieve adapted to trap [^{11}C]CO2, to the methylating agent produced through a silver triflate reactor, to the labeling and the purification of the final product using the incorporated HPLC system. ***Results:*** The tests carried out at high activity (final product activity ≥ 7 GBq) showed that the process is reliable, reproducible (yield 18±4% (n=5)) and the resulting product is stable up to even 2 hours. All the production satisfied the QC criteria and specifications (USP chapter 823) necessary for its utilization in human studies [3]. ***Conclusion:*** The presented [^{11}C]PiB example shows that the optimization of the platform has therefore the potential to create a methylation agent able to be used in a wide range of ^{11}C-labeling tracers in a efficiently, reproducibly, and most importantly quickly way. ***References:*** 1] Heeman, F. et al. EJNMMI Res 10, 123 (2020). [2] Myburgh PJ, Solingapuram Sai KK. Am J Nucl Med Mol Imaging. 2024 Feb 20;14(1):48-62. [3] Myburgh PJ et al. Appl Radiat Isot. 2023 Dec;202:111040.

EPS-081

A fully automated synthesis of [^{18F}]Fluro-L-meta-tyrosine (FMT) on AllInOne synthesizer

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Aim/Introduction: The [^{18F}]FDOPA is the most used tracer in the imagining of the dopaminergic pathway of the brain. However, is mainly metabolized in peripheral tissues by aromatic amino acid decarboxylase (DDC) to [^{18F}]fluorodopamine and by catechol-O-methyl transferase (COMT) to [^{18F}]3-O-methyl-6-fluoro-DOPA (OMFD1). OMFD is able to crosses the blood-brain barrier bidirectionally, and distributes widely throughout the brain, compromising image contrast and making its quantitative analysis very complicated. On the contrary, [^{18F}]FMT is not a substrate for COMT and ca be a better PET tracer for the in vivo clinical research imaging of cerebral dopamine system (2). Different methods are proposed to synthesize [^{18F}]FMT however, to this day, is possible to obtain only a feeble yields (8-26% d.c.) and there is no offer for ready to use kits for cassette-based routine production(3,4,5). ***Materials and Methods:*** In this work we have improved the [^{18F}]FDOPA synthesis method to produce [^{18F}]FMT under cGMP conditions using the Trasis AllinOne synthesizer. We report a new synthesis of [^{18F}]FMT via a multi-step synthesis that include, labelling, solid phase reduction and halogenation, chiral phase transfer alkylation, strong acid deprotection, HPLC purifications and final formulation (6, 7). ***Results:*** This synthetic method provided a radiochemical yields over 20% n.d.c. (>30% corrected; n=15) using a starting activities from 100 to 200 GBq after 80 min production. ***Conclusion:*** The formulated product was demonstrated stable over 8 hours with a radiochemical purity higher than 99% (enantiomeric purity always above 97%) and a total impurities amount lower than 0.5 µg/ml. ***References:*** 1 Pauwels et al. / European Journal of Pharmacology 257 (1994) 53-582 VanBrocklin et al. / Applied Radiation and Isotopes 61 (2004) 1289-12943 DeJesus et al /Journal Of Nuclear Medcine 38 (1997) 6304 Craig et al Chem. Commun., 2020, 56, 95055 Melean et al J. Label Compd. Radiopharm 2015, 58 133-1406 Lemaire, C., et al.,. J. Fluorine Chem., 2012. 1387 Libert, L., et al., r. Journal of Labelled Compounds and Radiopharmaceuticals, 2011. 54.

EPS-082

A cassette-based process for the multidose production of [^{11}C]Acetate on the AllinOne

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Aim/Introduction: [^{11}C]Acetate is a versatile PET tracer used in cardiology for studying myocardial perfusion and oxygen metabolism, and in oncology for studying liver cancer and brain tumors.[1] Existing processes for the synthesis of [^{11}C]Acetate are well described in the literature and are based on home-made [2-4] or commercial full or partially fixed-tubing systems [5-7]. The challenge with existing processes in a routine production environment is to develop, validate and implement a cleaning procedure of the production equipment after each run. This work

aims at developing a fully automated and cassette based process that offers high production yields while minimizing the workload of production personnel. ***Results:*** Cyclotron-produced [^{11}C]CO2 is first concentrated and purified on the AllinOne's molecular sieve, which also makes [^{11}C]CO2 transfer and the subsequent radiolabelling robust to all site and cyclotron configurations. [^{11}C] CO2 is then thermally desorbed and transferred to the Grignard reagent (CH3MgCl) where its carboxylation reaction yields acetate. After quenching and dilution with aqueous acetic acid, the reaction mixture is purified on solid phase extraction (SPE) cartridges. Finally, [^{11}C]Acetate is dispensed through a sterile filter in an isotonic citrate buffer. Careful process development and optimization resulted in an all-time-high [^{11}C]Acetate yield of 53±3% n.d.c. in 10 minutes (RCY = 74% d.c., RCP ≥ 99 %). Up to 16 GBq per batch of [^{11}C]Acetate have been produced using this process: the delivered product complies with monograph 04/2023:1920 of the Eur.Ph., with a confirmed final product stability of more than 2 hours. ***Conclusion:*** We herein report the development of a single-use cassette, reagent kit and process for the synthesis of [^{11}C]Acetate on the AllinOne. With its cassette-based and GMP-compatible approach delivering multi-patient doses of [^{11}C]Acetate, this new manufacturing process is specifically designed for use in routine PET diagnosis in hospitals that need to produce [^{11}C]Acetate on a regular basis. ***References:*** [1] Am J Nucl Med Mol Imaging 2012; 2(1):33-47 [2] J Label Compd Radiopharm 2006; 49: 263-267 [3] Applied Radiation and Isotopes 67 (2009) 581-589 [4] Nuclear Medicine and Biology 38 (2011) 1135-1142 [5] Applied Radiation and Isotopes 65 (2007) 691-695 [6] Applied Radiation and Isotopes 69 (2011) 691-698 [7] Applied Radiation and Isotopes 82 (2013) 7-11.

EPS-083

Optimized cassette-based process for [^{18F}]FMZ production: an outlook to generic ArylBpin radiolabellings in GMP environment

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Aim/Introduction: [^{18F}]Flumazenil (FMZ) is an imidazobenzodiazepine tracer used in PET imaging to identify alterations in neuronal density and study neuronal disorders such as Huntington's disease or epilepsy. While this PET tracer has historically been difficult to bring to the clinic due to technical limitations of historical labelling methods, the emergence of ArylBPin radiofluorination technology[1,2] offered a promising approach to [^{18F}]FMZ manufacturing [3]. ArylBPin chemistry can however be challenging in some aspects and its industrialization to full-blown, readily available GMP processes has to the best of our knowledge remained unheard of. ***Results:*** In this work, we report the successful industrialization of the automated [^{18F}]FMZ production process on the AllinOne synthesis module, which was also translated into readily available consumables. The project comprised 3 main axes of development; (1) a process for the synthesis of GMP-grade FMZ-BPin precursor and the corresponding purification and analytical methods for release and stability studies. (2) a process to manufacture the CuPy4OTf2 catalyst with the objective to overcome existing procurement issues of this compound with existing vendors and make it available for nuclear medicine applications. (3) a cassette, kit and automated process for the routine production of [^{18F}]FMZ for human use. The resulting process delivers [^{18F}]FMZ with excellent yields (30% n.d.c., <1hour) at multi-patient dose levels. Both the FMZ-BPin precursor and radiolabelled [^{18F}]FMZ pass the quality requirements for human use as per the relevant general monographs of the Ph.Eur. ***Conclusion:*** This process and the release of ready-to-use kits for the ArylBPin-mediated manufacturing of [^{18F}]FMZ are the first step towards the clinical deployment of this radiolabelling technology that has the potential to bring to the clinic many otherwise inaccessible F18-labelled PET tracers. Further work will be dedicated to demonstrating the compatibility of these precursor manufacturing advances as well as of the automated radiosynthesis process with other ArylBPin precursors of clinical interest. ***References:*** - [1] Mossine A.W, Org. Lett. 2015, 17, 23, 5780-5783 - [2] Preshlock S. et al. Chem. Commun., 2016,52, 8361-8364 - [3] Gendron et al. EJNMMI Radiopharm Chem. 2022 Mar 20;7(1):5.

EPS-084

Development of adsorption/desorption material for novel ^{68}Ge/^{68}Ga generator

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Aim/Introduction: With the increasing global use of 68Ge/68Ga generators in medical applications, there is an urgent need for research into the column materials of these generators and their adsorption and desorption capabilities for the radionuclides 68Ge and 68Ga. In this study, we developed microsized beads for a 68Ge/68Ga generator system, utilizing chitosan and titanium dioxide to ensure high adsorption/desorption capacity for 68Ge (parent nuclide) and 68Ga (daughter nuclide), respectively, while maintaining stability in hydrochloric acid. ***Materials and Methods:*** The 68Ge/68Ga generator column material was synthesized using a low molecular weight chitosan-based TiO2 adsorbent via physical trapping, resulting in a durable 68Ge/68Ga generator column material. Long-term adsorption/desorption studies demonstrated a higher separation factor of 68Ge/68Ga across the examined concentration range of HCl (0.01 M to 1.0 M). ***Results:*** The prepared chitosan-TiO2 adsorbent (CLA) exhibited acid resistance capabilities, with >70% 68Ga elution yield and 10-3 to 10-4% 68Ge breakthrough. Notably, the labeling efficiency of DOTA and NOTA using the generator-eluted 68Ga was highly encouraging, confirming efficiencies of 99.65% and 99.69%, respectively. Thus, the behavior of CLA towards 68Ge/68Ga adsorption/desorption and stability with aqueous HCl suggests a high potential for ionexchange solid-phase extraction in the 68Ge/68Ga generator column material. ***Conclusion:*** We have demonstrated that the synthesized CLA can serve as a novel column material for a 68Ge/68Ga generator. Given the imperative for medical radioisotope generators to provide elution with high purity and specific activity, our developed column material addresses these requirements, offering promising elution efficiency and stability while maintaining a high purity (>99.9%) of 68Ga elution with 10-3 to 10-4% 68Ge breakthrough. Moreover, it can effectively filter impure metals, ensuring optimal labeling yields for 68Ga-radiopharmaceuticals. ***References:*** [1] Rösch, F. Past, present and future of 68Ge/68Ga generators. Appl. Radiat. Isot. 2013, 76, 24-30.[2] Kumar, K.Y.; Muralidhara, H.; Nayaka, Y.A.; Balasubramanyam, J.; Hanumanthappa, H. Low-cost synthesis of metal oxide nanoparticles and their application in adsorption of commercial dye and heavy metal ion in aqueous solution. Powder Technol. 2013, 246, 125-136. [3] Jun-Young Lee ,; Pyeong-Seok Choi,; Seung-Dae Yang; Jeong-Hoon Park.; TiO2 Decorated Low-Molecular Chitosan a Microsized Adsorbent for a 68Ge/68Ga Generator System. Molecules. 2021, 26, 3185.

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Sunday, October 20, 2024, 16:45 - 18:15
Hall G1

CTE 3 - Technologists Committee - Patient's Advocacy

OP-249
Patient advocacy in practice - the experience of a Patient Experience Lead
N. Lewis;
Associate Director of Patient Experience, Medway NHS Foundation Trust, Gillingham, KENT.

OP-250
Scope and impact of a Foundation at the service of Nuclear Medicine – real life examples
R. Lo Bue;
Oncidium Foundation, Brussels, BELGIUM.

OP-251
What does Patient Advocacy in Nuclear Medicine looks like from across the Atlantic?
D. Gilmore;
Massachusetts College of Pharmacy and Health Sciences, Boston, UNITED STATES OF AMERICA.

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Sunday, October 20, 2024,16:45 - 18:15
Hall Y1-Y3

Theranostics Track - TROP Session: Oncology & Theranostics Committee: Neuro-endocrine Therapy

OP-252
Therapy with the somatostatin receptor antagonist DOTA-LM3 labeled with terbium-161: Interim results of the Phase 0 Study in patients with gastroenteropancreatic neuroendocrine tumors
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Aim/Introduction: The goal of this Phase 0 study (NCT05359146) was to determine the absorbed doses in tumors and relevant organs after a test injection of [161Tb]Tb-DOTA-LM3 and [177Lu]Lu-DOTATOC in a cohort of grade 1 and 2 gastroenteropancreatic neuroendocrine tumor patients. ***Materials and Methods:*** In this randomized, cross-over, prospective, single-center, open-label Phase 0 study, six of eight patients were evaluated to date. Patients received 1 GBq [161Tb]Tb-DOTA-LM3 and 1 GBq [177Lu]Lu-DOTATOC over a 4-week interval. Quantitative SPECT/CT imaging was performed ~3, ~24, ~72, and ~168 h after infusion of both radiopharmaceuticals to calculate tumor and organ absorbed doses (3D dosimetry using a Monte-Carlo-based OSEM algorithm). ***Results:*** After injection of only 1 GBq [161Tb]Tb-DOTA-LM3, SPECT/CT revealed excellent image quality with intense tumor uptake in all patients and a median of the mean (range) effective tumor half-life of 100 hours (49-130 hours) for [161Tb]Tb-DOTA-LM3 compared to [177Lu]Lu-DOTATOC (75 (41-108) hours). The median (range) of the mean tumor absorbed doses of [161Tb]Tb-DOTA-LM3 and [177Lu]Lu-DOTATOC were 46 (25-98) and 8 (3-14) Gy/GBq, respectively. The median (range) kidney, spleen and bone marrow absorbed doses were 3.2 (2.4-3.8), 4.4 (4.4-6.9), 0.3 (0.2-0.5) Gy/GBq for [161Tb]Tb-DOTA-LM3 and 0.7 (0.5-0.8), 1.2 (1.2-4.7), 0.04 (0.02-0.05) Gy/GBq for [177Lu]Lu-DOTATOC, respectively. According to CTCAE v5.0, there were grade 1 adverse events (anemia, leukopenia, thrombopenia) in four of the six patients after the infusion of 1 GBq [161Tb]Tb-DOTA-LM3. ***Conclusion:*** [161Tb]Tb-DOTA-LM3 shows a 7-fold higher tumor absorbed dose compared to [177Lu]Lu-DOTATOC. The tumor-to-bone marrow absorbed dose ratio for [161Tb]Tb-DOTA-LM3 was 1.4-fold lower compared to [177Lu]Lu-DOTATOC. The administration of 1 GBq [161Tb]Tb-DOTA-LM3 was safe in all patients without relevant adverse events. Note: It is planned to present the final results of all eight patients.

OP-253
A multicenter phase 2 randomised controlled trial comparing ^{177}Lu-Dotatate and capecitabine combination treatment with ^{177}Lu-Dotatate in neuroendocrine tumor patients.
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Aim/Introduction: Peptide receptor radionuclide therapy (PRRT) with [177Lu]Lu-[DOTA0,Tyr3]octreotate (177Lu-DOTATATE) is an effective and safe treatment option for patients with metastatic neuroendocrine tumors (NET). In advanced NET patients, 177Lu-DOTATATE has been proven to prolong progression-free survival (PFS) and preserve quality of life. However, objective response rates (ORR) are limited. The use of radiosensitizers could increase efficacy without the need for higher PRRT dose. Capecitabine is a pro-drug of 5-fluorouracil which inhibits deoxythymidine monophosphate via thymidylate synthase, leading to a decrease in DNA synthesis and repair. The combination of 177Lu-DOTATATE with capecitabine has only been studied in heterogeneous, single arm studies. In this phase II study, we investigated whether capecitabine has an additional cytotoxic or radiosensitizing effect on top of 177Lu-DOTATATE. ***Materials and Methods:*** This is a phase II randomized controlled trial in patients with advanced somatostatin receptor-positive gastroenteropancreatic or bronchopulmonary NET. Patients were treated with either 177Lu-DOTATATE and capecitabine combination therapy or 177Lu-DOTATATE only. Every patient received four cycles of 7.4 MBq 177Lu-DOTATATE. Patients treated with capecitabine received 1650 mg/m2/day for two weeks starting at the time of 177Lu-DOTATATE administration. Primary endpoints were ORR, PFS and median overall survival (OS). Toxicity was evaluated as a secondary endpoint. ***Results:*** 111 patients were enrolled and randomized for treatment with 177Lu-DOTATATE/capecitabine (n=50) or 177Lu-

DOTATATE (n=61). The ORR was 32% in the 177Lu-DOTATATE/capecitabine group and 44% in the 177Lu-DOTATATE group (p = 0.222). There was no significant change in PFS with 45.7 months (95% CI 34.2-57.2) in the 177Lu-DOTATATE/capecitabine group versus 31.7 months (95% CI 24.8-38.7) in the 177Lu-DOTATATE group (p = 0.629), with a hazard ratio of 0.761 (95% CI 0.501-1.157). Also, OS was not significantly different with 75.8 months (95% CI 58.9-92.6) and 61.4 months (95% CI 45.2-77.6) months, respectively (p = 0.530), and a hazard ratio of 0.842 (95% CI 0.539-1.315). There were no significant differences in the occurrence of short-term haematological or renal toxicities between the 177Lu-DOTATATE/capecitabine group and the 177Lu-DOTATATE group. Long-term haematological toxicity as myelodysplastic syndrome or acute myeloid leukaemia was 6% in the 177Lu-DOTATATE/capecitabine group and 3.3% in the 177Lu-DOTATATE group (p=0.656). ***Conclusion:*** In this randomized phase II trial, capecitabine combination therapy with 177Lu-DOTATATE did not improve response rates or survival compared to 177Lu-DOTATATE alone.

OP-254

Early Outcomes of ^{225}Ac-DOTA-LM3 Radiopeptide Therapy for Resistant Neuroendocrine Tumors: An Assessment Using Theranostic Response Criteria In Solid Tumors (THERCIST)

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Aim/Introduction: The benefits of somatostatin receptor antagonists, including enhanced uptake and prolonged tumor retention [1], present promising avenues for receptor radionuclide therapy. Combining somatostatin receptor antagonists with alpha emitters like 225Ac represents an innovative approach, potentially serving as salvage therapy for patients refractory to 177Lu- and 90Y-labelled somatostatin receptor agonists or 177Lu-labelled antagonists alone. ***Materials and Methods:*** We assessed treatment outcomes in 12 patients (8 males, 4 females; mean age 41.5 years) with G3 neuroendocrine tumors (7 pancreatic, 2 duodenal, 2 rectal, 1 gastrinoma; Ki67 (%) 27.5±22.5, mean 26.5%), resistant to all conventional regimens including peptide receptor therapy (PRRT) with SSTR agonists. Therapy involved 225Ac-DOTA-LM3 (6 treatments, 16.5±8.5 MBq; mean 13.4 MBq), with 10 sessions combining 225Ac-DOTA-LM3 (12.5±7.5 MBq; mean 9.5 MBq) with 177Lu-DOTA-LM3 (5.1±3.3 GBq, mean 4.9 GBq) as TANDEM. Treatment response was evaluated post-therapy using 68Ga-DOTA-LM3 PET/CT (223±172 days after therapy; mean 129 days) with THERCIST. ***Results:*** As per THERCIST criteria, we observed partial molecular responses after 9 treatments (56%) in 8 patients (67%), minor molecular responses after 4 treatments (25%) in 1 patient (8%), stable molecular disease after 2 treatments (13%) in 2 patients (17%), and progressive disease after one treatment (6%) in one patient (8%). Post-therapeutic tumor volume reduction averaged 48% (41% with 225Ac-DOTA-LM3; 52% with TANDEM DOTA-LM3), with a similar decrease of 49% noted for hepatic metastases (50% with 225Ac-DOTA-LM3; 48% with TANDEM DOTA-LM3). ***Conclusion:*** Our preliminary findings suggest higher therapeutic efficacy of 225Ac-DOTA-LM3 compared to existing data on outcomes with 177Lu-PRRT [2], underscoring the potential of 225Ac-DOTA-LM3 as a new therapeutic agent for refractory metastatic neuroendocrine tumors. ***References:*** [1] Baum RP, Zhang J, Schuchardt C, Müller D, Mäcke H. First-in-humans study of the SSTR antagonist 177Lu-DOTA-LM3 for Peptide Receptor Radionuclide Therapy in patients with metastatic neuroendocrine neoplasms: Dosimetry, safety, and efficacy. J Nucl Med. 2021; 62:1571-81, [2] Strosberg J, Leeuwenkamp O, Siddiqui MK. Peptide receptor radiotherapy re-treatment in patients with progressive neuroendocrine tumors - A systematic review and meta-analysis. Cancer Treatment Rev. 2021; 93: 102-141

OP-255

Preliminary Safety Results of Phase 1 Trial of Lu-177-DOTATATE in Combination with Olaparib in Metastatic SSTR+ Gastroenteropancreatico Neuroendocrine Tumor

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Aim/Introduction: Gastroenteropancreatic neuroendocrine tumors (GEP-NETs) are somatostatin receptor (SSTR) expressing tumors that can be treated with Lu-177-DOTATATE. As ionizing radiation kills tumors via DNA damage, combination therapy with olaparib, a poly-ADP-ribose polymerase inhibitor that blocks single-stranded DNA repair, is theorized to synergistically enhance Lu-177-DOTATATE's efficacy but may also exacerbate radiation-induced toxicity. We present the in-progress safety results of a phase 1/2 trial testing this combination in metastatic GEP-NETs. ***Materials and Methods:*** In this standard 3+3 dose escalation, single-center phase 1/2 study (NCT04086485), Lu-177-DOTATATE is given at fixed dose of 200 mCi x 4 cycles with olaparib being escalated from dose level (DL) 1 at 50mg to 100mg (DL2), 200mg (DL3), and 300mg (DL4) bid. Olaparib dosing starts 2 days prior to Lu-177-DOTATATE until 28 days post, for a total of 30 days with each Lu-177-DOTATATE administration. Eligibility includes SSTR+ tumors and progressive disease by RECIST within 36 months of enrollment. Specific DNA-repair mutations such as BRCA are not required for eligibilitiy. Dose limiting toxicities (DLTs) are defined as any grade 4+ hematological (except lymphocyte count) or any grade 3+ non-hematologic adverse event (AE) related to treatment that occurred within 5 weeks of the first cycle. The study opened for enrollment in September 2022 and will require up to 33 patients for full accrual. ***Results:*** As of April 2024, 11 patients have been treated on study with 3 patients each on DLs 1-3, and 2 patients on DL4. Six patients have completed therapy with all 4 cycles of Lu-177-DOTATATE, 3 have completed 3 cycles, and 2 have had 1 cycle of treatment. For safety, no DLTs have been reported in any patients. One patient needed to have a dose reduction for one of the Lu-177-DOTATATE cycles due to a grade 3 non-hematological AE that occurred outside of the DLT window (hyperglycemia). For AEs, 9 patients have data that have been analyzed. Of these 9, all (100%) had at least 1 reported treatment-related AE with 2/9 (22%) reporting at least 1 SAE (excluding grade 3+ lymphocyte count decreased). Most common AEs include leukopenia (78%), abnormal serum prolactin levels (55%), hyponatremia/hyperkalemia (44%), thrombocytopenia (33%), and anemia (33%). Grade 1 creatinine elevation in 3/9 (33%) and liver enzyme elevation in 1/9 (11%) of patients were observed. ***Conclusion:*** Preliminary data suggests that Lu-177-DOTATATE at 200 mCi is well tolerated in combination with olaparib up to 300 mg bid, the FDA-approved single agent dose.

OP-256

Interim results of ^{212}Pb-VMT-α-NET Targeted Alpha Therapy in Metastatic Gastro-entero-pancreatic Neuroendocrine Tumors: First In-human Clinical Results on Safety and Efficacy

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Aim/Introduction: Targeted alpha therapy using 212Pb has garnered growing interest. The proprietary molecule 212Pb-VMT-α-NET has demonstrated remarkable performance in preclinical studies. The objective of this study was to investigate the interim results on safety and efficacy of 212Pb-VMT-alpha-NET therapy (TAT) in patients with advanced, progressive, 177Lu-DOTATATE refractory, somatostatin receptor (SSTR) positive, metastatic gastro-entero-pancreatic neuroendocrine tumors (GEP-NETs). ***Materials and Methods:*** The Institute Ethics Committee (IEC No: 2023-002-EMP-40) approved this exploratory first-in-human study. In our ongoing study (November 2022 to April 2024), we enrolled ten patients with well-differentiated NETs. These patients underwent a screening 68Ga-DOTANOC PET/CT scan to confirm high SSTR expression and progressive disease following prior therapies. 212Pb-VMT-α-NET was administered at a dosage of 50 µCi/kg body weight, with an interval of 08-weeks for up to 4 cycles. Hematologic, kidney, and liver function tests were repeated after each cycle at 2, 4, and 8-week intervals. Treatment-related side-effects were assessed every 2 weeks through physical examinations, laboratory results and evaluation of adverse events using the CTCAE v5.0 grading system. Efficacy assessment included evaluating clinical response and radiological changes. Objective radiological response was measured using contrast-enhanced CT scans (RECIST 1.1 criteria) and receptor expression was observed on 68Ga-DOTANOC PET/CT scans. Alterations in 68Ga-DOTANOC uptake only, were also considered as indicators of treatment response. ***Results:*** Out of ten heavily pre-treated patients included in this study, seven patients completed all four cycles of therapy, however, three patients progressed and succumbed to disease in due course of study. Treatment was well tolerated in all patients, with most common treatment-related adverse events were nausea, fatigue, and alopecia. None of the patients experienced grade 3 or 4 hemato-toxicity, renal insufficiencies or hepatotoxicity, At the time of assessment, the morphological response assessment indicated a partial response in 4 out of 7 patients, while 3 out of 7 patients showed stable disease. All patients demonstrated an improvement in their quality of life and clinical symptoms. ***Conclusion:*** The interim results of the 212Pb-VMT-α-NET therapy seems to be encouraging following favourable clinical as well as radiological response in seventy percent of patients. Also, the treatment appears to be safe, with minimal and transient side effects. However, the long-term survival data will emerge with extended follow-up.

OP-257

Prediction of patient progression-free survival with 177Lu-DOTATATE in clinical practice: NEPTUNE-SEPTRALU model for patient selection

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Aim/Introduction: Peptide receptor radionuclide therapy (PRRT) is increasingly recognized for its efficacy in treating neuroendocrine neoplasms (NENs). As clinical trials evaluate the optimal sequencing and integration of PRRT, accurately predicting individual patient outcomes has become essential. Our study aims to develop and validate a model to predict progression-free survival (PFS) in patients undergoing PRRT ***Materials and Methods:*** The data for this study were collected from the SEPTRALU study (NCT04949282), a comprehensive national registry supported by the Spanish Society of Nuclear Medicine and Molecular Imaging (SEMNIM). This registry records outcomes for patients with advanced NENs treated with 177Lu-DOTATATE under various clinical conditions. We used an accelerated failure time model to estimate PFS, which was internally validated using bootstrap methods. The resulting NEPTUNE model was transformed into a nomogram and is accessible through an online calculator (https://www.prognostictools.es/Neptune/calculator/calculator.aspx). ***Results:*** As of October 2023, the registry included 713 patients, with 624 meeting the inclusion criteria and having available follow-up data. The cohort primarily consisted of males (59%, n=368), with a median age of 61.2 years (range 18 to 88). Most participants (90.3%, n= 563) had a good performance status (ECOG-PS 0-1). The primary tumor locations were pancreatic (36%, n=225), midgut (28%, n=175), bronchopulmonary (10%, n=62), paragangliomas/pheochromocytomas (6%, n=37), other gastroenteropancreatic (11%, n=69), and other non-gastroenteropancreatic (9%, n=56). A significant portion (35.4%, n=221) received PRRT as a second-line treatment. The median duration from oncological diagnosis to PRRT initiation was 40 months (range 0.5-288 months). Common previous treatments included somatostatin analogs (90.4%, n=564), everolimus (42.5%, n=265), chemotherapy (26.4%, n=165), and sunitinib (18.6%, n=116). The median PFS was 27.2 months (95% CI, 23.5-31.8), and overall survival was 48.5 months (95% CI, 41.2-61.7). The model's prognostic factors included ECOG performance status, Ki67 index, tumor origin, site of metastasis, Krenning score from scintigraphy or Gallium PET, time from diagnosis to PRRT initiation, and the number of prior systemic antineoplastic treatments. The model demonstrated strong calibration and discrimination, supported by a bootstrap-adjusted Harrell's C-index of 0.693 (95% CI, 0.666-0.726). ***Conclusion:*** The NEPTUNE-SEPTRALU nomogram confirms the feasibility of predicting individual outcomes for patients with advanced NENs treated with 177Lu-DOTATATE, offering a sound basis for patient selection.

OP-258

Peptide receptor radiopeptide therapy (PRRT) using the 225Actinium- and 225Actinium/177Lutetium-labelled (TANDEM) somatostatin-receptor (SSTR) antagonist DOTA-LM3 in patients with neuroendocrine neoplasms (NEN): A retrospective study concerning safety and survival

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Aim/Introduction: PRRT with 225Actinium-labelled somatostatin-receptor antagonists such as DOTA-LM3 is a promising therapy option for progressive NEN due to high tumour uptake, and prolonged tumour retention. This retrospective study in advanced NEN-patients analyses the safety and overall survival (OS) after 225Ac-DOTA-LM3 PRRT, both as monotherapy and in combination with 177Lutetium (TANDEM). ***Materials and Methods:*** Between March 2022 and February 2024, 28 patients (19 men, 9 women; age 36-85 years) received 225Ac-DOTA-LM3 PRRT based on 68Ga-DOTA-LM3 PET/CT findings. Primary NEN: pancreas (n=16), small intestine (n=7), rectum (n=2), pheochromocytoma (n=1), aesthesioneuroblastoma (n=1), CUP-NEN (n=1). Premedication (antiemetics/dexamethasone) and para-aminohippuric acid (PAH) for renal protection were administered. CTCAE v.5.0 was used to grade haematological, renal, and hepatic adverse events, considering patients with ≥1 follow-up visit (n=25). ***Results:*** In total, 44 225Ac-DOTA-LM3 cycles were administered over 23 months (17 monotherapies, 27 TANDEM). At the time of analysis, 15 patients had received one cycle, monotherapy or TANDEM (2-20 MBq 225Ac); 11 patients had received two cycles (8.9-29.9 MBq 225Ac) and 2 patients three cycles (26.4 and 31.9 MBq 225Ac). Mostly mild and transient acute reactions were reported after PRRT: emesis (n=7); nausea (n=6); flare pain (n=6); flushing (n=5); diarrhoea (n=2); fatigue (n=1); hypertension (n=1). During follow-up, three patients died (OS 12-20 months) due to post-surgical complications (one) and disease progression after initial response (two). 25 patients are still alive (follow-up 1-18 months). After PRRT (vs. baseline): 26 patients showed anaemia G1/G2 (vs.19), 4 anaemia G3 (vs.2); 7 patients showed leukocytopenia G1/G2 (vs.3), 2 leukocytopenia G3 (vs.1). Absolute neutrophil count G3 occurred in one patient three weeks after TANDEM-PRRT. Ten patients developed thrombocytopenia G1/G2 (vs.5), and 5 patients thrombocytopenia G3. One acute myeloid leukaemia was diagnosed 12 years after the first 90Y-DOTATOC PRRT. After therapy, renal impairment G1/G2 occurred in 6 patients (vs.4), and renal insufficiency G3 in 2 patients. Hepatic function worsened in one patient with heavy liver involvement (from G2 to G3). ***Conclusion:*** This retrospective analysis demonstrates the safety of 225Ac-DOTA-LM3 PRRT in terms of acute and long-term adverse events: few patients (with extensive bone metastases) developed new G3 haematological toxicity; one leukaemia (3 months after TANDEM, 12 years after initial PRRT); two renal insufficiency G3 (one known neurogenic bladder with recurrent urinary infections; in the other patient, PRRT-related toxicity was excluded by biopsy). No significant PRRT-related hepatotoxicity was observed. 225Ac-DOTA-LM3 PRRT showed encouraging survival outcomes in patients unresponsive to 177Lu-DOTATATE or 177Lu-DOTATOC.

OP-259

Safety, Dosimetry, and Efficacy of an Optimized Long-acting Somatostatin Analog for Peptide Receptor Radionuclide Therapy in Metastatic Neuroendocrine Tumors: from Preclinical Testing to First-in-Humans Study

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Aim/Introduction: Radiolabeled somatostatin analog (SSA) therapy is established for unresectable or metastatic neuroendocrine tumors (NETs). However, A potential disadvantage of 177Lu-DOTATATE is its rapid blood clearance, resulting in relatively short tumor retention. So, through combining Evans blue (EB, albumin binder) and altering the linker we developed an optimized EB-modified radiolabeled SSA, 177Lu-LNC1010. Following preclinical in vitro and in vivo biological evaluation, advanced/metastatic SSTR2-positive NETs. ***Materials and Methods:*** SPECT imaging and biodistribution studies of 177Lu-LNC1010 was performed to visualize the radioligand distribution in vivo and absolute tumor uptake. This was an open-label, non-randomized, first-in-human, dose-escalation, and investigator-initiated trial (IIT) involving patients with advanced/metastatic SSTR2-positive NETs. A '3+3' design was adopted, starting the treatment with 2.22 GBq of 177Lu-LNC1010, with treatment cycles spaced 8 weeks apart. The primary objectives were to determine the safety, tolerability, and maximum tolerated dose of 177Lu-LNC1010. ***Results:*** High binding affinity of LNC1010 (IC50 = 20.39 nM) for SSTR2 was confirmed in vitro. SPECT imaging and biodistribution studies of 177Lu-LNC1010 demonstrated significantly improved tumor uptake and retention than those of 177Lu-DOTATATE. Administration of 177Lu-LNC1010 was well tolerated, with no adverse or life-threatening events in any patients. None of the 3 patients experienced dose-limiting toxicity (DLT) in Group A (2.22 GBq/cycle). Grade(G)4 thrombocytopenia was recorded in one patient in Group B (3.33 GBq/cycle); hence, another three patients were enrolled in Group B, and none experienced DLT. G4 hematologic toxicities were recorded in two patients in Group C (4.99 GBq/cycle). G3 thrombocytopenia was recorded in one patient in Group D (EB-TATE, 3.33 GBq/cycle). G3 hepatotoxicity was observed in two patients from Groups C and D. No nephrotoxicity was observed. No significant difference in whole-body mean effective dose was observed between 177Lu-LNC1010 and 177Lu-EB-TATE (0.23±0.06 vs. 0.23±0.08 mSv/MBq, P=1.00), however ,177Lu-LNC1010 exhibited 2.7-, 4.0-, and 3.0-fold higher radiation doses in the metastatic lymph nodes, liver, and other metastases than those of 177Lu-EB-TATE, respectively. In patients treated with 177Lu-LNC1010, 5 (42%) had a partial response, 5 (42%) had stable disease, and 2 (17%) had progressive disease. The objective response rate and disease control rate were 25% and 83%, respectively. ***Conclusion:*** The first-in-human trial with 177Lu-LNC1010 is well tolerated in patients with advanced NETs, with high radiation doses delivered to the tumor lesions. In addition, the dose-escalation study identified 3.3 GBq/cycle as the

optimal therapeutic dose for future trials. Further investigations through multicenter, prospective, and randomized controlled trials are needed.

OP-260

Retreatment PRRT with 177Lu-DOTATATE in patients with progressive neuroendocrine neoplasm: Spanish clinical experience from national registry

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Aim/Introduction: 177Lu-DOTATATE is an effective and safe therapy for well-differentiated neuroendocrine neoplasm (NEN) patients, evidenced by the NETTER-1 phase 3 trial. For patients experiencing disease progression after initial response, additional 177Lu-DOTATATE cycles as salvage therapy can be considered. However, literature on salvage PRRT is limited, covering diverse patient profiles, cycle numbers, follow-up durations, and varied responses and toxicities. The purpose of this study is to evaluate the clinical practice experiences with PRRT retreatment (rPRRT) from the SEPTRALU registry. ***Materials and Methods:*** SEPTRALU (NCT04949282) is a multicenter national registry of NENs treated with PRRT. A case eligible for registration is defined as any adult with a metastatic, unresectable, somatostatin receptor (SSTR) overexpressing, histologically confirmed neoplasm, who receives at least one cycle of 177Lu-DOTATATE, following the clinical practices of each center. rPRRT was defined as the administration of several additional doses of PRRT some time after the completion of the initial four cycles, possibly having received some other oncological treatment in between, and in the context of radiological progression. ***Results:*** Seventy-one rPRRT patients (41% female, average age 55) were included. The primary tumor locations were mainly ileal (35%) and pancreatic (34%), with 35% being functional tumors. The majority had hepatic (85%), bone (25%), and peritoneal (14%) metastases. Histologically, the mean Ki67 index was 10%, with 32% of patients having a Ki67 index ≥10%; WHO grade 1: 37%, grade 2: 49%, and grade 3: 14%. The first PRRT (PRRT1) was administered as second (35.5%) and third-line (27%) treatment. All patients received four doses, achieving an overall response rate (ORR) of 61.7% and a progression-free survival (PFS) of 35 months. The average interval between the end of PRRT1 and rPRRT was 29.3 months. For rPRRT , patients received between 1 to 4 doses at rates of 100%, 66%, 24%, and 17%, respectively. Treatment discontinuation was mainly due to progression (18%). The ORR for rePRRT was 17.6% with a clinical benefit rate of 58.8% and PFS was not reached after 10 months of follow-up, with a 10-month PFS rate of 78%. No new toxicity alerts were reported. Univariate analysis identified a previous response to PRRT1 as a predictor of radiological response to rPRRT (p=0.004). ***Conclusion:*** PRRT retreatment presents a viable therapeutic strategy for advanced NENs, with favorable efficacy and identifiable response predictors, notably previous response to PRRT. Future trials are expected to provide further insights into the optimal duration and sequencing of rPRRT.

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Monday, October 21, 2024, 08:00 - 09:30
Hall 1

CME 5 - Paediatrics Committee Children on Fire (FUO in Paediatrics)

OP-261

Clinical aspects of FUO

S. Trapani;
University of Florence, Florence, ITALY.

OP-262

Nuclear Medicine in FUO/ Role of 18 FDG PET/CT

M. Holm Reichkendler;
Rigshospitalet University, Copenhagen, DENMARK.

OP-263

FUO as neoplastic disease onset

M. Luporsi;
Curie Institut, Paris, FRANCE.

OP-264

FUO as inflammatory/rheumatologic disease onset

C. Olianti;
University of Florence, Florence, ITALY.

702

Monday, October 21, 2024, 08:00 - 09:30
Hall 4

Special Track 5 - Translational Molecular Imaging & Therapy Committee - Challenge the Expert ETransatlantic Comparison: Who does What and Why in PSMA-Image guided Therapy

OP-265

Is PSMA the Next Frontier in Prostate Cancer Theranostics?

O. Sartor;
Mayo Clinic, Rochester, UNITED STATES OF AMERICA.

OP-266
Challengers' cases
N. Ahmadi Bidakhvidi;
University Hospital Leuven, Nuclear Medicine, Leuven, BELGIUM.

OP-267a
Challengers' cases
F. Serani;
"Spirito Santo" Hospital, Nuclear Medicine, Pescara, ITALY.

OP-267b
Challengers' cases
C. Voltin;
University Hospital Cologne, Department of Nuclear Medicine, Cologne, GERMANY.

OP-267c
Challengers' cases
M. Cysouw;
Amsterdam UMC, Dept. of Radiology and Nuclear Medicine, Amsterdam, NETHERLANDS.

OP-267d
Challengers' cases
R. Laudicella;
Nuclear Medicine Unit, Department of Biomedical and Dental Science and Morpho-Functional Imaging of Messina University, Messina, ITALY.

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Monday, October 21, 2024, 08:00 - 09:30
Hall X9-X12

LIPS Session 5 - Translational Molecular Imaging & Therapy Committee - How to set up a Delphi Consensus

OP-268
Short introduction: Potential of Delphi consensus within nuclear medicine
G. Pisano;
Fondazione Policlinico Universitario Agostino Gemelli IRCCS, Roma, ITALY.

OP-269
Insight into available consensus methodologies
S. Maclennan;
University of Aberdeen, Aberdeen, UNITED KINGDOM.

OP-270
How to set up a face-to-face Delphi for training purposes – an EAU perspective
P. Dell'Olgio;
ASST Grande Ospedale Metropolitano Niguarda, Milan, ITALY.

OP-271
How to use survey monkey to set up a Delphi for image guided therapy
A. Berrens;
The Netherlands Cancer Institute, Amsterdam, NETHERLANDS.

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Monday, October 21, 2024, 08:00 - 09:30
Hall X1-X4

M2M Track - TROP Session: Radiopharmaceutical Sciences + Translational Molecular Imaging & Therapy Committee: Applications for Nanoparticles and Nanocarriers

OP-272
DARP in-mediated PNA-based pretargeting: in vitro proof-of-principle.
E. Papalanis[1], *M. Oroujeni[1], K. Westerlund[2], J. Clinton[2], A. Van Deventer[3], A. Eriksson Karlström[2], V. Tolmachev[1];*
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Aim/Introduction: The human epidermal growth factor receptor 2 (HER2) is overexpressed in 20% of breast cancers. Designed ankyrin repeat protein (DARPin) G3 is an engineered scaffold protein (ESP) that binds to HER2 with a high affinity (KD= 90 pM) [1] and has been successfully used in clinics. A limiting factor for targeted radionuclide therapy using ESPs is the high renal accumulation. A pretargeting methodology based on Peptic Nucleic Acid (PNA) using another type of ESP, affibodies, has previously shown a reduction in renal uptake. This methodology is based on hybridization between a primary agent containing a recognition tag HP1 and a secondary agent HP2 complementary to HP1 [2]. HP2 contains a DOTA chelator enabling the labeling with 177Lu. Our aim was to test whether the PNA-pretargeting could be applied for DARPin-G3. ***Materials and Methods:*** HP1 was fused with DARPin-G3 using sortase A-mediated ligation. Authenticity of DARPin-G3-HP1 and HP2 was evaluated using mass spectroscopy. The affinity of DARPin-G3-HP1 to HER2 was measured using surface plasmon resonance (SPR). DARPin-G3-HP1 and HP2 were radiolabeled with 125I and 177Lu respectively. In vitro specificity and internalization assays were conducted using the HER2-expressing cell lines, SKOV3 and BT474. LigandTracer was used to measure the affinity of [125I]I-G3-HP1 to HER2-expressing living cells and binding of [177Lu]Lu-HP2 to G3-HP1-pretreated cells. ***Results:*** Mass-spectroscopy confirmed that the coupling of HP1 with DARPin-G3 was successful. SPR demonstrated a high affinity (0.64 nM) of the G3-HP1 to HER2 at 25 o C. Radiolabeling of DARPin-G3 -HP1 with 125I and HP2 with 177Lu resulted in high radiochemical purities, >97%. The in vitro experiments showed that DARPin-G3 -HP1 binding to HER2 expressing cells is saturable i.e. is specific. [177Lu] Lu-HP2's binding to G3-HP1-pretreated cells can be blocked by pre-saturation of HER2 with cold G3 and by saturation of HP1 with cold HP2. The binding of [177Lu]Lu-HP2 was negligible without pre-treatment of cells with G3-HP1. The binding affinities of [125I]I-G3-HP1 to HER2-expressing cells and of [177Lu]Lu-HP2 to G3-HP1-pretreated cells were 318 pM and 160 pM respectively. ***Conclusion:*** The data show that in vitro pretargeting using G3-HP1/[177Lu]Lu-HP2 system is HER2-mediated and PNA-dependent A high targeted specificity and affinity were demonstrated in vitro. ***References:*** [1] Zahnd C et al. A Designed Ankyrin Repeat Protein Evolved to Picomolar Affinity to Her2. J Mol Biol 2007; 369:1015-1028. [2] Westerlund K et al. Design, Preparation, and Characterization of PNA-Based Hybridization Probes for Affibody-Molecule-Mediated Pretargeting. Bioconjug Chem. 2015; 26:1724-1736.

OP-273

Therapeutic efficacy and safety of intraperitoneally administered ^{211}At labeled gold nanoparticles for cancer peritoneal dissemination

H. Kato[1], *Y. Kadonaga[1], K. Kaneda-Nakashima[2], K. Ooe[1], X. Huang[3], E. Hilmayanti[3], A. Shimoyama[3], K. Kabayama[1], Y. Xiaojie[4], H. Haba[4], Y. Kon[1], A. Toyoshima[1], K. Fukase[3];*
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Aim/Introduction: Peritoneal dissemination is a very poor prognosis condition for which no effective treatment has been established. Integrins are considered to be the key molecules of cell adhesion involved in cancer cell invasion and metastasis. The aim of this study was to evaluate the intraperitoneally administered astatinated nanoparticle with PEG and cyclic RGD peptide modifications mPEG-S-AuNP[211At]-c[RGDfK(C)] with respect to its kinetics, safety, and therapeutic efficacy. ***Materials and Methods:*** Fluorescent protein-expressing C6 rat glioma cells and human pancreatic cancer cells BxPC3 were seeded intraperitoneally in nude mice and intraperitoneally injected with mPEG-S-AuNP[211At]-c[RGDfK(C)] (0.98 ± 0.19 MBq for C6 models, 1.1 ± 0.035 MBq for BxPC3 models) or saline 7 days and 5 days later, respectively. The distribution of radio isotope was evaluated by scintigraphy up to 42 hours after administration. Intraperitoneal tumor growth was observed by fluorescence imaging. ***Results:*** In vitro studies have confirmed the cellular internalization of the nanodrug and the inhibitory effect of the nanodrug on tumor cell viability when it was administered to cultured tumor cells. In the peritoneal seeding model, the establishment of peritoneal dissemination was confirmed by fluorescence imaging. In nude mice intraperitoneally seeded with C6 rat glioma cells, 23 days after administration, the animals were dissected and intraperitoneal tumors were harvested. Tumor mass was significantly lower in the drug-treated group compared with controls. For the BxPC3 peritoneal dissemination model, a survival analysis revealed that the drug significantly prolonged overall survival. It was found that the administered radioisotope showed little transfer to the blood and remained in the abdominal cavity for a long time. Although transient weight loss, leukopenia, and thrombocytopenia were observed by one week post-administration, then a recovery trend was evident thereafter. One month after administration, no abnormalities in blood counts, blood biochemistry, or histology of intra-abdominal organs were found. ***Conclusion:*** The kinetics, safety, and therapeutic efficacy of intraperitoneally administered astatinated nanoparticle mPEG-S-AuNP[211At]-c[RGDfK(C)] on the intraperitoneal dissemination of malignant tumors expressing integrins that recognize RGD peptides.

OP-274

^{161}Terbium-labeled Gold Nanoparticles for Nanoscale Brachytherapy

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Aim/Introduction: Gold nanoparticles (AuNPs) are useful multifunctional carriers able to deliver radioisotopes and provide imaging and therapy capabilities. Terbium-161 (161Tb) is an attractive radioisotope for theranostic applications, due to its beta-particle and Auger emissions for therapy, in combination with its low energy γ-ray emission, allowing imaging with Single Photon Emission Computed Tomography (SPECT). Injectable radiopharmaceuticals exhibit outstanding therapeutic effects along with minimizing the discomfort associated with brachytherapy procedures1,2. In this perspective, radioactive nanoparticles could represent a promising alternative to conventional brachytherapy with superior results3,4. Our aim was the development and evaluation of AuNPs and gold nanoflowers (AuNFs) radiolabeled with 161Tb via a DOTA-derivative chelator as a nanobrachytherapy agent for the treatment of breast cancer. The obtained radio-nanomedicines were evaluated for their radiolabeling stability, in vitro cytotoxicity, ex vivo biodistribution and therapeutic efficacy in tumor animal models. ***Materials and Methods:*** Au@TADOTAGA nanoparticles (AuNPs) and Au@TADOTAGA nanoflowers (AuNFs) were radiolabeled with 5-30 MBq [161Tb]TbCl3 and the percentage of incorporated 161Tb was determined by instant thin-layer chromatography (ITLC). In vitro stability of the 161Tb-labeled nanoconjugates was evaluated at room temperature (RT) and in the presence of serum up to 21d. In vitro cytotoxicity of AuNPs, AuNFs, [161Tb]Tb-AuNPs, [161Tb]Tb-AuNFs and [161Tb]TbCl3 against 4T1 cells was determined by the MTT assay. Ex vivo biodistribution and therapeutic efficacy were assessed on SCID mice bearing 4T1 breast cancer tumors. ***Results:*** Radiochemical yield of both [161Tb]Tb-AuNPs and [161Tb]Tb-AuNFs was >98% after 1h incubation at 75°C and 850rpm. The radionanoconjugates were stable at RT and serum up to 21d post-radiolabeling. Cytotoxicity studies in 4T1 cells showed a concentration and time-dependent toxicity especially for the AuNFs. Ex vivo biodistribution showed enhanced retention at the injection site. Tumor regression was observed after intratumoral injection of both radionanoconjugates. ***Conclusion:*** Radiolabeling of both AuNPs and AuNFs with 161Tb was fast and robust. In vitro cytotoxicity on 4T1 cells of the radiolabeled and non-radiolabeled AuNFs was higher, when compared to AuNPs. Therapeutic efficacy studies showed that both 161Tb-labeled nanomedicines led to tumor regression. Based on these preliminary results, we conclude that [161Tb]Tb-AuNFs and [161Tb]Tb-AuNPs should be further investigated in other cancer models, to assess their therapeutic potential as nanobrachytherapy agents. ***References:*** 1. Laprise-Pelletier et al, Adv. Healthc. Mater. 2018, 7. 2. Ehlerding, E.B., Cai, W. J. Nucl. Med. 2016, 57, 834-835. 3. Laprise-Pelletier, M. et al, Adv. Healthc. Mater. 2017, 6. 4. Salvanou E.-A. et al, Pharmaceutics 2020, 12(2), 188.

OP-275

Protein Embedded and Intrinsically Radiolabeled [^{188}Re]ReO$_x$ Nanoparticles for Concurrent Radio-photothermal Therapy

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Aim/Introduction: Boosting therapeutic efficiency is the essential key for translating any anticancer nanomedicine from preclinical investigations to clinical practice. Herein, we have synthesised

human serum albumin (HSA) encapsulated radioactive rhenium oxide nanoparticles ([188Re]ReOx-HSA NPs) for combined radiotherapy and photothermal therapy. ***Materials and Methods:*** 188Re was obtained from an in-house developed 188W/188Re-generator. [188Re]ReOx-HSA NPs were synthesised by a controlled reduction of 188ReO4- in HSA medium. Photothermal efficiency of the nanoformulation was investigated by illuminating it with a 808 nm laser (0.8 W cm-2) at different concentrations of the NPs for different time periods. Cell cytotoxicity of the NPs was checked in B16F10 cell lines. The anticancer effect of the NPs was evaluated by incubating ReOx-HSA NPs and [188Re]ReOx-HSA NPs in B16F10 cell lines followed by irradiation with an NIR laser after 12 h of incubation. In-vivo SPECT/CT imaging, autoradiography and biodistribution studies were performed after intratumoral injection of radiolabelled NP in B16F10 tumour-bearing C57BL/6 mice. Systematic tumour regression studies and histopathological analyses were performed to demonstrate therapeutic efficacy in the aforesaid mice model after intratumoral injection of [188Re] ReOx-HSA NPs followed by irradiation of the tumour by NIR laser for 5 minutes. ***Results:*** [188Re]ReOx NPs (size 6 - 8 nm) possessed high colloidal and radiochemical stability. The temperature of the aqueous ReOx NPs dispersion with a concentration of 500 ppm was raised from 25 to 45 oC under laser irradiation for 5 minutes. The photothermal conversion efficacy of the NPs was ~28%. The MTT assay confirmed that even at 500 ppm concertation of the non-radioactive NPs, > 90% of cells survived. Whereas, upon laser exposure on cells incubated with radioactive NPs, only 20% of cells were alive demonstrating the therapeutic efficacy. Uniform dose distribution and retention of the radiolabelled NPs in the tumour volume were observed via SPECT/CT imaging and autoradiography studies. In a tumour regression study, tumour growth was significantly arrested with ~ 18.5 MBq dose and simultaneous laser irradiation. In histopathological analysis, loss of mitotic cells was apparent in the tumour tissue of treated groups whereas no significant damage in lungs, kidney, and liver tissue morphology was observed. Serum biochemistry and blood parameters of the treated mice were also comparable with healthy mice. ***Conclusion:*** This work demonstrates the potential of [188Re]ReOx-HSA NPs towards concurrent radiation and photothermal therapy for personalized cancer care management. ***References:*** 1. Ognjanović, M., et al., ACS applied materials & interfaces, 2019. 11(44): p. 41109-41117.

OP-276

Radiobiological comparison of yttrium-90 and holmium-166 in liver cancer cells

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Aim/Introduction: Hepatocellular carcinoma (HCC) is the 4th cancer-related cause of death worldwide in 2020. Liver cancer is often diagnosed late, with a 70% of recurrence 5 years after treatment. A promising therapy is radioembolization, which deliver radioactive microspheres to the tumor site by intra-arterial injection. The currently available microspheres in the clinic are radiolabeled with either yttrium-90 or holmium-166. Although several studies showed the benefits of radioembolization in unresectable liver cancer compared to standard care, there is currently no study comparing these two radionuclides and thus the selection is currently not based on radiobiological knowledge. Both radionuclides are β- emitters, however yttrium-90 shows a higher β- energy (2.28MeV) and longer half-life (64.1h) compared to holmium-166 (1.81MeV and 26.8h). Whether this difference in physical characteristics will result in a difference in therapeutic efficacy and under which conditions has yet to be determined. ***Materials and Methods:*** In this project, we are studying the radiobiological impact of yttrium-90 and holmium-166 on 3 HCC human cell lines in vitro with different proliferation rates (Hep3b 30 hours, PLC 17 hours and Huh7 27 hours), to analyze whether proliferation speed influences sensitivity to each radionuclide. In vitro dosimetry was realized with the MCNP software to calculate the activity concentration needed for both radionuclides to reach a total absorbed dose of 1.5Gy or 2.5Gy over a cell culture period of 24h. Subsequently, survival and DNA damage were measured by clonogenic survival assay and staining of 53BP1 and γH2AX protein foci, respectively. ***Results:*** Holmium-166 and yttrium-90 showed a similar, dose-dependent reduction of survival in all three cell lines. While both radionuclides have a similar impact on cell survival at identical doses, the DNA damage induction is different. After 24h of irradiation, yttrium-90 irradiated cells show a dose-dependent increase of DNA damage as expected, but holmium-166 irradiated cells do not. This discrepancy in DNA damage induction can be explained by the difference in dose rate, which is higher for holmium-166 than for yttrium-90. Further studies on real-time DNA damage induction kinetics will allow us to better understand the impact of both radionuclide at the DNA level. ***Conclusion:*** Both radionuclides seem to have a similar toxicity on the HCC cell line in vitro. However, if the discrepancy in DNA damage induction is confirmed, further experiments combining them with DNA repair targeting drugs could lead to improved therapy efficiency.

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^{90}Y-labeled montmorillonite microspheres for intra-arterial brachytherapy of hepatocellular carcinoma

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Aim/Introduction: The intra-arterial administration of radioactive microspheres is an alternative therapy option for treating primary hepatocellular carcinoma (HCC). Currently, the clinically used radioembolization microspheres, 90Y-labeled glass microspheres and resin microspheres, are complicated to prepare and expensive, thus there is an urgent need to develop a new type of radioactive microspheres with simple preparation, low-cost, and stable radiolabeling. Montmorillonite (MMT), as a naturally occurring layered silicate clay mineral, have micro ~ nano-scale size distribution upon different process technology, and the hard Lewis bases (Si-O, Al-O) on its surface are able to stabilize metal ions, so we envisioned the possibility of yttrium 90-labeling on MMT microspheres and its application for embolization radiotherapy of HCC. ***Materials and Methods:*** 90Y-labeled MMT microspheres were prepared by simple temperature-controlled mixing MMT solution and 90YCl3. Size distribution and zeta potentials of montmorillonite were analyzed on a Malvern Zetasizer. The phase purities of MMT were characterized by X-ray diffractometer. The radiolabeling yield and serum stability study were tested by Mini-Scan radio-TLC Strip Scanner (BioScan, USA). For the in vivo studies, 90Y-labeled MMT microspheres was administrated on mouse HepG2 tumor model and rabbit VX2 liver tumor model to verify the in vivo radiostability and therapeutic effect. ***Results:*** The size of the used MMT was 20-70 μm, which was suitable for embolizing the microvessels of HCC. Meanwhile, the negative potential of its surface and the strong Lewis base

have very high adsorption efficiency for 90Y3+. Importantly, it can keep the radiolabeling stability in serum and animals during 14 days' observation. Next, intratumoral administration of 90Y-MMT was performed in HepG2 tumor-bearing mice, we found that 90Y-MMT could be stably retained in the tumor region and could completely eliminate the tumor growth during 14-days' monitoring. In the rabbit VX2 liver tumor, DSA-guided intravascular brachytherapy can accurately deliver 90Y-MMT to the tumor site, which can be monitored by PET scanning, and also the tumor inhibition can be seen based on 18F-FDG uptake. Immunostaining and immunoblotting results also confirmed the powerful tumor suppression. ***Conclusion:*** In summary, we successfully developed 90Y-labeled MMT microspheres for efficient locoregional intravascular brachytherapy of HCC. The merit of 90Y-MMT with controlled size, good radiostability and good radioembolization effect do good for effectively inhibit tumor growth, indicating the powerful interventional radioembolization candidate for HCC therapy. ***References:*** (1) Theranostics 2023, 13(7), 2114-2139. (2) Adv Funct Mater 2023, 33, 2306215. (3) Adv Funct Mater 2023, 33, 2215110.

OP-278

Delivery of the Auger Therapeutic [^{125}I]IUdR via Nanocarriers for Treatment of Glioblastoma

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Aim/Introduction: Glioblastoma (GBM) is the most common primary cancer in the brain. Life expectancy is extremely low with a median survival of 16 months. Even after the current treatment, a combination of surgery, external irradiation and temozolomide chemotherapy, the recurrence rate is 100%. While the bulk tumor can be removed, the key challenge is the infiltration of GBM cells into the surrounding healthy brain. These infiltrating cells are mostly unaffected by current treatments being main cause of recurrence. We present a novel approach to eradicate infiltrating GBM cells, harnessing the potent Auger radiotherapeutic [125I] iododeoxyuridine ([125I]IUdR). Stealth liposomes capable of sustained release of [125I]IUdR were developed. These liposomes can be infused into the healthy brain after surgical removal of bulk tumor with a wide distribution enabled by convection enhanced delivery (CED). As a target-agnostic therapy, released [125I]IUdR is taken up by all proliferating infiltrating GBM cells and incorporated into their DNA, killing them via Auger electron emission. ***Materials and Methods:*** We synthesized a library of [125I]IUdR-Cn prodrugs with Cn being different lipid-anchors conjugated via an ester-linker. All prodrugs were radiolabeled with iodine-125, purified and loaded into preformed liposomes (LIPs) in a cold-kit like manner in high yield. Loaded LIPs were then assessed for their esterase-triggered release rate of [125I]IUdR in relevant biological media, including rat brain homogenate. In vitro, we assessed CellTiterBlue and clonogenic growth in GBM cells. DNA incorporation of released [125I]IUdR was assessed both in vitro and in vivo. Imaging and ex vivo biodistribution after intracranial administration was performed in glioblastoma-bearing rodents. ***Results:*** LIPs loaded with lead prodrug; [125I]IUdR-C18, were prepared in good RCY (62%) and an optimal in vitro release of [125I]IUdR over 2 to 7 days was observed, corresponding with GBM cell division timelines and duration of CED. Cell viability studies demonstrated comparable cytotoxicity in LN229 GBM cells as free [125I]IUdR. In vivo data showed significant retention in the brain up to several days, low uptake in off-target organs, and, crucially, in vivo DNA uptake of [125I]IUdR. ***Conclusion:*** We report a novel radioligand therapy concept; [125I]IUdR releasing liposomes for eradicating infiltrating GBM cells. Our results demonstrate high in vitro cytoxicity and promising in vivo properties. This novel Auger radiotherapy holds promise as adjuvant to current GBM treatments with the key feature of potential efficacy against highly heterogeneous GBM cell populations. Efficacy studies and adaptation to iodine-123 are on-going. ***References:*** [1] Thisgaard et al. Theranostics 2016.

OP-279

Therapeutic Effects of [^{64}Cu]Cu-Labeled Nanoparticle Albumin-bounded Paclitaxel in a SPARC-Expressing Xenograft Mouse Model

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Aim/Introduction: Secreted Protein Acidic and Rich in Cysteine (SPARC) is highly expressed in various tumor cells, facilitating the tumor-specific uptake of albumin. This study employs nanoparticle albumin-bound paclitaxel (nab-paclitaxel), a conjugate of paclitaxel and human serum albumin, to explore the SPARC-mediated tumor uptake and specific anticancer effects. ***Materials and Methods:*** We selected the glioblastoma cell line U87MG for its high SPARC expression and generated SPARC-negative variants through retroviral transduction using SPARC-specific shRNA. SPARC expression levels were confirmed by Western blotting. The nab-paclitaxel was radiolabeled with [64Cu]Cu using Click chemistry. Seven male balb/c-nu mice were xenografted with U87MG cell line on the left upper limb and U87MG-shSPARC on the right. Each mouse received an intravenous injection of 12 MBq of [64Cu]Cu-nab-paclitaxel, and PET images were acquired at 0, 4, 8, and 24 hours post-injection to assess in vivo distribution. ***Results:*** In vivo PET imaging revealed a 1.8-fold higher signal in SPARC-positive tumors compared to SPARC-negative tumors (16.5 %ID/g in U87MG vs. 9.16 %ID/g in U87MG-shSPARC), confirming SPARC-mediated uptake of nab-paclitaxel. Post-treatment, SPARC-positive tumors showed more than one-third reduction in volume within five days. ***Conclusion:*** Our findings demonstrate that nab-paclitaxel undergoes SPARC-mediated cellular uptake, leading to significant therapeutic effects on SPARC-expressing tumors. These results underscore the potential of nab-paclitaxel as a theranostic probe in SPARC-positive tumors. ***References:*** Park et al. Secreted protein acidic and rich in cysteine mediates active targeting of human serum albumin in U87MG xenograft mouse models. Theranostics. 2019 Oct 11;9(24):7447-7457.

OP-280

Production, Radiochemical Separation and Radiolabeling of Gold Nanoparticle Bioconjugates with ^{211}At for Targeted Alpha Therapy

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Aim/Introduction: Targeted alpha therapy (TAT) is now emerging in advanced cancer management due to the short range and high linear energy transfer (LET) of α-particles. Astatine-211 has attained significant interest for TAT over other α-emitters as it emits only one α-particle per decay which alleviates certain concerns related to in vivo administration and also simplifies dosimetry calculations. In this study, we have produced 211At via 209Bi (α, 2n) 211At reaction in a cyclotron and radiochemically separated it for formulation of nanoradiopharmaceuticals. ***Materials and Methods:*** Natural bismuth oxide target in pelletized form wrapped in Al foil (foil thickness ~25.4 μm) was irradiated with 30 MeV α-beam in an AVF cyclotron. The irradiated target was first cooled down and dissolved in 2 M HNO3 at room temperature. Subsequently, Bi was precipitated as Bi(OH)3 using 2 M NaOH followed by the separation of ionic sodium astatide solution by centrifugation and membrane filtration. The radiochemically separated 211At was used for labelling cyclic RGD peptide conjugated gold nanoparticles (Au-RGD NPs) by surface adsorption. The radiochemical stability of 211At-Au-RGD NPs was evaluated under physiological conditions. ***Results:*** The batch yield of 211At at the end of irradiation was 6.0 ± 0.3 MBq.μA-1.h-1. The overall separation yield of 211At was ~ 80% with >99.9 % radionuclidic purity. The γ-spectra of the decayed samples did not show the presence of extraneous radioisotopes. Graphite furnace atomic absorption spectrometry (GFAAS) analysis of the decayed samples confirmed that the bismuth level was < 1 ppm in the radiochemically separated samples. In the synthesis procedure of the Au NPs, the RGD peptide acted as both reducing and stabilizing agent and thus precluded the need for using toxic surfactants. Such NPs (particle size 8.4±0.8 nm) are not only biocompatible but also target the integrin αvβ3 receptors which are overexpressed on tumour endothelial cells of varying cancer types. Au-RGD NPs could be labelled with 211At adopting a non-covalent approach. The radiolabelling yield was found to be > 99 % and the radiolabelled nanoparticles retained their integrity under physiological conditions over a period of 21 h. ***Conclusion:*** The present strategy simplifies 211At production in terms of purification and would increase affordable access to this radioisotope for TAT of cancer. ***References:*** 1. Parker C, Lewington V, Shore N, Kratochwil C, Levy M, Lindén O, et al.,JAMA Oncol (2018);4:1765-72.

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Monday, October 21, 2024, 08:00 - 09:30
Hall Y4-Y9

Cutting Edge Science Track - TROP Session: Physics Committee: Data Corrections / Image Enhancement

OP-281

A robust two-step deep learning method for pseudo-CT generation for PET-MR attenuation correction in brain

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Aim/Introduction: One of the main obstacles for absolute quantification of brain PET-MR images is the accuracy of the attenuation correction map (μ-map). Several studies have attempted to improve the μ-map accuracy by employing deep-learning techniques. However, rigorous evaluation on PET images is limited. This study introduces and evaluates a deep-learning approach which combines MR with pseudo-MR images for performing attenuation correction on brain PET-MRI. ***Materials and Methods:*** Paired CT, T1- and T2-weighted images of 106 adult patients who underwent brain $^{[18F]}$FDG PET-CT and PET-MR scanning on the Siemens mMR were used to generate a pseudo-CT using a residual 3D-UNET by training: 1) The T1-weighted images (DL-T1), 2) the T1- and T2-weighted images (DL-T1+T2) and 3) the T1-weighted images to generate a pseudo-T2 before using both T1-weighted and pseudo-T2 as input to method 2 (DL-T1+pT2). All methods were tested on six different patients who underwent $^{[18F]}$FDG PET-CT scanning followed by a simultaneous PET-MR scan on a Siemens mMR. An accelerated T1-weighted (T1acc) image on which the network was not trained on, was also acquired on those patients and used as input to methods 1 and 3. Whole brain, grey matter (GM), white matter (WM) and cerebrospinal fluid (CSF) masks were applied to the reconstructed PET images to estimate the relative mean absolute error (rMAE), using CT-based attenuation correction as reference. The results were also compared to the manufacturer's Dixon with bone atlas (Dixon-BA) and UTE methods. ***Results:*** rMAE for DIXON-BA and UTE was 5.0±6.3% and 9.0±11.1%, respectively, (weighted mean ± standard deviation) in the whole brain which was decreased to 2.8±3.6% for DL-T1+T2. Bias and standard deviation were more than halved in GM and CSF for DL-T1+T2 compared to the manufacturer-provided sequences. All deep learning-based methods had similar performance (rMAE range in whole brain: 2.8-3.6%). However, a few voxels in the ventricles and blood vessels were misclassified to bone or air in three patients when using DL-T1 with the effect being further exacerbated for T1acc leading to a ~60% bias in those voxels. No misclassifications were noted when the T2-weighted or pseudo-T2 image were also used for the prediction of the pseudo-CT. ***Conclusion:*** Deep learning-based attenuation correction using anatomical images can substantially decrease bias in the reconstructed PET images compared to the manufacturer-provided sequences. Inclusion of both T1- and T2-weighted images can increase robustness and generalisability. Scanning time could also be reduced by using a predicted T2-weighted image.

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External validation of deep learning-based attenuation correction for chest FDG PET/MRI using Zero-TE MRI and unpaired PET/CT data

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Aim/Introduction: Attenuation correction (AC) of bone components in the chest on positron emission tomography-magnetic resonance images (PET/MRI) is challenging due to the complicated anatomical structures and limited delineation of the bone on MRI. A deep learning approach using unsupervised generative adversarial networks (GANs) with adaptive layer-instance normalization for image-to-image translation (U-GAT-

IT) in combination with a modality-independent neighborhood descriptor (MIND) performed in our previous study yielded a pseudo-CT (pCT) generation with bone components from Zero echo-time (ZTE) MRI for AC in the chest. The purpose of this study was the external validation of the deep learning approach. ***Materials and Methods:*** 360 studies with chest FDG PET/MRI, including central-frequency-adjusted and bias-corrected ZTE and CT components of PET/CT, were utilized for training unsupervised GANs with a U-GAT-IT/MIND model. Data from thirty patients who underwent chest FDG PET/MRI in two institutions (fifteen patients for each) were assessed for external validation. PET was reconstructed by conventional pCT (conv-pCT) and deep-learning-based pCT with bone components (DL-pCT) and evaluated by placing fixed regions of interest in the spine and the liver. The similarity of the CT Hounsfield Unit (HU) histogram of the bone was measured by the correlation coefficients between CT and pCT in the same patient. The coefficients of conv-pCT and DL-pCT were statistically compared in the two institutions. Bone and liver mean SUV by conv-pCT and DL-pCT were also statistically compared in the two institutions. ***Results:*** The mean coefficients of conv-pCT and DL-pCT in Institution 1 were 0.150±0.157 and 0.703±0.194, and those in Institution 2 were 0.162±0.119 and 0.729±0.196, respectively. The coefficients of DL-pCT were significantly higher than those of conv-pCT in both institutions ($p<0.0001$). The mean SUV of the bone by conv-pCT and DL-pCT in Institution 1 were 1.34±0.37 and 1.44±0.37, and those in Institution 2 were 1.36±0.29 and 1.45±0.38, respectively. The mean SUV of the bone by DL-pCT was significantly higher than that by conv-pCT ($p<0.0001$). The mean SUV of the liver by conv-pCT and DL-pCT in Institution 1 were 2.42±0.44 and 2.38±0.52, and those in Institution 2 were 2.45±0.44 and 2.42±0.43, respectively. The mean SUV of the liver by DL-pCT was significantly higher than that by conv-pCT ($p<0.0001$). ***Conclusion:*** The similarity of the CT HU histogram of the bone and SUV difference of normal bone and liver showed a similar trend between the two institutions, suggesting the deep-learning approach is valid in quantitative value for the external patient data.

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A comparative study on deep-learning-based approaches for denoising ultra-fast whole-body [18F] FDG PET/CT

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Aim/Introduction: This study aims to compare different deep-learning-based approaches to improve image quality of ultra-fast whole-body [18F]FDG PET acquisitions. ***Materials and Methods:*** 772 whole-body [18F]FDG PET scans were included in the training (625+50 for validation) and testing (97) of three versions of the U-Net: 3D, 2.5D (coronal, sagittal and axial planes) and 2.5D_3CAx (3 axial channels). Mean squared error (MSE) was employed as the loss function. Included studies belong to a public dataset [1] and were acquired either on a United Imaging uExplorer or a Siemens Vision Quadra PET/CT scanner, from two different centres. Acquisition duration reduction factor was either 1/2, 1/4, 1/10, 1/20, 1/50 or 1/100, from the reference (5-10min/AFOV). MSE, intraclass correlation coefficient (ICC) and peak signal-to-noise ratio (PSNR) were used for a voxel-wise comparison between deep-learning-denoised (DL) and reference images. Further quantitative analysis was performed in terms of the mean concentration (Cmean) and signal-to-noise ratio (SNR=Cmean/standard deviation) in the liver and lungs (regions with expected uptake uniformity). A custom weighted rank score, ranging from 1 (lowest) to 4 (highest), was used to compare methods: 25% MSE, 10% ICC, 20% PSNR, 12.5% |ΔCmean|liver, 12.5% |ΔCmean|lungs, 10% SNRliver and 10% SNRlungs. ***Results:*** Voxel-wise MSE, ICC and PSNR between reference and DL-denoised images showed a statistically significant improvement relative to the original (not denoised) ($p<0.001$, Wilcoxon signed-rank). Statistically significant differences in these metrics were also observed between the different models ($p<0.001$, Wilcoxon signed-rank). The obtained custom scores were of 1.00 for the original (not denoised) test set, and 3.75, 3.25 and 2.00 for the test set denoised with the 3D, 2.5D and 2.5D_3CAx U-Nets, respectively. SNR in the liver was 17±4 for the reference, 5±4 for the original (not denoised) images and 21±9, 19±9, 15±7 for the 3D, 2.5D and 2.5D_3CAx U-Nets, respectively. Focusing on the 68 ultra-fast acquisitions (reduction factors of either 1/10, 1/20, 1/50 or 1/100), liver SNR was 17±4 [reference], 4±2 [not denoised], 22±11 [3D], 18±9 [2.5D] and 13±6 [2.5D_3CAx]. The custom rank-based scores are maintained for this subset. ***Conclusion:*** All three implemented DL-based strategies proved to be viable for denoising ultra-fast whole-body [18F]FDG PET scans, having achieved comparable quantitative image quality compared to the reference. However, the 3D U-Net was the best-performing network overall and when considering solely the ultra-fast acquisitions. ***References:*** [1] Xue et al. "A cross-scanner and cross-tracer deep learning method for the recovery of standard-dose imaging quality from low-dose PET". EJNMMI, 49(6):1843-1856, 2022.

OP-284

Deep Learning Time-of-Flight (ToF) Enhancement of Theranostic and FDG non-ToF PET Scans

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Aim/Introduction: To evaluate a deep learning-based time-of-flight (DLToF) model trained to enhance the image quality of FDG and a range of theranostic non-ToF PET images, reconstructed using BSREM algorithm, towards ToF images. ***Materials and Methods:*** A 3D residual U-NET model was trained using 8 different tracers (FDG:74% and non-FDG:26%) from 11 sites from 3 continents. A total of 309 training and 33 validation datasets scanned on GE Discovery MI (DMI) ToF scanners were used for development of DLToF models of three strengths: low (L), medium (M) and high (H). The training and validation pairs consisted of target ToF and input non-ToF BSREM reconstructions using site-preferred regularisation parameters (beta values). The contrast and noise properties of each model were defined by adjusting the beta value of target ToF images. A total of 60 DMI datasets, consisting of a set of 4 tracers (18F-FDG, 18F-PSMA, 68Ga-PSMA, 68Ga-Dotatate) and 15 exams each, were collected for testing and quantitative analysis of the models based on standardised uptake value (SUV) in regions of interest (ROI) placed in lesions, lungs and liver. Each dataset includes 5 image series: ToF and non-ToF BSREM with the same regularization (beta value), as well as one series for each of the three DLToF strengths. A subset of 32 datasets (4

tracers, 8 exams) were then selected for blinded clinical scoring by 4 readers based on diagnostic confidence, lesion detectability and image noise/quality on a 5-point Likert score. ***Results:*** Lesion SUVmax difference (%) in non-ToF BSREM, and DLToF-L, -M and -H images with respect to reference ToF BSREM images showed the following results: for ^{18}F-FDG (38 lesions) -39±16, -38±16, -25±17, -7±24; for ^{18}F-PSMA (35 lesions) -42±10, -39±13, -23±20, -7±28; for 68Ga-PSMA (23 lesions) -33±10, -26±12, -18±11, -4±15; for 68Ga-Dotatate (32 lesions) -34±13, -38±13, -25±17, -12±22, respectively. Quantification results in liver and lung also showed ToF-like performance of DLToF models. Clinical readings for lesion detectability in ToF BSREM, non-ToF BSREM, and DLToF-L, -M and -H images were as following: for ^{18}F-FDG 4.00±0.48, 3.81±0.43, 3.66±0.6, 4.12±0.37, 4.28±0.27; for ^{18}F-PSMA 4.69±0.13, 3.31±0.45, 3.59±0.43, 4.31±0.26, 4.75±0.14; for 68Ga-PSMA 4.34±0.30, 3.41±0.59, 3.91±0.52, 4.28±0.29, 4.44±0.19; for 68Ga-Dotatate 4.09±0.34, 4.12±0.41, 4.09±0.55, 4.28±0.33, 4.25±0.27, respectively. For other metrics, DLToF models presented ToF comparable scores. ***Conclusion:*** This study demonstrated that the DLToF models are suitable for both FDG and non-FDG theranostic tracers and could be utilised for digital BGO PET-CT scanners to provide ToF comparable image quality.

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Lesion-Dependent Recovery Coefficient Predictions Using Machine Learning Protocols

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Aim/Introduction: SPECT segmentation for lesion activity quantification is challenging due to the limited spatial resolution of SPECT images. CT-based segmentation often underestimates the total activity within lesions, with errors mostly influenced by the lesion size and the signal-to-background (SBR) activity concentration ratio. Recovery coefficients (RCs) can be used to correct for inaccuracies in lesion activity quantification, but they require modelling the dependence of RCs with the characteristics of the lesions and image quality. The aim of this work was to develop a machine learning model that predicts accurate lesion-specific recovery coefficients based on lesion size, activity and background concentrations. ***Materials and Methods:*** We performed Monte-Carlo simulations using SIMIND of multiple Jaszczak phantoms with twelve total spheres of 9.5, 12.7, 14.24, 15.9, 19.1, 19.04, 23.84, 25.4, 28.64, 31.8, 38.1 and 47.7 mm diameter. The phantom and the spheres were filled with a solution of Lu-177. SBR between spheres and background were varied from 1:2 to 300:1. The simulated acquisition involved 96 projections, with a duration of 15 seconds per projection. Images were reconstructed with the OSEM algorithm using our PyTomography software, which included CT-based attenuation correction and triple energy window scatter correction. Segmentation was performed by placing voxelized-spherical ROIs created in Python considering spheres-position and radius, which were used to determine each sphere's volume and mean activity concentration. The background concentration was measured using a 3 cm diameter sphere placed in the centre of the phantom. These values were used as inputs to train 6 machine-learning regression models to predict RCs. Decision Tree (DT), Support Vector Machine (SVM), and K-Nearest Neighbor with ten neighbors (KNN) were used as nonparametric regression models. Linear Regression, Random Sample Consensus (RANSAC) and Kernel Ridge (KR) using a polynomial kernel were parametric models used. The mean absolute percentage error (MAPE) was used to evaluate the models. ***Results:*** Nonparametric models yielded MAPE of 0.04, 0.16, and 0.1 for DT, SVM, and KNN, respectively. MAPE over the parametric models were 0.24, 0.31, and 0.35 to KR, LR, and RANSAC, respectively. Intra and extrapolation behavior of nonparametric models were tested and their MAPEs were 0.14, 0.15 and 0.29 for KNN, DT and SVM, respectively. ***Conclusion:*** Our results show that nonparametric models accurately predict lesion-dependent recovery coefficients that can be used for lesion quantification and dosimetry. We are now focusing on developing models using simulated anthropomorphic phantoms and different segmentation methods.

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Towards Uncertainty Estimation in PET Partial Volume Correction with a Diffusion Probabilistic Model

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Aim/Introduction: Most image reconstruction research focus on methods that produce pixel-wise estimates without quantification of the reconstruction uncertainty/accuracy of which regions in the resultant images are most susceptible to error. In this work, we estimate the statistical and systematic uncertainty of resultant images from a diffusion probabilistic model when applied to partial volume correction (PVC) of brain PET images (DiffPVC). ***Materials and Methods:*** Our DiffPVC model [1] uses a modified image-conditioned denoising diffusion probabilistic pipeline which employs an attention U-Net to correct for partial volume effect (PVE). To estimate statistical uncertainty, we sample DiffPVC 100 times using different random noise ensembles. To estimate systematic uncertainty, we train an ensemble of 10 conditional diffusion models [2], where each model is initialized with random weights, and then for each learned model, we sample the DiffPVC 100 times. To train the model, we selected ten F^{18} FDG brain PET scans acquired for 6min on a Siemens Quadra and reconstructed using OSEM (0mm as reference, 5mm gaussian filter as PVE) were selected. For each patient, we selected 56 continuous axial images. We then tested the model using one additional patient dataset from the Quadra (in-distribution, ID) and one dataset from a Discovery-690 scanner (out-of-distribution, OOD). All models were fine-tuned using the ADAM optimizer on the PyTorch platform and executed on NVIDIA A100 GPUs. Image quality was evaluated using PSNR/SSIM, while uncertainty was determined using variance, squared bias, and squared error maps of resultant images. ***Results:*** Resultant mean predictions of PVC images show PSNR/SSIM values of 35.13dB/0.982 and 37.58dB/0.962 for statistical and systematic uncertainty respectively when compared to the ground truth (GT) images (0mm) for ID datasets. Similar results were observed for the OOD dataset. However, uncertainty maps showed regions of varying statistical and systematical variance, bias, and error distributions in the predicted images, with OOD results showing higher bias and error than ID results. ***Conclusion:*** Diffusion models allow the spatial representation of uncertainty metrics beyond the routine use of PSNR/SSIM. These metrics further enrich the assessment of the resultant images with respect to the ground truth. ***References:*** [1] "DiffPVC: A Conditional Diffusion Model for Partial Volume Correction in Brain PET Imaging". American Association of Physicists in Medicine Annual Meeting (2024). Los Angeles, CA. [2] Lakshminarayanan, Balaji, Alexander

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OP-287

Impact of Tissue-Dependent Spatially-Variant Positron Range Correction for Gallium-68 on Patient PET Reconstructions

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Aim/Introduction: The 68Ga PET image quality is negatively affected by the distance travelled by the positrons before annihilation, the so-called positron range (PR). In particular, the PR of 68Ga depends on the underlying tissue (electron) density, an effect which is not considered in tissue-independent positron range correction (PRC) techniques. In this study we investigate the impact of a tissue-dependent spatially-variant PRC (Heterogeneous PRC) on image quality. ***Materials and Methods:*** The PR distribution profiles of 68Ga in water, bone, and lung tissue were obtained via Monte Carlo simulations. Heterogenous PRC was performed by incorporating those uniform profiles for the underlying tissue in the PET reconstruction algorithm [1]. A total of 15 patients (68Ga-PSMA: 4, 68Ga-DOTATOC: 11) containing 78 lesions were imaged in PET/CT. Cubic sections containing tissue interfaces of different tissue types were segmented from the patient CT images. In each section, a 68Ga point source was placed in the center. PR distribution profiles were obtained using Monte Carlo simulations and were compared to the corresponding heterogeneous PRC profiles. Moreover, Q.Clear reconstructions (PSF + ToF) of the PET data were performed. Three reconstruction settings were compared, non-PRC (β=700), water-based tissue-independent PRC (β=600), and heterogeneous PRC (β=600). The contrast-to-noise ratio (CNR) of each lesion was calculated as the difference between the mean lesion activity concentration and mean background activity concentration scaled by the background noise. The Wilcoxon signed rank test (α=0.05) was performed and the p-value was adjusted for multiple comparisons using Bonferroni correction. ***Results:*** The heterogeneous PRC profiles showed good agreement to those obtained via Monte Carlo simulations. However, discrepancies, typically about 11%, were observed when the point source was located close to the tissue boundaries. In soft-tissue lesions (32) the tissue-independent and heterogeneous PRC showed similar increase in CNR of 8.0% ($p<0.001$) and 7.9% ($p<0.001$), respectively, compared to the non-PRC. For bone lesions (35), the tissue-independent PRC showed higher increase in CNR (13,1%, $p<0.001$) compared to heterogeneous PRC (11.4%, $p=0.004$) with no statistical significant difference between the two PRCs. In lung lesions (11), the heterogeneous PRC resulted in greater increment than the tissue-independent PRC (21.9%, $p=0.003$, vs 6.6%, $p=0.003$), which was statistically significant ($p=0.006$). ***Conclusion:*** 68Ga-PRC using PR distribution profiles resulted in CNR improvements in PET patient images. For soft-tissue and bone lesions, tissue-independent PRC showed similar improvement compared to heterogeneous PRC. However, for lung lesions, heterogeneous PRC outperformed tissue-independent PRC. ***References:*** [1] Kertész H, et al., Front Physiol. 2022.

OP-288

Impact of time-of-flight and point-spread-function correction on commonly utilized PET image quality parameters in a wide variety of PET-CT scanners

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Aim/Introduction: The influence of time-of-flight (TOF) and point-spread-function (PSF) correction on recovery coefficients (RCs), percent background variability (PBV), accuracy of corrections (AOC) and background coefficient of variation (COV) was studied using 12 PET-CT scanners and a NEMA image quality (IQ) phantom filled permanently with 68Ge. ***Materials and Methods:*** The 68Ge-filled NEMA IQ phantom included six hot spheres with diameters of 10, 13, 17, 22, 28 and 37 mm with a concentration ratio of 4:1 to background, and a cold lung insert. During a five months period, the phantom was imaged using 12 PET-CT scanners, including analog and digital systems from two major vendors. With every scanner, the phantom was imaged 20 times with five minutes bed position centered in the middle plane of the hot spheres without moving the phantom in-between. The imaging protocol was standardized as closely as possible between the scanners, including 256x256 matrix, voxel size of 3x3x3 mm3, OSEM reconstruction with iterations times subsets between 40-50, no post-reconstruction filtering, and CT based attenuation and scatter correction. In addition, in datasets 1 TOF and PSF correction were used, in datasets 2 only TOF but not PSF correction, and in datasets 3 neither TOF nor PSF correction. For the RCs, the max, mean and peak activity concentrations for all spheres were measured from the datasets and divided by the known activity concentration. The results from the corresponding 20 repetitions were averaged. Also, PBV, AOC and COV were computed and averaged. Results from datasets 1, 2 and 3, including all scanners, were pairwise compared using Wilcoxon signed rank test with $p = 0.05$. ***Results:*** For the max, mean and peak RCs of different sphere sizes, significant differences were found in 91 % of pairwise comparisons between datasets 1, 2 and 3. For PBV, datasets 1 produced significantly smaller values than datasets 2 and 3 for all sphere sizes, and datasets 2 smaller values than datasets 3 except for the two smallest spheres. For AOC, datasets 1 and 2 produced significantly smaller values than datasets 3, and datasets 1 clearly but not significantly smaller values than datasets 2. For COV, results for datasets 1 were significantly smaller than for datasets 2 and 3. ***Conclusion:*** Without uncertainties related to phantom filling, the significant impact of TOF and PSF correction on commonly utilized QA parameters of PET was confirmed, even outstanding the impact of different scanner models.

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Tumour Margin Thickness Inference for ^{99m}Tc Radio-guided Surgery Using Internal Conversion Electrons

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Aim/Introduction: In 99mTc radio-guided surgery (RGS) using intraoperative probes, it is not possible to delineate the boundary between cancerous and healthy tissue. In this study, the feasibility of inferring tumour thickness and depth using signal measured from an intraoperative probe was explored with convolutional neural networks (CNNs). Given the difference in the emission energies and tissue interaction properties between the gammas,

internal conversion (IC) electrons and X-rays from 99mTc, the ratio of emissions will vary for a given source distribution [1]. Hence, a CNN can learn these features alongside any other pertinent information present in the training dataset to perform source thickness and depth inference. ***Materials and Methods:*** Training data were experimentally collected with 99mTc sources of different thicknesses and depths, and used to train a CNN to infer source thickness and infer whether the emission depth is above or below a certain value. Data was collected using an intraoperative probe with a complementary metal-oxide semiconductor (CMOS) sensor, optimised towards the detection of IC electrons from 99mTc [2]. The network input is a collection of 500 emission events measured from a given thickness or depth. where each emission event is a 25 × 25 image. The test performances of the thickness and depth inference networks were evaluated through computing the root mean squared error (RMSE) and the area under the receiver operating characteristic curve (AUC) respectively. ***Results:*** For thicknesses between 500 µm and 1250 µm, the network trained for thickness inference was able to achieve a RMSE of approximately 90 µm. For depth inference, the performance with the classifier trained at a threshold of 23 µm is promising regarding the ability to differentiate between superficial and non-superficial sources. While the classifier demonstrates AUC scores above 0.7 for micron depth ranges, the performance worsens at millimetre depth ranges. However, for prostatectomies, cancerous tissue that is within 100 µm of the surgical margin is associated with an increased risk of recurrence [3], which is within the feasible range. ***Conclusion:*** Overall, the proposed methods were able to infer source characteristics that may be valuable for intraoperative tumour margin evaluation using 99mTc RGS. Future work may focus on evaluating the proposed methods with data that reflects clinical conditions by using more realistic radiotracer distributions. ***References:*** [1] J. Moo et al., IEEE NSS/MIC, 2022 [2] J. Moo et al., IEEE TRPMS, 2022 [3] J.P. Izard et al., Am. J. Surg. Pathol, 2014.

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Hall Z

Clinical Oncology Track - TROP Session: Oncology & Theranostics Committee: Gastrointestinal

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The prognostic role of ^{18}F-FDG PET/CT in patients with locally advanced resectable esophageal squamous cell carcinoma(ESCC) submitted to neoadjuvant PD-L1 blockade therapy: A single-center prospective study

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Aim/Introduction: Neoadjuvant immunotherapy combined with chemotherapy or chemoradiotherapy has been explored in several clinical trials for locally advanced resectable ESCC, and the potential role of 18F-FDG PET/CT-derived parameters as biomarkers has been investigated. However, due to the potentially distinct tumor response patterns of immunotherapy compared to traditional therapies, the therapeutic effects of immunotherapy on tumors were unable to be predicted separately. This prospective study aimed to evaluate whether 18F-FDG PET/CT-derived parameters could prognosticate the precise impact of immunotherapy alone on tumor regression, and aid in targeting the population suitable for mono-immunotherapy. ***Materials and Methods:*** Patients with ESCC who underwent two cycles of neoadjuvant PD-L1 blockade adebrelimab followed by surgery were enrolled in NATION-1907 trial (NCT04215471). 18FDG PET/CT scans were performed before immunotherapy (scan-1) and a median of 3 days before surgery (scan-2). SULmax, SULpeak and TLR (SULmax of lesion/SULmean of liver) were documented for primary tumors and lymph nodes, among which lesions>1cm3 were segmented with a threshold of 50% of SULmax, and then SULmean, TLG, MTV were calculated. The percentage change of all the metabolic parameters(Δ%change) was also recorded. Responders were identified as patients with residual viable tumor of ≤33% according to histological evaluation. Kaplan-Meier curves were used to compare OS and PFS between PET/CT parameters on cut-off values. ***Results:*** A total of 18 patients were included for this analysis, with 10 classified as responders and 8 as non-responders. The degree of pathological regression exhibited a negative correlation with all metabolic parameters of scan-2 and the Δ%change between two scans. Moreover, all metabolic parameters of scan-2, except MTV, were significantly lower in responders compared to non-responders. Additionally, %ΔMTV, %ΔTLG and %ΔTLR were significantly higher in the non-responder group(all $p<0.05$). ROC curves indicated that SULpeak of scan-2 demonstrated the highest diagnostic power (sensitivity: 80%, specificity: 100%; cut-off: 5.05).%ΔMTV also exhibits excellent performance in predicting responders, with an AUC of 0.883(cut-off: -37.7%). Furthermore, none of the patients with a Δ%MTV of -37.7% or more at the primary tumor site experienced a relapse (median 46 months since surgery), and patients' PFS could be significantly predicted by Δ%MTV ($p<0.05$). In lymph nodes analysis, the percentage reduction of the metabolic parameters and the residual viable tumor of LNs also showed statistically significant differences. ***Conclusion:*** The metabolic parameters of 18F-FDG PET/CT could predict responders to neoadjuvant mono-immunotherapy in resectable ESCC, which may facilitate personalized immunotherapy and serve as a stratification tool in larger-scale studies.

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The value of a multiparameter diagnostic model based on 2-$^{[18F]}$FDG PET/CT metabolic parameters and clinical variables in the differential diagnosis of non-metastatic extrahepatic cholangiocarcinoma and cholangitis

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Aim/Introduction: The cholangiocarcinoma (CCA) is a malignant tumor originating from the epithelium of the bile duct and peribiliary glands, the classification of CCA divides tumors into intrahepatic (iCCA) and extrahepatic (eCCA), with eCCA further categorized as perihilar (pCCA) and distal (dCCA) lesions. The only treatment modality with the potential for curative intent in CCA is surgical resection. The accurate diagnosis of early CCA is crucial as it offers a chance for cure through surgery in patients at an early-stage. The 2-$^{[18F]}$FDG PET/CT has clinical value in the diagnosis, staging, evaluation of treatment response, and prediction of prognosis in different anatomical subtypes of CCA.

Therefore, the aim of our study is to evaluate the diagnostic value of a multiparameter model based on 2-[18F]FDG PET/CT metabolic parameters and clinical variables in differentiating non-metastatic eCCA from cholangitis. ***Materials and Methods:*** In total, 122 patients (86 non-metastatic eCCA patients and 29 cholangitis patients) with bile duct space-occupying lesions who underwent 18F-FDG PET/CT were included. The patients underwent surgical procedures and pathological examinations, during which baseline characteristics and clinical variables were systematically documented. The metabolic parameters of 2-[18F] FDG PET/CT, including SUVmax (maximum standard uptake value), SUVmean (mean standard uptake value), SUVpeak (peak standard uptake value), MTV (metabolic tumour volume), TLG (total lesion glycolysis) and SUVR (tumour-to-normal liver standard uptake value ratio), were evaluated. The differential diagnostic efficacy of each independent parameter and multiparameter combination model was evaluated using the receiver operating characteristic (ROC) curve. The improvement in diagnostic efficacy using a combination of the above multiple parameters was evaluated by integrated discriminatory improvement (IDI), net reclassification improvement (NRI) and bootstrap test. ***Results:*** The ROC curve showed that MTV had the highest diagnostic ability among the 18F-FDG PET/CT metabolic parameters (area under the curve [AUC]=0.669; sensitivity=0.655; specificity=0.663; positive predictive value [PPV]=0.396; negative predictive value [NPV]=0.851). The combined diagnostic model of cholangiolithiasis, fever, carbohydrate antigen 19-9 (CA19-9) >37 ng/ml and MTV showed an AUC of 0.863 (sensitivity=0.884, specificity=0.724, PPV=0.905, NPV=0.677). The diagnostic efficiency of the model was improved significantly compared with MTV (IDI=0.302, P<0.001; categorical NRI=0.344, P<0.001; D=3.022; boot: n=2000; boot: stratified=1; P=0.003). ***Conclusion:*** The multiparameter diagnostic model composed of 18F-FDG PET/CT metabolic parameters (MTV) and clinical variables, including cholangiolithiasis, fever, and CA19-9>37 ng/ml, has good diagnostic efficacy in the differential diagnosis of non-metastatic eCCA and cholangitis.

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^{68}Ga-labelled Prostate-Specific Membrane Antigen PET/MR for imaging patients suspected of hepatocellular carcinoma

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Aim/Introduction: Prostate-specific membrane antigen (PSMA) is an ideal target for prostate cancer diagnosis and therapy. Many radiolabeled drugs targeting PSMA have been developed and shown great potential for current clinical application. PSMA expresses on neovessels in some tumors, including hepatocellular carcinoma (HCC). This study aims to evaluate the diagnostic value of [68Ga]Ga-PSMA-11 PET/MR for HCC. ***Materials and Methods:*** Twelve patients highly suspected of HCC were prospectively enrolled in this single-center study. All patients underwent [68Ga]Ga-PSMA-11 PET/MR with resection of main suspicious liver lesions and histopathologic verification. Contrast-enhanced CT/MR (ceCT/MR) was performed simultaneously in 7 patients. All lesions were visually evaluated and semi-quantitatively analyzed. Uptake greater than surrounding normal tissue was considered positive and equal to or less than surrounding normal tissue was considered negative. Volumes of interest were drawn around the lesions, and maximal standard uptake value (SUVmax), tumor-to-liver ratios (TLR) and tumor-to-blood ratios (TBR) were calculated. All metastatic lesions were determined by intraoperative detection or comprehensive imaging evaluation. The diagnostic efficiency of [68Ga]Ga-PSMA-11 PET, ceCT/MR and [68Ga]Ga-PSMA-11 PET/MR were calculated. Quantitative analysis of PSMA expression on immunohistochemistry was performed by Image J, and its correlation with SUVmax was analyzed. ***Results:*** Twelve patients (10 men, 58.75±12.08 years old) were enrolled in this study, including 10 HCC, 2 intrahepatic cholangiocarcinomas (ICC) and 4 hemangiomas patients. SUVmax, TLR and TBR of all HCC primary tumors were 11.30±6.54, 3.41±1.84, 2.50±1.96, respectively. SUVmax, TLR and TBR were 4.40±1.84, 1.34±0.64, and 1.53±0.75, respectively in 2 ICC lesions. All 6 hemangiomas lesions exhibited negative uptake with SUVmax, TLR and TBR 2.88±1.07, 0.91±0.39 and 1.12±0.44, respectively. There were significant differences in the SUVmax, TLR or TBR between HCC primary tumors and hemangiomas. When using positive as the diagnostic criterion for HCC and negative as non-HCC with only intrahepatic lesions counted, the accuracy, sensitivity, specificity, positive predictive value, and negative predictive value of [68Ga]Ga-PSMA-11 PET were 83.3% (15/18), 80% (8/10), 87.5% (7/8), 88.9% (8/9), and 77.8% (7/9), respectively. The diagnostic accuracy of ceCT/MR was 77.8% (8/10, 1/2, and 5/6 for HCC, ICC and hemangiomas, respectively). The combination diagnostic accuracy of [68Ga]Ga-PSMA-11 PET/MR and ceCT/MR increased to 88.9%. Moreover, there were correlations between PSMA staining score and SUVmax (R2=0.6209) in HCC primary tumors. ***Conclusion:*** Contrast-enhanced [68Ga]Ga-PSMA-11 PET/MR may be more beneficial for accurate diagnosis and staging in patients with HCC than [68Ga]Ga-PSMA-11 PET and ceCT/MR alone.

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Evaluating the potential of PSMA theranostics for upper digestive tract cancers, a prospective study

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Aim/Introduction: Upper digestive tract cancers are an important health issue with limited survival (less than 30% with 5-year survival for esophageal, gastric, biliary, and pancreatic adenocarcinoma). When metastatic/unresectable, therapeutic options are limited. Endoradiotherapy, could be an elegant solution for systemic therapy and is usually well-tolerated. Case reports and small prospective studies have documented that upper-digestive tract cancers can show Prostate Specific Membrane Antigen (PSMA)-targeting radiotracer uptake on positron emission tomography (PET). However, frequency of PSMA uptake and eligibility for PSMA-targeted therapy remains uninvestigated. We aimed to prospectively determine, with 68Ga-PSMA PET, the proportion of upper digestive tract cancers that

meet criteria for 177Lu-PSMA treatment, which is the first step in bringing this new line of therapy to cancer patients(1-8). ***Materials and Methods:*** This prospective clinical trial (NCT05214820) was approved by the local ethics committee. Patients with upper digestive tract adenocarcinoma, confirmed by pathology, with active or progressive disease on computed tomography (CT) were included. We excluded patients with more than one active cancer and with ECOG score > 3. Participants underwent PET with 68GaPSMA-617 labeled with cyclotron-produced gallium-68, on a Siemens Biograph Vision PET/CT. We evaluated eligibility based on the VISION trial criteria for prostate cancer endoradiotherapy and reported the level of uptake of the most intense lesion as SUVmaxbw as well as its scoring on the PROMISEv2 scale(9-10). ***Results:*** We recruited 17 adults (12 men, 5 women; 66.7±8.7 years of age) with gastric (2), esophageal (6), biliary (3), and pancreatic (6) adenocarcinoma. The mean of the SUVmaxbw of the hottest lesion per patient was 6.50±3.52. For PROMISEv2 PSMA expression score, 5 cases (29%) had no-uptake (score-0), 5 (29%) had low-uptake (score-1), 7 (41%) had intermediate-uptake (score-2), and 0 (0%) had high-uptake (score-3). According to the VISION study criteria, 12% (2/17) of patients were considered treatable with 177Lu-PSMA. With PROMISEv2 scores, 41% (7/17) had uptake considered positive for PSMA radioligand therapy. ***Conclusion:*** We demonstrated that sufficient PSMA radiopharmaceutical accumulation for therapy occurred in at least 12% of patients with upper digestive tract cancers according to VISION criteria used for prostate cancer therapy. This suggests eligibility for a new line of therapy for these patients. However, a prospective therapeutic clinical trial will be needed to ascertain endoradiotherapy efficacy, since response to this treatment might be different in upper digestive tract cancers than in prostate cancer. ***References:*** Brenner.cmaj, 2020.192(9): p.E199-205; Canadian Cancer Society, Cancer-specific stats 2020; Malik.ClinNuclMed, 2018.43(7): p.529-532; Marafi.ClinNuclMed, 2019.44(7): p.e439-e441; Chahinian AsiOceanJNuclMedBiol, 2020.8(2): p.136-140; Shetty.Tomography, 2018.4(4): p.182-193; Backhaus EurJNuclMedMolImaging, 2018.45(5):p.860-877; Vujik.Cancers(Basel), 2022.14(24): p.6209; Sartor NEnglJMed.2021.385(12): p.1091-1103; Seifert.Eur Urol.2023.83(5): p.405-412.

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Assessment of postsurgical liver remnant by [99mTc]Tc-Mebrophenin hepatobiliary SPECT/CT (HBS-SPECT/CT) scintigraphy in primary and secondary liver neoplasms

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Aim/Introduction: The main aim is to correlate the data obtained through computed tomography volumetry and hepatobiliary scintigraphy (Graaf and HIBA index) with the risk of developing postoperative liver dysfunction. ***Materials and Methods:*** A cohort study was performed using univariate analysis in patients who underwent major hepatic resection from August 2017 to July 2022 at the Cruces University Hospital. ***Results:*** A total of 49 patients were included, 12 of them (24.5%) developed liver dysfunction after major hepatic resection. The median value for the percentage of volume increase in future liver remnant was 2% (0-5%) in patients with dysfunction compared to 31% (2-45%) in patients without dysfunction (p=0,04). The mean Graaf's index was 2.05±0.21%/min/m2 in patients with dysfunction compared to 2.77±0.84%/min/m2 in patients without dysfunction (p=0,04). The area under the curve obtained as a cut-off value of 2.8%/min/m2 for de Graaf`s index (AUC=0,54) and 25% for the HIBA´s index (AUC=0,59). ***Conclusion:*** Patients who developed liver dysfunction had lower scores for the percentage of volume increase of the future liver remnant and Graaf`s index compared to those without dysfunction with statistical significance. However, more research is needed in order to establish a cut-off value for de Graaf index and HIBA index which may predict liver dysfunction.

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Radiomics and Machine Learning in Gall Bladder cancer vs cholecystitis: simplifying the diagnostic dilemma

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Aim/Introduction: Gall bladder cancer(GBCa) is an aggressive malignancy with poor prognosis. However, its diagnosis can be challenging and is often confused with cholecystitis, particularly xanthogranulomatous cholecystitis. Neither clinical symptoms, laboratory tests, nor conventional radiological techniques offer a reliable method for differential diagnosis. Thus, we investigated utility of 18F-FDG PET-CT derived radiomic features(RF) and a machine learning model(MLM) to accurately distinguish GBCa from cholecystitis. ***Materials and Methods:*** Patients with suspected GBCa who underwent ^{18}F-FDG PET-CECT were included in the study. Experienced Nuclear Medicine physicians manually delineated regions of interest(ROIs), and intensity-threshold restrictions of 25% and 35% were applied to create three distinct sets of ROIs and high-dimensional RF were extracted using LIFEx(v7.6). Univariate analysis was applied to each RF as well as metabolic parameters(SUVmax, MTV and TLG), using area-under-curve(AUC) of receiver-operator-curve(ROC) and p-value computed by Mann-Whitney-U test. p-value<0.05 was considered significant. Histopathological examination(HPE) was taken as the gold standard. RF with an AUC>0.7 were further refined with least absolute shrinkage and operator(LASSO) algorithm. A support vector machine(SVM)-based MLM was developed using Rv.4.1.3, with 75% of data for training and 25% for validation. Model's performance was assessed using ROC curves and compared with metabolic parameters. Similarly, another SVM-based MLM was developed to predict the probability of metastatic disease. ***Results:*** The study included 41 GBCa patients (14 males, median age-57, range: 35-76 years). Among these, 35 had GBCa while and 6 had cholecystitis on final HPE. A total of 161-RF were extracted from each ^{18}F FDG PET-CT image at three intensity thresholds, with the most significant results observed at 35% threshold. Univariate analysis revealed that 20 RF were statistically significant predictors of outcome. In multivariate analysis the best SVM-LASSO model consisted of 3 RF at 35% threshold(Table-1).The SVM-MLM achieved a sensitivity and specificity of 88.89% & 50% with AUC 0.944 compared to 77.1% & 33.4% for SUVmax at a cut-off of 5.23 and 80% & 50% for TLG at a cut-off of 46.6 with an AUC of 0.757 and 0.767 respectively. Thus, SVM-MLM demonstrated superior performance compared to metabolic parameters with an overall accuracy of 81.8%. Similarly, SVM-LASSO model for metastatic disease prediction included 4 RF at 25% threshold and achieved a sensitivity, specificity, and accuracy of 83.3%, 66.67%, and 66.67% respectively with AUC of 0.778. ***Conclusion:*** SVM-MLM can be instrumental in effectively predicting the histology (GBCa vs cholecystitis) as well as distant metastasis in cases with Suspected GBCa.

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[^{68}Ga]Ga-RYZ-GPC3; a glypican-3 targeted diagnostic radiopharmaceutical for hepatocellular carcinoma molecular imaging. A future game-changer in HCC?

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Aim/Introduction: Hepatocellular carcinoma (HCC) is the most common primary liver cancer. To date, imaging of HCC is difficult, challenging for disease staging (especially for extrahepatic disease) and has barely improved over the past decades. Glypican-3 (GPC3) is a cell-surface receptor highly expressed by HCC but not by normal or cirrhotic liver tissue. Here we report initial clinical results of GPC3 targeted PET-imaging with [68Ga]Ga-RYZ-GPC3 , a peptide based GPC3 ligand in patients with known or suspected HCC. ***Materials and Methods:*** [68Ga]Ga-RYZ-GPC3 was obtained upon labeling the peptide precursor with 68Ga from a 68Ge/68Ga-generator and heating at 90^{0}C for 10 min followed by sterile filtration. After administration of [68Ga]Ga-RYZ-GPC3, a dynamic or static PET/CT scan was acquired between 45 minutes and 4 hours post-administration. Radiotracer uptake was measured by standardized uptake values (SUVs) for the following tissues: (suspected) HCC lesions, non-tumor bearing healthy liver (HL), renal cortex, blood pool activity in the left ventricle (BP) and gastric fundus. Additionally, tumor-to-healthy liver ratios (TLR) were calculated. ***Results:*** Twenty-four patients (five patients dynamic; 19 patients static protocol) were scanned. Two patients had no lesion detected and did not have an HCC during follow-up. In total, 50 lesions were detected and analyzed. Mean SUVmax of these lesions was 19.6 (range 2.7 - 95.3) and mean SUVmean was 10.1 (range 1.0 - 49.2) at approximately 60 minutes p.i.. Uptake in HL and BP rapidly decreases over time and becomes negligible 45 minutes after administration (SUVmean<1.6), with a continuous declining trend to 4 hours after administration (Mean SUVmean = 1.0). The opposite was observed for HCC lesions, for which SUVs and TLRs continuously increased for up to 4 hours after administration. In individual lesion analysis, TLR was the highest between 60 - 120 minutes post-injection. Uptake in the gastric fundus gradually increased for up to 45 minutes (to SUVmax 31.3) and decreased gradually afterwards. ***Conclusion:*** [68Ga]Ga-RYZ-GPC3 allows for high contrast imaging of GPC3-positive liver tumors, with a rapid clearance from normal organs and overall favorable biodistribution. Thereby, [68Ga]Ga-RYZ-GPC3 is promising for HCC diagnosis and staging.

OP-297

Evaluation of the Neovasculature of Hepatocellular Carcinoma with Multiparametric [68Ga]-PSMA-11-PET/MRI: A Proof-of-Concept Study

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Aim/Introduction: Prostate-specific membrane antigen (PSMA) is expressed not only in prostate cancer but also in tumor-associated neovasculature and may be a potential theranostic in many solid cancers. This study aims to explore the feasibility of multiparametric (mp) [68Ga]-PSMA-11-PET/MRI in providing detailed imaging of the tumor neovasculature in patients with hepatocellular carcinoma (HCC), thereby potentially predicting treatment response and improving patient management. ***Materials and Methods:*** Six treatment-naïve patients with intermediate- and advanced-stage HCC underwent mpPSMA-PET/MRI on a 3T PET/MRI hybrid system prior to stage- and guideline-appropriate anti-neoangiogenesis treatment (transarterial chemoembolization or radioembolization, immunotherapy). The mpMRI protocol included intravoxel incoherent motion diffusion-weighted imaging (IVIM-DWI), T1- and T2*-weighted mapping, and dynamic contrast-enhanced (DCE) imaging. Dynamic PET was acquired simultaneously over 40 minutes. We analyzed tracer and contrast agent kinetics for both [68Ga]-PSMA ligands and gadolinium (GD), comparing tumor tissue with adjacent non-tumor liver tissue. ***Results:*** Preliminary results indicate enhanced GD and PSMA uptake in tumor neovasculature compared to normal liver tissue, suggesting different kinetic profiles. Quantitative analysis of imaging data revealed significant differences in perfusion characteristics and vascular permeability between HCC lesions and non-tumor liver tissue [mean Ktrans (10-3/min): HCC, 796±330 vs. non-tumor, 227±165, p=0.0036; mean ADC (10-3 mm^2/s): HCC, 1.30±0.29 vs. non-tumor, 2.23±0.20, p<0.0001; mean T2* (ms): HCC, 39±4 vs. non-tumor, 18±5, p=0.004] highlighting the potential of mpPSMA-PET/MRI to delineate tumor physiology at the molecular level ***Conclusion:*** mpPSMA-PET/MRI appears to be a promising tool for advanced characterization of HCC, providing superior insights into the tumor microenvironment and vascular properties. These findings may facilitate more tailored therapeutic strategies, particularly in intermediate and advanced HCC, where anti-neoangiogenesis therapies play a critical role.

OP-298

Correlation of 68Ga-PSMA-11 PET Biodistribution with PSMA Expression by Immunohistochemistry in Patients with HCC: A Pilot Prospective Monocentric Study

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Aim/Introduction: While contrast-enhanced CT(ceCT) and ceMRI are the standard imaging modalities for Hepatocellular Carcinoma(HCC), they offer limited insight into the biological aspects. Hence the need of other techniques capable of providing additional information. Preliminary investigations revealed PSMA overexpression in HCC vessels. This study aimed to assess whether 68Ga-PSMA-11 PET biodistribution reflects PSMA-expression in vitro from resected liver. ***Materials and Methods:*** The MORE-PSMA study is a pilot prospective single-center investigation. From September 2021 to March 2024 all patients with suspicion of HCC eligible for Liver Transplantation(LT) or Hepatic Resection(LR), naive for systemic therapy were screened. Following ultrasound, ceCT, or biopsy, eligible patients underwent both ceMRI with hepatospecific-contrast and PSMA-PET within a 3-month timeframe. No treatments were allowed between PSMA-PET and

MRI. PSMA-PET and ceMRI images were read by 3 independent blinded nuclear medicine physicians and by 2 radiologists, respectively. PSMA-PET and ceMRI results were compared with post-operative histological examination. Anatomopathological analyses included histological diagnosis of HCC and Edmondson-grading. Immunohistochemical evaluation of PSMA-expression involved assessing both percentage of PSMA-expressing vessel cells and intensity, with intensity visually graded on a four-point scale (negative, mild, moderate, strong), and a composite score generated from intensity multiplied by percentage (immunoreactive score,IRS). ***Results:*** 33patients underwent ceMRI and PSMA-PET, of whom 25/33(76%) underwent surgery [22/25 (88%) male; mean age 65yo(range 26-81 yo)]. 7/25(28%) received LT; 18/25(72%) LR. Histology confirmed HCC in 21/25(84%), 2/25(8%) showed high-grade-dysplasia-nodules(HGDN), 1/25(4%) was pseudotumor, 1/25 was negative for HCC. Median size of HCC nodules on ceMRI was 28(range 15-49mm). PSMA-PET was positive in 23/25(92%)patients, achieving a detection rate of 100% for HCC (median lesion'sSUVmax=12; median liver background SUVmax=6). PSMA-IHC-expression was observed in endothelial cells across all lesions, while no expression was detected in cancer cells. IRS was strong in 10/21(48%)cases, moderate in 4/21(19%), mild in 1/21(5%), negative in 6/21(28%) cases. A moderate Spearman correlation was observed between IRS and SUVmax (p=0.02) and between percentage and SUVmax (p=0.017). There was a trend between Edmondson and SUVmax. Sensitivity for PSMA-PET and ceMRI was 100%vs95%, specificity 50% vs 25%; PPV 91% vs 87%; NPV 100% vs 50%; and accuracy 92% vs 86%, respectively. ***Conclusion:*** Our preliminary findings showed elevated PSMA-ligand-uptake on PET imaging and a correlation between 68Ga-PSMA-11 PET and PSMA tissue expression in HCC. Also, PSMA-PET exhibited a superior detection rate for HCC, showing heightened sensitivity, NPV and accuracy when compared with ceMRI. These findings support further exploration of PSMA-PET as an imaging biomarker for HCC.

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Monday, October 21, 2024, 08:00 - 09:30
Hall Y10-Y12

TROP Session: Inflammation & Infection Committee: Top on Inflammation and Infection Imaging

OP-299

Metabolic Tumor Volume at baseline [18F]FDG-PET/CT independently predicts the time to treatment failure and the relapse-free survival in antibiotic-naïve patients with pyogenic spondylodiscitis

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Aim/Introduction: Pyogenic spondylodiscitis presents a clinical challenge that can lead to long-term complications. Reliable early predictors of clinical outcomes in these patients are currently lacking. Despite its growing importance in diagnosing and managing spondylodiscitis, the prognostic value of [18F]FDG-PET/CT has been insufficiently explored. ***Materials and Methods:*** Patients clinically diagnosed with pyogenic spondylodiscitis who underwent [18F]FDG-PET/CT at IRCCS Policlinico San Martino between 2020 and 2023, were retrospectively enrolled. Inclusion criteria included: 1) absence of previous spine surgery; 2) absence of onco-hematological diseases; 3) absence of corticosteroid treatment. Although antibiotic therapy at the time of imaging was documented, it did not serve as an exclusion criterion. Key laboratory markers such as C-reactive protein, procalcitonin, white blood cell differential counts, lactate dehydrogenase (LDH), and creatinine levels were collected. For each lesion, the standardised uptake value maximum (SUVmax), metabolic tumor volume (MTV), and total lesion glycolysis (TLG) were quantified from [18F]FDG-PET/CT images. Baseline [18F]FDG-PET/CT scans were evaluated as predictors of time to treatment failure (TTF) and relapse-free survival (RFS). ***Results:*** A total of eighty patients (119 lesions) were retrospectively enrolled. Of these, 65% (78 lesions) were antibiotic-naïve, while 35% (41 lesions) had received antimicrobial treatments for 1-14 days. Baseline demographics, clinical, and laboratory characteristics were balanced between the two groups. All patients adhered to the prescribed treatment until full recovery. The median clinical follow-up period was 15 months (range: 3-59 months). In the antibiotic-naïve group, the univariate analysis identified procalcitonin (p=0.001), neutrophils (p=0.009), lymphocytes (p=0.039), monocytes (p=0.027), SUVmax (p=0.025), MTV (p<0.001), and TLG (p<0.001) as predictors of TTF. LDH (p=0.076), MTV (p<0.001), and TLG (p=0.017) were predictors of RFS. The multivariate model confirmed MTV as the sole independent predictor of TTF (p=0.033) and RFS (p=0.009). When categorised according to the Youden's index, patients with lesions exhibiting an MTV ≥ 30 mL (23.1%) had a median TTF of 8.7 weeks (95%CI 8.0-9.5) and an RFS of 11.0 months (95%CI 11.0-11.0), whereas the remaining subgroup did not reach the median for either endpoint (p<0.001 for both). No baseline lab marker or metabolic measure from [18F]FDG-PET/CT significantly predicted TTF and RFS in patients receiving antibiotic therapy. ***Conclusion:*** Before initiating antimicrobial treatment, [18F]FDG-PET/CT-derived MTV independently predicts TTF and RFS in patients with pyogenic spondylodiscitis, facilitating early risk stratification that could potentially enhance subsequent clinical management. This prognostic capability diminishes in patients already under antibiotic therapy.

OP-300

Usefulness of ^{18}F-FDG PET/CT in the detection of prosthetic infection after reconstruction of the aortic arch and thoracic aorta using the Thoraflex device

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Aim/Introduction: The Elephant Trunk prosthesis (Thoraflex) is a novel vascular device that, unlike traditional devices, simulates vascular anatomy. It is used for the replacement of the aortic arch and thoracic aorta in patients with aneurysms of different etiologies. Its use is increasing and it is necessary to know the management of the infectious complication and the clinical impact of [18F]FDG-PET/CT in Thoraflex. The objectives of this study are: to assess the usefulness of [18F]FDG-PET/CT in the detection of infection; to identify the morphometabolic characteristics that allow differentiation between post-surgical inflammatory changes and infection; to correlate PET/CT findings with clinical data. ***Materials and Methods:*** Retrospective descriptive study in Thoraflex-bearing patients who presented clinical suspicion of infection and underwent [18F]FDG-PET/CT study for diagnostic purposes between March 2016 and February 2024. The median time between surgery and acquisition of [18F]FDG-PET/CT was 29.1 months. Demographic data, vascular device, symptomatology and PET/CT study characteristics were analyzed, contrasting with the final diagnosis decided in a multidisciplinary committee. ***Results:*** 6 patients with a total of 10 studies were analyzed (2 women and 4 men), with a mean age of 56.8 years (30-73). Among 8 studies that PET/CT classified as positive, 7 were true positive, 1 false positive. Between the 2 negative PET/CT studies, all were true negative. False-positive PET was not considered as such clinically and prolonged antibiotic treatment was discouraged. In 5 of the 7 true positive studies, the highest metabolic activity was observed in the body of the prosthesis with a mean SUVmax of 5 mg/dl and in 2 studies in the sutures, with a higher mean SUVmax value (11 mg/dl).In the 2 negative studies a SUVmax of 4 mg/dl was observed and the metabolic activity visualized was attributed to post-surgical inflammatory activity. Likewise, these two studies presented findings compatible with respiratory infection.The false-positive study showed a focal uptake of high metabolic rate on PET/CT images that ultimately corresponded with inflammatory activity.CT imaging identified suspicious signs of infection (thickening, enlargement and fat trabeculation) in 6 of the 8 studies considered as positive. Positive patients presented higher SUVmax semiquantitative index and higher elevation of leukocytes than negative patients. ***Conclusion:*** [18F]FDG PET/CT is a useful noninvasive method to detect infection related to Thoraflex devices.The [18F]FDG-PET/CT allowed the rejection of all negative patients avoiding unnecessary surgeries and prolonged cycles of antibiotherapy. PET-CT has an important role in clinical and therapeutic decision making in complex patients.

OP-301

The Relationship Between PET/CT Metabolic Parameters and Inflammation Parameters and Final Clinical Diagnosis in Patients Who Have F^{18} FDG PET/CT Examination with Suspicion of Large Vessel Vasculitis

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Aim/Introduction: Diseases characterized by damage to vascular structures as a result of inflammation in the aorta and its main vascular branches are called Large Vessel Vasculitis (LVV). Inflammation parameters obtained from routine blood biochemistry are the first-line tests in diagnosing LVV . In suspected cases F18 FDG PET/CT is a nuclear medicine examination frequently used to make and assist in diagnosis. In our study, it was aimed to show the relationship between F18 FDG PET/CT findings and blood biochemical inflammation parameters. ***Materials and Methods:*** 80 patients who were referred to F18 FDG PET/CT examination with a preliminary diagnosis of LVV in our clinic, who did not have any other diseases that could cause inflammation were included. Final clinical diagnoses were scanned from clinician notes and recorded as LVV negative, suspicious and positive. In the F_{18} FDG PET/CT examination, the involvement of the aorta and its branches was visually evaluated according to the liver parenchyma and divided into three groups. Target/Liver ratio (T/ Lmax), Metabolic Volume (MV) and Total Glycolysis (TG) values. In addition, inflammation parameters were noted from blood tests that were less than 15 days apart from the PET/CT test. Chi-Square, Mann Whitney, Spearman tests and ROC analyzes were performed on the obtained parameters using the IBM SPSS 22 program . ***Results:*** In the F^{18} FDG PET/CT examination , a significant difference was detected in SUVmax , CRP, CRP/Albumin and Ferritin parameters between the negative group and the cases that were considered positive in visual scoring ($p<0.01$). In the ROC analysis performed to measure the diagnostic performance in LLV in the SUVmax parameter, sensitivity and specificity were found to be 100% and 93%, respectively, for the cut-off value of 3.18 g/ml. In the BDV positive group, a significant difference was detected in CRP and CRP/Albumin parameters between the groups with two positive and three positive visual scores on F^{18} FDG PET/CT ($p<0.05$). Additionally , a significant positive correlation was detected between MV and CRP (Rho =0.40) and TG and CRP (Rho =0.46) in clinically BDV positive cases ($p<0.05$). ***Conclusion:*** Concordance was found between inflammatory parameters and visual scoring evaluated on F^{18} FDG PET/CT. In addition to visual evaluation, it was evaluated that metabolic parameters obtained from F^{18} FDG PET/CT examination could be useful in cases where the final clinical diagnosis is incomplete.

OP-302

Liver based-standardization approach for improved consensus reading of [18F]FDG PET scans in patients with Takayasu arteritis

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Aim/Introduction: The role of [18F]FDG PET in the diagnosis and monitoring of patients with Takayasu arteritis (TAK) is constantly increasing; yet, challenges persist due to the lack of image standardization and consensus reading, which are essential for enhancing reading reliability. We propose a novel approach for standardizing PET scans acquired from different tomographs in a cohort of TAK patients. ***Materials and Methods:*** A pool of 60 [18F]FDG PET scans performed between 2013-2023 corresponding to 35 TAK patients and characterized by no vascular tracer uptake was selected. Image acquisition was performed using different scanners: PET/CT Discovery-690 (n=15), Discovery-STE (n=15), Discovery ST (n=15) and Signa PET/MRI 3 Tesla (n=15) (GE Healthcare). An OSEM 3D algorithm was used for PET image reconstruction, both for PET/CT and PET/MRI. Images were converted to standardized uptake value (SUV) units and resampled to 3x3x3mm. A 10-voxel (3cm) diameter sphere was applied on the liver image of each scan, and SUV statistics of the defined region, including mean and standard deviation (SD), were derived. PET scans were cropped around the thorax to remove the background (80x60x75 voxels), and SUV statistics of the cropped image were measured. The cropped scans were

then standardized using the mean and SD of the sphere on the liver, and SUV statistics were measured again on both the liver sphere and the cropped image. Mann-Whitney U test was used to assess SUV differences among all pairs of tomographs, both before and after standardizaton. ***Results:*** Before standardization, at the liver sphere-level, a statistically significant difference in SUV mean values was observed for 690 vs.ST (p=0.016), 690 vs.STE (p=0.002), and Signa vs.ST (p=0.023), but not for Signa vs.690 (p=0.590), Signa vs.ST (p=0.772), and ST vs.STE (p=0.455). After standardization, no significant difference was observed between any of the combinations (p>0.05). In addition, at the PET image-level, before standardization a statistically significant difference in SUVmean values was observed for Signa vs.690 (p=0.003), 690 vs.STE (p=0.008), Signa vs.ST (p=0.016), and ST vs.STE (p=0.040), but not for 690 vs.ST (p=0.934) and Signa vs.STE (p=0.507). After standardization, all observed differences disappeared (p>0.05), except for 690 vs.ST (p=0.020). ***Conclusion:*** The applied methodology can facilitate the comparison of images acquired with different scanners, improving [18F]FDG PET scans consensus reading, comparability of SUV statistics, and thus TAK patients' diagnosis and monitoring. Future studies will aim to validate the technique on a larger series of patients, and to automate the procedure.

OP-303

Quantitative PET/CT Parameters as Prognostic Biomarkers in Giant Cell Arteritis

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Aim/Introduction: This study aimed to asses the diagnostic and prognostic value of a novel quantitative parameter obtained from FDG PET/CT imaging, total inflammation vascular volume (TIVV), in patients with Giant Cell Arteritis (GCA). ***Materials and Methods:*** GCA patients enrolled in a prospective trial and treated with three boluses of intravenous methylprednisone and weekly subcutaneous tocilizumab (TCZ) monotherapy for 52 weeks were included. PET/CT scans were performed at diagnosis and repeated at weeks 24, 52, and 74. TIVV was calculated using a semiautomatic approach with FIJI software for each PET scan. Total inflammation glycolytic volume (TIGV) was also obtained by multiplying TIVV by SUVmean. Visual analysis using PET vascular activity score (PETVAS) was also conducted. The EULAR criteria were utilized to define clinically active disease. ***Results:*** 18 patients (72% female, mean age 68.5 years) for a total of 61 PET scans were included, of which 29 in active disease. The TIVV mean values were 82 (SD 67) and 262 (SD 181); for TIGV were 187 (SD 153) and 608 (SD 414), and for PETVAS were 9.0 (SD 4.5) and 15.2 (SD 5.6), in relapse and active disease, respectively. In a cross-sectional regression analysis TIVV, TIGV and PETVAS were strongly associated with clinically active disease, with OR of 5.55 (95% CI 2.36-13.07), 6.31 (95% CI 2.53-15.78) and 4.65 (95% CI 1.98-10.91). Over a follow-up time of 24 months, 10 patients experienced disease relapse. Cox hazard model showed a strong association of TIVV and TIGV with time to relapse, with HR of 2.67 (95% CI 1.03-6.92) and 2.41 (95% CI 1.01-5.76), respectively. Conversely, PETVAS exhibited a weaker prognostic role (HR 2.03; 95% CI 0.84-4.92). ***Conclusion:*** Our findings suggest that, in patients with GCA, semiautomatic quantitative PET parameters, such as TIVV and TIGV, which quantify the inflammatory active volume of vessels, represent promising biomarkers and may overcome visual analysis.

OP-304

Utility of ^{18}F-FDG PET/CT Semiquantitative and Qualitative Assessment Methods in the Baseline and Follow-up of Patients with Giant Cell Arteritis

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Aim/Introduction: To assess the utility of the PET vascular activity score (PETVAS) in the basal PET/CT and during the follow-up in patients with giant cell arteritis (GCA). To evaluate the impact of including the vertebral arteries (PETvVAS). ***Materials and Methods:*** We conducted a retrospective study of patients diagnosed with GCA between 2012 and 2023, who had a basal PET/CT within 15 days after the start of steroids and a follow-up PET/CT between 6-15 months thereafter. We evaluated the scans according to the EANM recommended visual PET/CT grading scale (VS): grade 3 positive and grade 2 possibly positive. We calculated PETVAS and PETvVAS. ***Results:*** We included 24 patients with a median age of 76.6 years (72.2-79.4), 54.2% women. All patients were classified according to 2022 GCA classification criteria. Temporal artery biopsy was done in 16 patients, being positive in 10 (62.5%). Ischemic symptoms were present in 7 (29.2%) and systemic symptoms in 14 (58.3%). All patients received steroids (8 (33.3%) including methylprednisolone bolus) as part of the treatment. Methotrexate was initiated in 3 patients (12.5%) at diagnosis and in 11 (45.8%) between the two PET/CTs. Basal PET/CT showed VS≥2 in 100% of the scans. 20 (83.3%) displayed grade 3 uptake. Vertebral arteries were the most frequently positive vascular territories (12/24) and were the sole arteries exhibiting a VS3 in one-third of the patients (8/24). The follow-up PET/CT was acquired after 281 (249-340.5) days. Twenty-three (95%) patients were in clinical remission, but PET/CT was still showing persistent uptake of at least grade VS2 in 19 (79.2%) patients (63.1% of them with grade 3). We evaluated PETVAS and PETvVAS in both scans and analyzed them based on the presence or absence of clinical relapse (Table 1). ***Conclusion:*** Considering VS≥2, rather than VS=3, as a threshold for positivity increased diagnostic sensitivity from 83% to 100%. The reduction in PETVAS and PETvVAS values remains low even after steroid and methotrexate treatment, correlating poorly with clinical responses, and does not seem to predict disease relapses. Due to frequent and intense vertebral vascular involvement, its incorporation into PETVAS analysis might improve disease activity evaluation and warrants assessment in a larger patient cohort.

OP-305

Extracardiac Findings in Suspected Infective Endocarditis, Added Value of ^{18}F-FDG PET/CT

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Aim/Introduction: To evaluate the usefulness of 18F-FDG PET/CT in the assessment of extracardiac findings and to determine the association of indirect signs of infection/inflammation on ^{18}F-FDG PET/CT, in patients with suspected native valve endocarditis (NVE), prosthetic valve endocarditis (PVE) or cardiac implantable electronic devices (CIED) infection. ***Materials and Methods:*** A retrospective study including patients with suspected NVE or

PVE or CIED infection from April 2019 to January 2022. 18F-FDG PET/CT from head to upper thighs acquisition at 60 min and thoracic delayed acquisition at 120-180 min was performed (10 min/bed), all patients under myocardial suppression. The diagnosis of endocarditis was established by a multidisciplinary team. The presence of extracardiac findings was determined and followed up to establish their significance, classifying them as increased focal or diffuse uptake. Focal findings might be of infectious or tumoral origin among others, whereas bone marrow (BM) and/or spleen diffuse uptake could represent indirect signs of infection/inflammation in this setting. SUVmax was determined in spleen and vertebral body of L2 for BM assessment, classifying as positive those values higher than hepatic SUVmax. ***Results:*** Eighty-five patients were assessed: 34 with NVE, 33 with PVE and 18 with CIED. Infective endocarditis was finally considered definite in 27 patients and 9 patients were diagnosed with CIED infection. Among all patients included, 84% were on antibiotic treatment, initiated an average of 11 days before the 18F-FDG PET/CT scan. Of the 85 subjects included, 21 (24.7%) had inadequate myocardial suppression defined as persistent myocardial uptake greater than blood pool activity, but only 8 (9.4%) of them were not finally assessable. ^{18}F-FDG PET/CT identified 39.4%, 38.2% and 38.9% extracardiac manifestations in NVE, PVE and CIED infection, respectively. The prevalence of bone marrow hypermetabolism was 25.5% (30/85), 22.1% (26/85) in case of splenic hypermetabolism, 12.5% (15/85) of both simultaneously and 48.2% (41/85) in case of splenic and/or BM hypermetabolism. ***Conclusion:*** The use of PET/CT in suspected cases of endocarditis or device infection could help to detect indirect signs of infection to support the diagnosis. It is also useful to identify possible infective foci of unknown or alternative origin.

OP-306

Association between cardiovascular inflammation and alterations in immune system induced by HIV infection detected on ^{18}F-FDG PET/MRI

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Aim/Introduction: Activation of the immune system and inflammation in HIV infection promote the development of comorbidities such as cardiovascular disease. New antiretroviral treatments (ART) aim to control virus replication, but fail to suppress inflammation completely. We aimed to assess biomarkers of HIV-induced inflammation at baseline and 1-year post-ART by means of whole-body ^{18}F-FDG PET/MRI. ***Materials and Methods:*** Prospective study including 14 newly diagnosed asymptomatic HIV patients (90% stage A1-3; 10% stage B). A ^{18}F--FDG PET/MRI (PET/MR 3.0T Signa.GE) was performed at baseline and 1-year post-ART, with patient implementation of a fat-rich diet/carbohydrate restriction for 7 days before procedure. Whole-body PET/MRI: PET emission (3 min./bed), MRI (T1/T2/diffusion sequences). Cardiac MRI (CMR): anatomical and functional sequences: dynamic/native T1 pre-contrast/T2 3Dpost-contrast/4Dflow. Analysis by MN and CMR specialists at baseline and 1-year post-ART: Qualitative vascular assessment in 4 grades as compared to liver reference uptake (Meller et al.). Quantitative assessment (SUVmax) and ratio (liver-reference) of ^{18}F--FDG uptake. Estimation of native T1 and T2 values in 16 myocardial segments. ***Results:*** In three patients (21.4%) baseline CMR showed a decreased left ventricular ejection fraction (LVEF), with normalization post-ART. Native T1 (pre-contrast) values ruled out diffuse fibrosis, and T2 values showed no signs of myocardial edema at baseline or post-ART. All patients (100%) showed adequate myocardial suppression at baseline and post-ART. Four patients (28.6%) showed baseline ^{18}F-FDG vascular uptake (score>3), two in ascending thoracic aorta and two in both ascending and descending thoracic aorta, all disappearing post-ART. All patients (100%) showed baseline lymphadenopathy uptake (ratio>4); supra (n:14) and infradiaphragmatic (n:13), the most frequent location being laterocervical (n:14) and inguinal (n:13), highly variable on number of territories affected (nine patients >6). Seven patients (50%) showed resolution, and the remaining seven a decrease extension (0 patients >5): 7 supra and 2 infradiaphragmatic (5 axillar, 2 inguinal). All 14 patients (100%), with a ratio >4, showed baseline and post-ART persistent adenoid uptake, 9 (64.3%) splenic, all of them resolved post-ART, and 7 (50.5%) gastric, 3 persistent post-ART. ***Conclusion:*** Cardiovascular biomarkers assessed on ^{18}F-FDG PET/MRI showed baseline activity in 28.6% of patients with large vessel uptake and low LVEF in 21.4%, with post-ART normalization. All patients presented with significant lymph node 18F-FDG uptake, with either post-ART normalisation or decreasing extension. All patients showed persistent adenoid uptake post-ART, 64.3% showed splenic uptake with post-ART resolution in all cases, and 21.4% showed gastric uptake with post-ART resolution in 57.1%. ***References:*** JAMA.2012:25; 308(4):379-386.doi:10.1001/jama.2012.6698.

OP-307

Brain metabolic connectivity and neurological symptoms persistence in Long-COVID

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Aim/Introduction: Univariate PET imaging findings reveal acute-phase brain hypometabolism in SARS-CoV-2 patients, particularly in frontal-insular cortex, which improves with recovery. Despite this, prolonged neurological symptoms persist in long-COVID patients. Using multivariate approach, our study delves into comprehensive brain metabolic connectivity in SARS-CoV-2 survivors from acute to chronic phases, aiming to understand the persistence of neurological symptoms in long-COVID patients. ***Materials and Methods:*** Study included 43 pts with neurological symptoms and FDG-PET, divided in two sub-groups for comparative purposes, e.g. the first group of 24 acute-sub-acute patients (7 pts at ≤ 1 m after onset; 4 pts ≥ 1-m, 7 pts ≥ 2-m and 6 pts ≥ 3-m) and second of 19 pts with long-COVID (4 pts ≥ 4-m, 5 pts ≥ 5 m, 3 pts ≥ 6-m, 4 pts ≥ 7-8-m, and 3 pts ≥ 12-m).Brain metabolic connectivity analysis was performed to investigate changes in large scale brain networks (anterior and posterior default mode ADMN, PDMN; executive, ECN; attentive, ATTN; limbic, LIN; anterior salience, SAN) of acute-subacute and long-COVID patients compared with 30 age-matched HCs. Voxel-wise IRCA was applied to derive networks connectivity. Mean ^{18}F-FDG seed uptake for each clinical group was set as variable of interest in multiple regression models, testing for voxel-level correlations with whole brain metabolic activity in different groups (p-uncorrected <0.005, K≥100 voxels FEW corrected at cluster level). Differences in network topography and spatial extension were measured according to Dice similarity coefficient and number of correlated voxels. SPM12 was used to investigate metabolic alterations at group level using statistical comparison between each group and HC. ***Results:*** Acute and

sub-acute showed severe hypometabolism in several cortical regions mainly in fronto-insular cortex that showed progressive reduction during time. At 6-12-m, no brain hypometabolism was detected. In contrast, connectivity analyses revealed significant reduction in resting state networks extension from acute-subacute to long-COVID patients (+ 39% to - 77%). Acute-subacute patients presented with hyperconnectivity in several networks mainly in SAL and ATTN (Dice 0.43), while long-COVID patients presented with hypoconnectivity in ATTN (Dice 0.23) and EXC (Dice 0.29), SAN (Dice 0.32), LIN (Dice 0.35). ***Conclusion:*** Although dysfunction of fronto-insular cortex is confirmed to be transient and reversible, neuro-COVID patients presented with compensatory or pathological phenomena of hyperconnectivity during acute-subacute phase (mainly SAL, ATTN) followed by resting state networks impairment (ATTN, ECN, SAN, LIN) during chronic phase, which likely explains persistence of memory and executive impairment in long-COVID patients.

708

Monday, October 21, 2024, 08:00 - 09:30
Hall G2

Joint Symposium 3 - Neuroimaging Committee / EAN - Image guided Anti-Amyloid Treatment in Alzheimer's Disease

OP-308
Anti-Amyloid Drugs to Treat Alzheimer's Disease

OP-309
PET Imaging in Anti-Amyloid Therapies
S. Morbelli;
University of Torino, Department of Nuclear Medicine, Torino, ITALY.

OP-310
MR Imaging of ARIAs
P. Scheltens;
Amsterdam University, Department of Neurology, Amsterdam, NETHERLANDS.

709

Monday, October 21, 2024, 08:00 - 09:30
Hall F

e-Poster Presentations Session 5: Oncology & Theranostics Committee: Novel Tracer and Oncology Imaging

EPS-085
Preclinical and clinical evaluation of a radiolabeled LNC1010 as a theranostic agent for molecular imaging and therapy in nasopharyngeal carcinomas
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Aim/Introduction: Somatostatin Receptor 2 (SSTR2) targeted radiopharmaceutical 68Ga-DOTATATE has demonstrated potential advantages in preclinical and clinical applications for nasopharyngeal carcinomas (NPC). In this study, we designed a novel SSTR2-targeting vector, denoted as LNC1010, based on DOTATATE with a truncated Evans blue (EB) binding moiety. We optimized the pharmacokinetics of LNC1010 and evaluated its performance in small-animal Positron Emission Tomography (PET) and Single Photon Emission Computed Tomography (SPECT) imaging and PRRT compared to DOTATATE using a SSTR2-positive C666-1 NPC xenograft mice model. Additionally, we also attempted PRRT in an advanced NPC patient with lung metastasis and achieved satisfactory results. ***Materials and Methods:*** The binding characteristic of LNC1010 was assessed in vitro using C666-1 NPC cells. As a targeting vector with potential therapeutic application, we comprehensively evaluated the preclinical pharmacokinetics of 68Ga/177Lu-LNC1010 and 68Ga/177Lu-DOTATATE in C666-1 NPC tumor xenografts using PET and SPECT, as well as biodistribution and PRRT experiments. Furthermore, we conducted 68Ga-DOTATATE PET/CT imaging before and after 177Lu-LNC1010 PRRT and multiple time-point 177Lu-LNC1010 SPECT imaging during treatment in an advanced NPC patient with lung metastasis. These investigations aimed to provide valuable information for the development of more effective SSTR2-targeted radiotracers and their application in PRRT for future advanced NPC treatment. ***Results:*** LNC1010 exhibited higher uptake and specific targeting to C666-1 NPC cells in vitro. In C666-1 NPC tumor xenografts, 68Ga/177Lu-LNC1010 demonstrated higher uptake and longer retention time in PET and SPECT imaging compared to 68Ga/177Lu-DOTATATE, making it a more suitable therapeutic radiopharmaceutical for PRRT application in NPC. Biodistribution studies further confirmed significantly higher tumor uptake of 177Lu-LNC1010 compared to 177Lu-DOTATATE at 4 h post-injection. Compared to 177Lu-DOTATATE, 177Lu-LNC1010 showed greater tumor growth inhibition in C666-1 NPC xenograft mice. In the subsequent translational study, 177Lu-LNC1010 PRRT revealed a great remission of lymph node and lung metastases in advanced NPC, with decreased tumor size and radiotracer uptake in most lesions. ***Conclusion:*** Compared to 177Lu-DOTATATE, 177Lu-LNC1010 demonstrated significantly increased tumor uptake and retention in NPCs, thereby improving the therapeutic efficacy and extending the clinical indication of PRRT, providing a promising treatment option in patients with advanced NPC.

EPS-086
Head-to-head comparison of [68Ga]Ga-DOTA-FAPI-04 and $^{[18F]}$FDG PET/CT for the evaluation of tonsil cancer and lymph node metastases: a single-centre retrospective study
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Aim/Introduction: The aim of this study was to compare the diagnostic value of [68Ga]Ga-DOTA-FAPI-04 and $^{[18F]}$FDG PET/CT imaging for primary lesions and metastatic lymph nodes in patients with tonsil cancer. ***Materials and Methods:*** We retrospectively studied 21 patients with tonsil cancer who underwent [68Ga]Ga-DOTA-FAPI-04 and $^{[18F]}$FDG PET/CT scans within two weeks. The maximum standardised uptake value (SUVmax) and tumour-to-background ratio (TBR) of the two tracers were compared using the Mann-Whitney U test. In addition, we analysed the change in TNM stage of patients and the sensitivity, specificity and accuracy

of metastatic lymph nodes under the two methods of diagnosis. We then further analysed the impact of HPV factors on tracer selection. ***Results:*** A total of 22 primary lesions in 21 patients were examined.68Ga-FAPI detected 20 primary lesions and 18F-FDG detected 9 lesions. [18F]FDG PET/CT showed higher uptake at primary foci than [68Ga]Ga-DOTA-FAPI-04 (P = 0.006). 68Ga-FAPI PET/CT showed higher TBR compared to 18F-FDG[18F]FDG PET/CT (P < 0.001). There was no significant difference in SUVmax and TBR between [68Ga]Ga-DOTA-FAPI-04 and [18F]FDG PET/CT in lymph node analysis (p > 0.05). The specificity and accuracy of [68Ga]Ga-DOTA-FAPI-04 PET/CT were higher than those of [18F]FDG PET/CT in diagnosing metastatic cervical lymph nodes (all P < 0.05). In the T stage assessment, [18F]FDG accurately diagnosed the T stage in 6 patients, while [68Ga]Ga-DOTA-FAPI-04 diagnosed in 15 patients. As for the N stage, the results were similar for [68Ga]Ga-DOTA-FAPI-04 and [18F]FDG (15 versus 14). ***Conclusion:*** This study showed that [68Ga]Ga-DOTA-FAPI-04 can accurately detect primary tumours in patients with tonsil cancer. [68Ga]Ga-DOTA-FAPI-04 may complement [18F]FDG in preoperative cervical lymph node staging.

EPS-087

Applicability of NI-RADS and Hopkins Criteria for Newly Diagnosed Head and Neck Cancers

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Aim/Introduction: NI-RADS and Hopkins-Criteria proposed to be used evaluating head-neck cancer PET-CT imaging to assess recurrence. To guide the surgeon, it is essential to point out metastatic lesions at the neck while staging newly diagnosed patients. The study's objective is to investigate the applicability of NI-RADS and Hopkins criteria on the staging PET-CT images of newly-diagnosed patients. ***Materials and Methods:*** Patients with newly diagnosed head-neck cancer who underwent F^{18}-FDG PET-CT were included. In this retrospective single-center study, the performance of lesion detection of NI-RADS, Hopkins-Criteria, and Expert-Nuclear-Medicine-Physician opinion were confirmed with pathology results of extensive neck dissection. Patient-based and lesion-based analysis were done. NI-RADS >2, Hopkins >3 lesions accepted as metastatic. ***Results:*** Thirty-two patients (F/M: 11/21) were included in the study. The mean age was 59.5(±2.7) years. The primary site was at the oral-cavity in eleven, lips in nine, other types of origin in twelve patients. Most of the lesions were SCC(29, 91%). Eleven(34%) were well-differentiated, fourteen(43%) were moderately-differentiated, and four were poorly-differentiated cancer(n:29). Local invasive disease was seen in 27/32. Mean primary-lesion-short-axis was 27.5(±3.5) cm, and mean SUVmax was 11.3(±1). A total of 1260 lymph nodes(LN) were dissected, and per-patient mean dissected-LN was 39(±4). Fourteen patients(44%) had biopsy-proven metastatic cervical-LN(s). Total 89 LN (30 level-I, 34 Level-II, 20 Level-III, 5-others) were addressed at PET-CT and 73(82% of the addressed and 6% of the total) LN diagnosed as metastatic (median size and SUVmax were 11(4-31) mm and 7.3(1-14) respectively). For addressed LN 56(63%), 60(67%), 66(74%) of them evaluated as metastatic according to NI-RADS, Hopkins and expert-opinion respectively. Sensitivity, specificity, negative-predictive-value, positive-predictive-value, kappa-correlations and AUC-values of ROC-analysis were; 71.2%, 75%, 0.327 (p<0.01), 36.3%, 92.9% and 0.731 for NI-RADS; were 75.3%, 68.7%, 37.9%, 91.7%, 0.335 (p<0.01) and 0.720 for Hopkins; 83.6%, 68.8%, 47.8, 92.4%, 0.447 (p<0.01) and 0.762 for expert-opinion, for the PET-CT-addressed LN respectively. NI-RADS and Hopkins methods were strongly correlated with expert opinion (Pearson-correlations: 0.853 and 0.798, p<0.01 respectively). Best pathology-"evaluation-method" correlation found with expert opinion (0.458, p<0.05). Expert opinion strong-moderately correlated with size (0.680, p<00.1), SUVmax(0.763, p<0.01), absence-of-hilus (0.544, p<0.01), irregular margins, necrosis. Metastasis-status moderately-correlated with LN's size, SUVmax, absence-of-hilus (0.420, p<0.01). No-correlation observed between primary-tumor-features mentioned above. ***Conclusion:*** Performance of NI-RADS and Hopkins-Criteria for LN-evaluation are comparable with expert-opinion and can be used for staging head-neck cancer patients for standardization of reporting. LN size, SUVmax and also absence-of-hilus may be incorporated in the referred methods.

EPS-088

Head-to-Head Comparison of ^{68}Ga-DOTATATE and ^{18}F-FDG PET in EBV-positive nonkeratinizing Nasopharyngeal Carcinoma

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Aim/Introduction: Head-to-Head comparison of the diagnostic efficacy and prognosis predictive value of 68Ga-DOTATATE and 18F-FDG PET in patients with EBV-positive nonkeratinized NPC. ***Materials and Methods:*** Patients meeting the inclusion criteria underwent 18F-FDG and 68Ga-DOTATATE whole-body PET within one week prior to any treatment. ***Results:*** (1)68Ga-DOTATATE PET demonstrated a comparable detection rate to 18F-FDG PET in visualising primary tumors, and both are 100% (26/26). The 18F-FDG uptake was significantly higher than the 68Ga-DOTATATE uptake in primary NPC tumors (median SUVmax:15.00 vs.9.73, P =0.001). The skull base extension from NPC could be clearly visualised on 68Ga-DOTATATE PET at a detection rate of 100% (12/12) and which was higher than 91.7% (11/12) of 18F-FDG PET. Among the primary tumor volumes delineated with different thresholds of 68Ga-DOTATATE PET and 18F-FDG PET, the delineation volume of 68Ga-DOTATATE 35% SUVmax as threshold had the highest credibility and consistency level with the volume measured by enhanced MRI (6.62cm3 vs. 5.80cm3, ICC:0.96, P<0.001).68Ga-DOTATATE PET and 18FDG PET showed 101/108(93.5%) and 103/108(95.4%) regional lymph nodes metastases, respectively(P=0.552), and 18F-FDG demonstrated significantly higher uptake than 68Ga-DOTATATE (median SUVmax:10.81 vs 6.05, P<0.001). Furthermore,54/92(58.7%) and 89/92(96.7%) distant metastases were detected by 18F-FDG and 68Ga-DOTATATE PET, separately(P<0.001), and 68Ga-DOTATATE can detect more tiny bone metastases. There was no difference in 68Ga-DOTATATE and 18F-FDG uptake in overall distant metastases, with a median SUVmax of 5.41 vs. 5.24 (P=0.324). There were 4 (15.4%), 8 (9.0%) and 11 (10.7%) lesions TLR of 68Ga-DOTATATE uptake in in primary tumors, regional lymph nodes metastases and distant metastases higher than 2, respectively. (2) Plasma EBV DNA was positively correlated with total MTV, total TLG, total SRETV and total TLSRE.(3) Patients with TLG > 192.0g , maximum DOTATATE SUVmax>14.5,total SRETV>33.8 cm3,and total TLSRE>191.2 g had significantly shorter PFS. ***Conclusion:*** (1)68Ga-DOTATATE PET/CT is a promising imaging modality for detecting primary and metastatic NPC, with favourable image contrast and diagnostic efficacy comparable to that of 18F-FDG

PET. (2) The delineation volume of 68Ga-DOTATATE 35%SUVmax as thresholds had the highest credibility and consistency level with the volume measured by enhanced MRI. (3) Plasma EBV DNA was positively correlated with total MTV, total TLG, total SRETV and total TLSRE. (4) Both 18F-FDG and 68Ga-DOTATATE PET parameters had predictive value for response evaluation and PFS in NPC patients.

EPS-089

Predictive value of neck imaging reporting and data system (NI-RADS) in surveillance of head and neck Squamous Cell Carcinoma (SCC) using FDG PET/CTPredictive value of neck imaging reporting and data system (NI-RADS) in surveillance of head and neck Squamous Cell Carcinoma (SCC) using FDG PET/CT

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Aim/Introduction: Neck Imaging Reporting and Data System (NI-RADS) offers a standardised approach for patient management. FDG PET/CT is a valuable tool in the surveillance of SCC due to its ability to detect metabolic activity indicative of disease. The aim of this study is to investigate the predictive value of NIRADS for the surveillance of patients with head and neck SCC using FDG PET/CT. ***Materials and Methods:*** This retrospective study included 120 patients with head and neck squamous cell carcinoma who were treated with curative intent with surgery, chemotherapy, radiation therapy, or their combination. Patients underwent PET/CT scanning 3 months after the curative treatment. NI-RADS scoring was performed for the primary site as well as regional lymph nodal sites. Distant metastases evaluation was also done on the whole-body PET/CT images. Patients were segregated into different NI-RADS categories on first surveillance FDG PET/CT and were subsequently followed up clinically, with subsequent imaging (PET/CT or MRI), USG neck (for nodal recurrence) or biopsy as indicated. Changes in the NIRAD scoring on subsequent follow-up scans was documented. Recurrence free survival was estimated for this cohort. ***Results:*** We observed a positive correlation between the depth of invasion (DOI), size and disease recurrence with the Pearson correlation coefficient (r) of 0.3 (P-value=0.1). There was a positive correlation between lymph nodes with NIRADS score in regional neck nodes. Univariate association analysis demonstrated a strong association between the NI-RADS score and ultimate disease recurrence, with P < .001 for primary and regional sites. The rate of tumour recurrence was significantly different among the NIRADS 1-2a, 2b-3 and 4 categories and the recurrence rate was higher for higher NIRADS scores at first imaging. The overall negative predictive value (NPV) of the NI-RADS 1-2 was 90%. 90% patients with NIRADS score of 1-2a on first surveillance PET scans showed no recurrence at 2 years whereas 65% of patients with NIRADS score of 2b-3 had no recurrence during 2 year follow-up. Patients with NIRADS score of 4 in the first surveillance PET scan demonstrated a 2 year recurrence free survival in only 35% of patients. ***Conclusion:*** NI-RADS scoring system using FDG PET/CT can be reliably used to predict disease recurrence in patients with head and neck squamous cell carcinoma treated with curative intent. ***References:*** Wangaryattawanich et al. AJNR, 2018. Abdelrahman et al. Egyptian Journal of Radiology and Nuclear Medicine, 2020.

EPS-090

Can pretherapeutic 2-[18F]FDG-PET/CT texture analysis predict prognosis of head and neck tumor patients?

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Aim/Introduction: There is evidence that results of a texture analysis of 2-[18F]FDG-PET/CT (FDG-PET/CT) is associated with patient outcome in several cancers [1]. The aim of this study was to investigate if textural parameters extracted from a pretherapeutic FDG-PET/CT might be predictive for the prognosis of head and neck tumor patients. ***Materials and Methods:*** Thirty-two patients (mean age: 66.1 ± 10,6 y; 27 male, 5 female) with head and neck tumors underwent FDG PET/CT before cancer treatment. Known prognostic factors for head and neck cancer (age, gender, smoking, alcohol, primary tumor location and size, pretherapeutic staging parameters) were recorded. Quantitative PET-parameter like metabolic tumoral volume (MTV), SUVmax SUVmean, total lesion glycolysis (TLG), and also textural features (e g. asphericity, sphericity, entropy levels) were extracted for each lesion using the software LifeX [2]. We performed univariate and multivariate analysis for overall survival (OS) and progression free survival (PFS) using Kaplan-Meier analysis and Cox-proportional hazards model. ***Results:*** Mean follow-up duration was 22.3 months for the entire cohort and 26.2 months for the surviving patients. In the univariate analysis tumor size, MTV, asphericity, TLG, sum entropy were significantly associated with OS. In the multivariate analysis, asphericity was an independent prognostic factor for OS (p = 0.006, HR = 14.22) ***Conclusion:*** In our study, asphericity was independently associated with poor overall survival. Thus, textural analysis of pretherapeutic FDG PET/CT in head and neck cancer patients could be helpful for patient-specific risk stratification for tumor treatment and post-therapeutic follow-up. For instance, a more individualized follow-up might be determined based on individual risk. ***References:*** 1. Gillies R et al (2016). Radiology, 278(2), 563-577.2. Nioche C,et al. (2018). Cancer Res, 78(16), 4786-4789.

EPS-091

The Selection of Reference Region for PET-CT with ^{18}F-FET Evaluation of the Pons in Children

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Aim/Introduction: The aim of the study was to assess the relative distribution of uptake radiolabelled amino acids in the posterior cranial fossa structures in children with a normal brain to select optimal reference region to brainstem lesion analysis. ***Materials and Methods:*** For retrospective analysis 30 children (aged 3-16 years) examined by PET-FET were selected. Entry criteria included untreated children with normal brainstem and cerebellum. Pons-to-cerebellum ratio (PCR) and pons-to-frontal cortex ratio (PFR) were analysed. For each ratio, six calculation methods were used, depending on the size of the region of interest (ROI) and the SUV statistics (maximum, mean, peak SUV in the 10 mm ROI or mean SUV in the banana-shaped ROI). ***Results:*** The FET uptake in the pons and cerebellum was significantly higher than in the frontal cortex in both groups, regardless of the measurement method used (p<0.05). The PCR showed no significant differences PET-FET scans (p>0,05).

Conclusion: The results allow us to recommend the cerebellum as a reference structure in the analysis of PET-FET in children with brainstem lesions.

EPS-092

^{18}F-FDG PET-CT features of cervical carcinoma of unknown primary in 192 patients

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Aim/Introduction: To investigate the value of 18F-FDG PET-CT in CCUP patients with cervical lymphadenopathy as the primary sign. ***Materials and Methods:*** A total of 192 consecutive patients who underwent 18F-FDG PET-CT scan with swollen lymph nodes in the neck as the first sign from January 2019 to October 2022 were retrospectively analyzed (141 males, 49 females, age range 15-79 (53.96±13.05) years). The pathological diagnosis or long-term clinical follow-up(≥6 months) were the golden diagnosis. The diagnostic sensitivity, specificity, accuracy, positive predictive value and negative predictive value of PET-CT were calculated. Pearson correlation coefficient was employed to analyze the relationship between the SUVmax of the primary tumor and cervical lymph node metastasis, and independent sample t test was used to analyze the relationship between the SUVmax of different pathological types of cervical metastasis. ***Results:*** Primary tumors were confirmed in 147 patients, among which head and neck tumors were the most common etiology in this study, accounting for 76.2% (112/147). The diagnostic sensitivity, specificity, accuracy, positive predictive value and negative predictive value were 97.3%(147/151),68.2%(28/41),91.1%(175/192),91.8%(147/160)and 87.5%(28/32), respectively. There was no significant correlation between the SUVmax of primary lesions and cervical metastases(P>0.05) . There was no significant difference in SUVmax between adenocarcinoma and squamous cell carcinoma(P>0.05). The detection rate of primary lesions in patients with squamous cell carcinoma of metastatic cervical lymph node is higher than that in patients with adenocarcinoma(x2=4.712, P<0.05). Patients with the primary tumor on the right side often have right cervical lymph node metastasis, and vice versa. When the primary tumor involves both sides, bilateral cervical lymph node would be involved. In cases where the primary tumor was located in high-level neck, cervical metastases were often located in the upper and middle cervical, and vice versa. ***Conclusion:*** 18F-FDG PET-CT plays a crucial role in detecting the primary tumor of CCUP. The specific distribution and SUVmax of cervical metastases can shed a light on finding the primary tumor especially when it is unclear.

EPS-093

Detection of malignancy in paraneoplastic neurological syndromes - do we need ^{18F}PET/CT or is conventional CT sufficient?

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Aim/Introduction: ^{18F}Fluorodeoxyglucose (FDG) - positron emission tomography (PET)/computed tomography (CT) has proven to be an exceptional diagnostic tool in oncology, providing functional as well as morphological information. Conventional CT, on the other hand, is limited to morphological imaging, but is less expensive, less time consuming and has better availability. Our goal was therefore to evaluate the suitability of ^{18F}FDG-PET/CT compared to conventional CT for the detection or exclusion of malignancy in paraneoplastic neurological syndromes (PNS). ***Materials and Methods:*** In our ongoing retrospective analysis we so far evaluated a total of 447 patients with PNS who underwent ^{18F}FDG-PET with diagnostic contrast enhanced CT in our department between March 2013 and March 2024. PET/CT scans were classified as positive or negative for malignancy based on PET/CT reports and the results were validated by either imaging or long-term clinical follow-up. In a second step, only the CT component of a subcohort was independently read by two radiologists with 3 years of experience, blinded to the PET/CT results and also classified as positive or negative for malignancy. Sensitivity, specificity, positive and negative predictive values (PPV and NPV) as well as accuracy were calculated for PET/CT and conventional CT, respectively. ***Results:*** The prevalence of malignancy in our cohort of PNS patients was 7.61%. 69 PET/CTs (28 with and 41 without malignancy) were selected for the separate reading of their CT component. Of the ^{18F}FDG-PET/CTs, 32 were true positive, 12 false positive, 401 true negative, and two false negative, while conventional CT yielded 36 true positives, six false positives, 76 true negatives and 20 false negatives. Sensitivity, specificity, PPV, NPV and accuracy for ^{18F}FDG-PET/CT/conventional CT were 0.94/0.64, 0.97/0.93, 0.73/0.86, 0.99/0.79 and 0.97/0.81, respectively. ***Conclusion:*** The preliminary results from our retrospective analysis suggest the superiority of ^{18F}FDG-PET/CT for malignancy screening in paraneoplastic neurological syndromes, but conventional CT may be an alternative in cases where the former is not available. Further evaluation with a larger CT cohort to validate these observations and a cost-effectiveness analysis will follow.

EPS-094

Relationship Of Pet/Ct Data And Histopathologic Findings In Patients With Unknown Primary Cancer With Isolated Brain Mass

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Aim/Introduction: Cancer of unknown origin (CUP) is a condition where the primary site of cancer cannot be determined despite thorough investigation. Brain masses are one of the common presentations of CUP. Identifying the primary lesion and other metastases is crucial in determining the appropriate treatment. We studied the relationship between PET/CT data and pathology results in CUP patients with brain masses. ***Materials and Methods:*** Images of 55 patients who underwent FDG imaging with this indication were evaluated. FDG avid lesions, metabolic PET parameters and histopathological diagnoses were recorded. In those with more than one suspicious focus on FDG-PET/CT, the lesions with the highest SUVmax were considered the dominant focus. ***Results:*** After correlating with histopathology, it was discovered that the primary focus was on the lung in 35 patients, the brain in 15 patients, and other regions in 5 patients (Table1). PET/CT scan showed the same focus as the histopathological diagnosis in 48 patients (87.2%). The most common site for lymph node metastasis was the paratracheal station. The most common histopathological subtype in the primary lung group was adenocarcinoma. The mean SUVmax value of primary and brain lesions was higher in women compared to men. When the groups were changed to lung, brain and others, higher age values were

found in the lung category(63) than in the brain category(55). The mean SUVmax values of dominant metastases were significantly lower in the lung group than in the others group. No metastasis was detected in the group with a primary brain tumor. The mean values of brain lesion/normal cortex were lower in the lung and brain groups than in the others group. ***Conclusion:*** Among occult cancers for which PET/CT is performed with an isolated brain mass, the most common clinical diagnosis is lung cancer, especially adenocarcinoma. FDG-PET/CT scans are very accurate and sensitive in detecting lung cancer and its metastases. Additionally, FDG-PET/CT can help determine whether an isolated brain mass is a primary brain tumor with 98% sensitivity and 67% specificity despite strong FDG uptake in the cerebral cortex. Therefore, in cases where an FDG PET/CT study is performed due to an isolated brain mass, if an FDG avid primary focus cannot be detected throughout the body, it should be kept in mind that this may be due to the low FDG uptake of the primary focus, or it may be because the brain lesion is the actual primary focus.

EPS-095

Predicting pathological complete response after neoadjuvant immunochemotherapy and radiation therapy in locally advanced rectal cancer with ^{68}Ga-FAPI PET, ^{18}F-FDG PET and contrast-enhanced MRI: A lesion to lesion comparison with histopathology

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Aim/Introduction: Neoadjuvant therapy in patients with locally advanced rectal cancer (LARC) has achieved good pathologic complete response (pCR) rates, potentially eliminating the need for surgical intervention. This study investigated preoperative methods for predicting pCR following neoadjuvant short-course radiotherapy (SCRT) combined with immunochemotherapy. ***Materials and Methods:*** Treatment-naïve participants with histologically confirmed LARC were enrolled from February, 2023 to July, 2023. Before surgery, the participants received neoadjuvant SCRT followed by two cycles of capecitabine and oxaliplatin plus camrelizumab. 68Ga-labeled fibroblast activation protein inhibitor (68Ga-FAPI) PET/MR, 18F-FDG PET/CT and contrast-enhanced MRI were performed before treatment initiation and before surgery in each participant. PET parameters, morphological and MR imaging features, the size and number of lesions were also collected from each scan. Each parameter's sensitivity, specificity, and diagnostic cutoff were derived via ROC curve analysis. ***Results:*** A total of 25 eligible participants were enrolled (18 men, 7 women; mean age, 58.8 years), and all participants had microsatellite instability-high/deficient mismatch repair LARC. The postoperative pathology illustrated pCR was achieved in 9 of 20 participants (45.0%). In the visual evaluation, both 18F-FDG and 68Ga-FAPI PET were limited to forecasting pCR. Contrast-enhanced MRI had a high rate of missed diagnosis with a sensitivity of 55.56%. In the quantitative evaluation, ΔFAPI-SULpeak% had the largest area under the curve (0.93) with high specificity (sensitivity=77.78%, specificity=100.0%, cutoff=63.92%). A combination named ΔFAPI-SULpeak% or contrast-enhanced MRI improved the sensitivity to 88.89% while retaining a high specificity of 100.0% in this set of participants. ***Conclusion:*** 68Ga-FAPI PET is a promising imaging modality for predicting pCR following SCRT combined with immunochemotherapy. The combination named ΔFAPI-SULpeak% or contrast-enhanced MRI may provide the guidance in selecting patients who can forgo surgery after neoadjuvant therapy.

EPS-096

OneStop ^{68}GaFAPI04/^{18}F-FDG Dual-Low Activity TotalBody PET/CT Scan: More Theranostics Information Available

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Aim/Introduction: 68Ga-fibroblast activation protein inhibitor (FAPI) probes have demonstrated promising complementary values to 2-18F-fluoro-2-deoxy-D-glucose (18F-FDG) in positron emission tomography/computed tomography (PET/CT) for tumor imaging, and hold significant value in theranostics. This study aims to explore the feasibility of a new one-stop 68Ga-FAPI-04/18F-FDG dual-low activity imaging protocol, providing more diagnostic and therapeutic information for oncological applications. ***Materials and Methods:*** We prospectively enrolled 40 patients with eight types of tumors confirmed by pathology. All patients underwent a one-stop 68Ga-FAPI-04 (0.925 MBq/kg) PET (PETFAPI) followed by an additional 18F-FDG (1.85 MBq/kg) injection for a 60 min dynamic acquisition (PETDUAL), with a single diagnostic CT to generate the PET/CT. PETDUAL was reconstructed at 10 min intervals (PETD0-10, PETD10-20, PETD20-30, PETD30-40, PETD40-50, PETD50-60). Lesion detectability and target-to-background ratios (TBRs) for tumors and metastatic lesions were analyzed using both single and dual-tracer PET/CT. The period from 30 to 60 min was then segmented into 5 min intervals for further evaluation (PETD30-35, PETD35-40, PETD40-45, PETD45-50, PETD50-55, PETD55-60). PETD50-60 and PETD55-60 were considered the references in each group. ***Results:*** Compared to the single 68Ga-FAPI-04 PET/CT, the dual-tracer PET/CT showed similar performance in detecting primary tumors (41 vs. 42, $P > 0.999$), whereas TBRs were significantly higher in PETFAPI ($P > 0.05$). Notably, more metastases were identified in PETD50-60 than in PETFAPI (95 vs. 50, $P < 0.001$). One poorly-differentiated gastric tumor (15% signet ring cell) , 42 suspected lymph nodes, two peritoneal metastases, and one liver metastasis were detected on PETDUAL but not identified on PETFAPI. In images reconstructed over 10 min intervals, the lesion detection rate showed no significant differences among PETD10-20, PETD20-30, PETD30-40, PETD40-50, and PETD50-60 (all $P>0.05$). Both PETD30-40 and PETD40-50 detected all lesions identified in PETD50-60, and there were no significant differences in the TBRs between PETD40-50 and PETD50-60 ($P > 0.05$). In images reconstructed over 5 min intervals from 30 to 60 min, the lesion detection rate did not differ significantly among these images ($P > 0.05$). The TBRs for primary lesions in PETD40-45, PETD45-50, and PETD50-55, as well as for metastatic lesions in PETD50-55 showed no significant differences compared to PETD55-60 ($P > 0.05$). ***Conclusion:*** The one-stop dual-tracer dual-low activity PET imaging protocol demonstrated greater lesion detectability and provided additional theranostics information, while reducing radiation exposure and shortening duration.

EPS-097

Whole body bone scan or multifield-bone SPECT/CT in the assessment of metastases in oncological patients

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Aim/Introduction: To analyse the agreement between whole body scan (WBS) and multifield SPECT/CT for the detection of blastic bone metastases in oncological patients. ***Materials and Methods:*** A retrospective study including consecutive oncology patients (p) referred for screening of metastatic bone involvement (October/2023-April/2024).Planar images of WBS (anterior and posterior views) and SPECT/CT images (from vertex to the upper third of the lower limbs) were acquired.Two Nuclear medicine physicians assessed the images randomly and blindly without access to clinical information or results of any other techniques reports. Location, skeletal involvement (oligometastatic [≤ 5 lesions] or polymetastatic [>5]), and the presence of a "superscan" pattern were assessed, analysing if new lesions were found in SPECT/CT vs. WBS. Additionally, the agreement between both techniques was evaluated using Cohen's Kappa coefficient (k). ***Results:*** Seventy-six patients (17 women) were evaluated, median age 70 years (42-90); 58/76p (76.3%) with prostate cancer, 15/76p (19.7%) with breast cancer, and 3/76p (3.91%) with other tumours (digestive or lymphomas). WBS showed suspicious lesions in 17/76p (22.4%), while SPECT/CT did it in 16/76p (21.1%). The agreement between both techniques was almost perfect (k=0.883; p<0.001). Furthermore, WBS showed polymetastatic involvement in 47.1% of patients (8/17p), while SPECT/CT did so in 58.8% (10/17p). The agreement between both techniques in distinguishing between oligometastatic and polymetastatic bone disease was substantial (k=0.750, p=0.02).SPECT/CT changed the therapeutic management in 5 patients (29.4%): 3/5p shifted from oligo to polymetastatic involvement, and 2 false positive of WBS (with 2 suspicious foci on WBS corresponding to benign findings in SPECT/CT). ***Conclusion:*** Despite the small size of the sample, the results suggest that the systematic incorporation of multifield bone SPECT/CT instead of WBS for osteoblastic metastases screening could lead to a change in the management in a significant percentage of oncological patients.

EPS-098

First-in-human study of a novel bifunctional PET tracer ^{68}Ga-DOTA-NI-FAPI-04 with FAPI and hypoxia-sensitive moieties

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Aim/Introduction: Fibroblast activation protein (FAP) is highly expressed in cancer-associated fibroblasts (CAFs). However, the objective response rate of targeted FAP radionuclide therapy was relatively low, suggesting that insufficient uptake of FAP inhibitor agents in tumor tissues and radio-resistance caused by tumor hypoxia. To improve this situation a novel bifunctional radiotracer, 68Ga-DOTA-NI-FAPI-04, containing FAP targeting moiety together with a hypoxia-sensitive 2-nitroimidazole (NI) group was developed. Preclinical studies have demonstrated that 68Ga-DOTA-NI-FAPI-04 exhibited favorable tumor binding affinity and improved tumor uptake and retention compared with 68Ga-DOTA-FAPI-04 without the NI group. This study explores the clinical application of 68Ga-DOTA-NI-FAPI-04 as well as comparison with 68Ga-DOTA-FAPI-04 and 68Ga-FAP-2286. ***Materials and Methods:*** Twelve patients with 5 different types of cancer underwent 68Ga-DOTA-NI-FAPI-04 PET/CT for initial study. For comparison, 9 patients underwent paired 68Ga-DOTA-NI-FAPI-04 and 68Ga-DOTA-FAPI-04 PET/CT and 3 patients underwent paired 68Ga-DOTA-NI-FAPI-04 and 68Ga-FAP-2286 PET/CT, respectively. Among of them, six patients underwent serial dynamic PET scans for 68Ga-DOTA-NI-FAPI-04 for dosimetry evaluation, and the others underwent scans at 60 and 120 min. Standardized uptake values (SUV) were measured for semi-quantitative comparison. ***Results:*** Biodistribution of 68Ga-DOTA-NI-FAPI-04 in humans showed uptakes in thyroid glands, pancreas, salivary glands, kidneys, heart content, spleen, liver, muscle, and urinary bladder. SUVmean values of normal organs decreased in all patients over time, except for the bladder. The highest average SUVmean was observed in the thyroid glands, decreasing from 12.3 at 3 min to 3.7 by 120 min (a decline of 69.9%). Tracer uptake in the tumor showed rapid and steady vales (Avg. SUVmax of 11.5, 12.7, 12.9, 13.0 and 12.8 at 3, 15, 30, 60 and 120 min, respectively). The lesions were clearly visualized by 15-min, and the detection of tumor improved at the 60 and 120 min. The uptake of 68Ga-DOTA-NI-FAPI-04 was significantly higher than that of 68Ga-DOTA-FAPI-04 and 68Ga-FAP-2286 (68Ga-DOTA-NI-FAPI-04 vs. 68Ga-DOTA-FAPI-04: 15.30±8.71 vs. 10.20±5.29 at 60 min, 14.07±7.58 vs. 10.20±3.79 at 120 min; 68Ga-DOTA-NI-FAPI-04 vs. 68Ga-FAP-2286: 14.51±4.88 vs. 10.83±4.54 at 60 min, 15.04±4.68 vs. 11.88±4.14 at 120 min, respectively, P value < 0.05). 68Ga-DOTA-NI-FAPI-04 provided a superior lesion detection in cancer patients. ***Conclusion:*** A bifunctional PET tracer, 68Ga-DOTA-NI-FAPI-04, showed significantly improved tumor uptake and retention than 68Ga-DOTA-FAPI-04 and 68Ga-FAP-2286, suggesting that hypoxia-sensitive moiety (nitroimidazole, NI) may play an important role. Further study of 68Ga-DOTA-NI-FAPI-04 in humans is warranted to explore the physiological mechanisms and clinical applications.

EPS-099

Value of ^{18}F-FAZA dynamic PET compared to intravoxel incoherent motion magnetic resonance imaging in sarcoma patients

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Aim/Introduction: To correlate dynamic parameters derived from 18F-FAZA PET with MRI-assessed intravoxel incoherent motion (IVIM) in soft-tissue sarcoma. ***Materials and Methods:*** In this REB-approved retrospective study, we included 20 patients with non-metastatic high-risk (grade 2+) soft-tissue sarcoma patients who underwent simultaneous 18F-FAZA PET and MRI. 18F-FAZA PET/MRI was performed with 5 MBq/kg of 18F-FAZA. Dynamic PET imaging was initiated simultaneously with injection and was acquired for 20 minutes. 2D echo-planner IVIM sequence was also acquired with multiple b-values. The tumour was contoured on the MRI component. IVIM maps were calculated, including true diffusion coefficient (D), pseudo-diffusion coefficient (D*), and perfusion fraction (f). On the dynamic PET images, 18F-FAZA kinetic parameters, including k1, k2, k3, k4, and vt, were extracted from the same segmentations. K1 (ml/cm3/min) was defined as the rate constant of perfusion from blood to tissue, k2 (min-1) the rate constant representing transport from interstitium to blood, k3 (min-1) the tracer accumulation rate constant in the tissue, k4 (min-1) the dissociation rate constant (de-phosphatization) of accumulated 18F-FAZA, and vt (mL·cm−3) 18F-FAZA total volume distribution. Additionally, k1/k2 was calculated, representing

perfusion-to-transport ratio. Spearman's rank correlation was performed to assess the relationship between the studied parameters. P-values <0.05 were considered statistically significant. ***Results:*** In this population (mean age= 58; male%= 90%), all tumor were located in the limbs or thorax. Average values for k1, k2, k3, k4, vt, D, D*, and f were 0.34 ±0.31, 0.64 ±0.60, 0.46 ±0.41, 0.0.79 ±0.64, 1.72 ±0.71, 123.123.41 ±33.38, 1488.65 ±415.81, and 158.32 ±32.93. k1/k2 and vt were correlated with f (rs= -0.588 and rs= -0.624; p=0.017 and p=0.010, respectively) and vt correlated with D* (rs= -0.49; p=0.05). Other dynamic parameters showed no correlations with IVIM values, though some trended in the plotted figures. ***Conclusion:*** Dynamic PET-based kinetic parameters correlated with perfusion parameters derived from IVIM MRI. Thus, adding early dynamic PET to the 18F-FAZA PET protocol may provide information regarding tissue perfusion.

EPS-100

Radiomics based on 2-[18F]FDG PET/CT can differentiate non-metastatic gallbladder cancer and cholecystitis

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Aim/Introduction: Gallbladder cancer (GBC) is the most common malignant tumor of the biliary tract worldwide and most patients are diagnosed in the late stage of gallbladder cancer. However, clinical symptoms of GBC and cholecystitis may present similarities, and there are no specific laboratory tests available to distinguish between GBC and cholecystitis. In addition, some imaging examination appearances exhibited by GBC may also be similar to cholecystitis. The accurate differential diagnosis between GBC and cholecystitis poses a significant clinical challenge, as it directly impacts the treatment and prognosis of patients. The aim of this study is to develop and validate radiomics based on 2-[18F]fluoro-D-glucose positron emission tomography (2-[18F]FDG PET/CT) parameters for differentiating between non-metastatic gallbladder cancer (GBC) and cholecystitis. ***Materials and Methods:*** A total of 108 patients with non-metastatic GBC and 33 patients with cholecystitis confirmed by pathological examination were included in our study. The patients were allocated into a training group and a testing group in a ratio of 7:3. The radiomics features extracted from 2-[18F]FDG PET/CT were subjected to analysis, with the utilization of the mRMR and LASSO regression algorithm for data dimension reduction. The clinical, radiomics and combined models were constructed. The receiver operating characteristic (ROC) curve and decision curve were plotted to assess the differentiating performance and the diagnostic performance measures were assessed by sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV). The DeLong test was used to compare the ROC curves of the combined model, radiomic model and clinical model in both groups. ***Results:*** The area under curve (AUC) of the clinical model and radiomics model was 0.754 (sensitivity=0.513, specificity=0.917) and 0.940 (sensitivity=0.882, specificity=0.875) in the training group, respectively; 0.691 (sensitivity=0.938, specificity=0.333) and 0.906 (sensitivity=0.781, specificity=1.000) in the testing group, respectively. In combined models, the AUC was 0.964, the sensitivity was 0.781 and the specificity was 1.000 in the training group; the AUC was 0.938, the sensitivity was 0.908 and the specificity was 0.958 in the texting group. ***Conclusion:*** The radiomics based on 2-[18F]FDG PET/CT could effectively distinguish non-metastatic GBC from cholecystitis; combining radiomics and clinical variables could more effectively differentiate non-metastatic GBC from cholecystitis. The combined prediction model can serve as potential decision support tools and avoid more patients receiving unnecessary treatment.

EPS-101

Can tumor-to-liver (T/L) ratio predict progression free survival in patients with post-chemotherapy seminoma residual

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Aim/Introduction: To predict progression free survival using tumor-to-liver ratio in patients with residual seminomatous disease post-chemotherapy. ***Materials and Methods:*** Patients with a residual mass of ≥3cm on post chemotherapy FDG PET/CT scan were included in the study. The ratio of SUVmax for the lesion to that of the normal liver which is the tumor-to-liver ratio was calculated for each patient. An ROC plot of the T/L ratio was made to get an optimum cut-off value. For determining the progression free survival (PFS), the duration from date of FDG PET/CT scan to the date of last follow-up/progression was calculated. The T/L ratio cut-off value was then used to study the difference in PFS between the 2 groups using the Kaplan-Meier analysis and the p-value obtained from log-rank test. ***Results:*** 49 male patients with were included in the study. All patients had their FDG PET/CT scan done between 8-12 weeks of chemotherapy. Lesions were ≥3cm. SUVmax for the residual lesion and the normal liver was determined which was used for calculation of T/L ratio. The ROC plot of T/L ratio had an AUC of 87.9%. The maximum Youden's index was 0.795, at which the T/L ratio cut-off was 1.21. 23 patients had T/L ratio ≤1.21 and this group had only 1 event. Whereas, 26 patients had T/L ratio >1.21 with 7 events. The p value is 0.037. Since the total no-of events was less than 50%, median PFS was not reached. ***Conclusion:*** The residual masses in seminoma post chemotherapy might just harbor non-viable fibrotic tissue and thus T/L ratio is a very robust method to determine viable disease in such masses. Majority of the events occurred when the T/L ratio was >1.21. Thus, this cut-off value can be utilized to determine the viability in residual seminomatous diseases and also be an added prognostic factor. ***References:*** 1. Ghosh, Suchismita; et al. Evaluation of post-chemotherapy residual seminomatous masses by [18]F-fluorodeoxyglucose PET/CT using tumor-to-liver ratio - conundrum or solution? Nuclear Medicine Communications 44(12):p 1156-1162, December 2023. | DOI: 10.1097/MNM.0000000000001762 2. De Santis M, et al. 2-18fluoro-deoxy-D-glucose Positron Emission Tomography Is a Reliable Predictor for Viable Tumor in Post chemotherapy Seminoma: An Update of the Prospective Multicentric SEMPET Trial. JCO. 2004 Mar 15;22(6):1034-9.

EPS-102

[68Ga]Ga-FAPI-04 PET/MR imaging strategy for Krukenberg tumours from gastric signet-ring-cell carcinoma

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Aim/Introduction: To compare performance of whole-body [68Ga]Ga-FAPI-04 and [18F]FDG PET imaging in the detection of Krukenberg tumors (KTs), primary site and extra-ovarian metastases of gastric signet-ring-cell carcinoma (GSRCC), and evaluate the value of [68Ga]Ga-FAPI-04 PET/MR imaging strategy in the assessment of KTs from GSRCC. ***Materials and Methods:*** Twelve patients with twenty-three KTs from GSRCC, who underwent both [68Ga]Ga-FAPI-04 pelvic PET/MR and whole-body [68Ga]Ga-FAPI-04 and [18F]FDG PET imaging were retrospectively analyzed. [68Ga]Ga-FAPI-04 and [18F]FDG uptakes were compared by using Wilcoxon signed-rank test or paired t tests. McNemar's test was used to compare diagnostic accuracy and lesion detectability between two modalities. Two-tailed P<0.05 was considered statistically significant. Immunohistochemistry staining was utilized to analyze the fibroblast activation protein (FAP) expression in KTs. ***Results:*** A total of 12 patients with 23 KTs from GSRCC (8 synchronous and 4 metachronous) were evaluated. [68Ga]Ga-FAPI-04 was superior to [18F]FDG PET in detecting primary sites of GSRCC (100% [11/11] vs. 18.2% [2/11], p = 0.002), involved lymph nodes (90.9% [10/11] vs. 54.5% [6/11], p=0.046) and peritoneal metastases (100% [12/12] vs. 41.7% [5/12], p=0.008), with higher SUVmax and TBR (all p < 0.005). Both tracers had limited value in identifying KTs, with 100% false negative rate on [68Ga]Ga-FAPI-04 PET and a low detection rate of 8.7% on [18F]FDG PET. Fap immunohistochemistry showed negative or slight FAP expression in neoplastic signet ring cells and ovarian stroma. [68Ga]Ga-FAPI-04 PET/MR imaging strategy greatly improved the detection rate of Krukenberg tumors (87%, 20/23). After adding diffusion-weighted imaging (DWI), the detection rate was further improved (87.5% vs. 100%, p=0.083). [68Ga]Ga-FAPI-04 PET/MR imaging strategy either upgraded TNM staging or changed treatment management in twelve patients. ***Conclusion:*** [68Ga]Ga-FAPI-04 PET outperformed [18F]FDG PET in detecting primary site (primary tumor and local recurrence) and most extra-ovarian metastases of GSRCC, but both tracers had limited value in identifying Krukenberg tumors. Pelvis MRI potentially compensates for the limitation of [68Ga]Ga-FAPI-04 PET imaging in identifying Krukenberg tumors. [68Ga]Ga-FAPI-04 PET/MR imaging strategy significantly improved the detection rate of Krukenberg tumors from GSRCC.

EPS-103

Cross-Sectional Analysis of Metabolic Tumor Burden Detected by F18 FDG PET/CT and Circulating Tumor DNA in Advanced Breast Cancer

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Aim/Introduction: Liquid biopsy is favoured for its non-invasive nature and its significant role in the prognosis of advanced breast cancer. The variant allele frequency (VAF) reflects the mutation rate in circulating tumour DNA (ctDNA), with the maximum VAF (VAFmax) expected to increase with increasing tumour burden. The correlation between metabolically active tumour burden as assessed by FDG PET/CT and prognostic factors in breast cancer has been established. This study retrospectively examines the correlation between VAFmax, mutation status and metabolic tumour burden. ***Materials and Methods:*** Of 83 patients with stage 4 breast cancer who underwent liquid biopsy, 40 also received FDG-PET/CT imaging without concurrent treatment. The mean age of the patients was 44.05 ± 10.72 years, and the mean interval between FDG PET/CT and liquid biopsy was 14.7 ± 12.99 days. Whole-body FDG-PET/CT imaging was performed after FDG administration according to guidelines, together with low-dose CT imaging. Images were analysed and MTV, TLG, SUVmax and SUVmean were calculated. Peripheral blood samples underwent NGS analysis using the AVENIO cfDNA Isolation Kit for ctDNA analysis, mutations and VAFmax determination. Statistical analysis was performed using SPSS 29 software. ***Results:*** The mean SUVmax, SUVmean, MTV and TLG were 13.58 ± 5.96, 5.29 ± 2.08, 161.71 ± 269.55, 759.42 ± 1281.99, respectively. ctDNA was detected in 23 patients (57.5%) by liquid biopsy, with a mean VAFmax of 10.56 ± 0.2%. Of these, 5 (12.5%) had 1 mutation, 10 (25%) had 2 mutations, 6 (15%) had 3 mutations and 1 patient (2.5%) had 4 and 5 mutations respectively. The median number of mutations was 1.36. Statistical analysis revealed higher MTV (p: 0.026) and TLG (p: 0.039) in patients with detected ctDNA. Weak but positive correlations were found between VAFmax and MTV (r: 0.375, p: 0.017), TLG (r: 0.356, p: 0.024), SUVmax (r: 0.381, p: 0.015). Positive correlations were observed between the number of mutations and MTV (r: 0.457, p: 0.003) and TLG (r: 0.373, p: 0.018). The association between number of mutations and MTV (p: 0.001) and TLG (p: 0.006) became stronger with 2 or more mutations. The association between SUVmean and VAFmax and between SUVmax and SUVmean with mutation status was statistically insignificant. ***Conclusion:*** This study highlights the relationship between VAFmax, mutation status and metabolic tumour burden. The combination of FDG-PET/CT with liquid biopsy may help to develop prognostic algorithms for advanced breast cancer and guide future testing to benefit specific groups.

EPS-104

Role of PET/MRI n diagnosis and prognosis of hepatocellular carcinoma using two metabolic tracers: F18-FDG and F18 FEC

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Aim/Introduction: To evaluate the diagnostic and prognostic benefit of PET/MRI examination using two metabolic tracers, [18F]-fluorodeoxyglucose (FDG) and [18F]-fluoroethylcholine (FEC) in HCC patients and to clarify whether there is a correlation between the tumour marker alpha-fetoprotein (AFP) and the uptake of both tracers in the tumour ***Materials and Methods:*** In this retrospective study, we included 30 patients who were referred to the Department of Radiology and Nuclear Medicine, Division of Nuclear Medicine, Medical University of Vienna (MUW) between December 2014 and September 2017 with a suspected diagnosis of HCC for further diagnostics. Each patient received a diagnostic PET/MRI scan with both tracers. Clinical and para-clinical data such as various PET parameters in term of standardized uptake values of the tumour as well as radiological parameters in terms of contrast media enhancement and the diffusion restriction of the liver lesions were collected. ***Results:*** The suspicion of malignancy was confirmed in 25 of 30 patients. FDG-PET/MRI showed diagnostic accuracy of 83.3% (sensitivity 92.0%, specificity 40.0%), and the FEC alone showed a diagnostic accuracy of 75.9% (sensitivity 87.5%, specificity 20.0%). The combination of both tracers showed diagnostic accuracy of 93.1% with a sensitivity of 95.8% and a specificity of 80.0%. In terms of survival, disease progression occurred in a total of 14 patients (46.7%) with a median follow-up of 52.4 ± 29.4 weeks, of whom 11 (64.7%) were graded G2 and 3 were diagnosed with HCC based on imaging features. Progression could not be assessed in the two G4 patients.There was a correlation between AFP and SUVmax for FEC in tumour tissue (p=0.050), SUVmax for FDG in tumour tissue (p=0.009), SUVmean for FDG in tumour tissue (p=0.004) and TLR for FDG (p=0.019).

Conclusion: According to our results, combined PET/MRI with FDG and/or FEC seems to have good potential for improving the diagnosis of HCC. Taking histology results into account, FDG was shown to be slightly better than FEC at detecting HCC.

EPS-105

Potentials of [18F]FDG PET/CT for the Assessment of Pathological Response to Neoadjuvant Therapy in Breast Cancer: A Prospective Study

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Aim/Introduction: Pathological complete response (pCR) to neoadjuvant chemotherapy (NAC) is a milestone in breast cancer (BC) management to identify patients with better prognosis. The revolutionary new frontier is to omit surgery in selected cases with an excellent response to NAC, improving patient outcomes and cost-effectiveness. Residual Cancer Burden (RCB) is a new approach to standardising the response to NAC. In addition, RCB accurately predicts recurrence and survival across BC subtypes. We investigated the potential utility of [18F]FDG PET/CT as a non-invasive predictive tool to assess response to NAC in BC patients prior to surgery. ***Materials and Methods:*** We prospectively enrolled patients with newly diagnosed BC who were candidates for preoperative NAC. All patients underwent baseline and preoperative [18F]FDG PET/CT. Clinicopathological data were collected. Response to NAC was defined as pCR or non-pCR on final histopathology, supplemented by RCB index assessment. Semiquantitative PET parameters (baseline, preoperative and delta absolute and tumour/background SUVs) were extracted from the primary tumour on baseline and preoperative PET/CT scans. The Kruskal-Wallis test was used to assess differences between groups. The Bonferroni test was used to correct for multiple comparisons. Multivariate logistic regression analysis was performed to identify potential predictors of response to NAC. Statistical significance was set at $p<0.05$. ***Results:*** We included 134 BC patients, predominantly with HER2-positive disease (n=74) and stage II disease (n=104). Sixty-nine patients achieved pCR after NAC and the RCB index was assessed in 130/134 patients. Baseline SUVmax correlated with tumour aggressiveness according to BC subtype, HER2 expression, ki-67, and tumour grading ($p<0.001$). Among all parameters, preoperative SUVmax was superior in identifying responders to NAC (pCR 1.2 vs non-pCR 1.8; $p<0.001$) and discriminating between different RCB classes (1.2 vs 1.5 vs 1.7 vs 3.9 for RCB-0, I, II, III, respectively; $p<0.001$); similar results were obtained according to BC subtype and HER2 expression. The best performance was seen in TNBC and HER2-negative BC ($p<0.001$ for both). Multivariate logistic analysis identified preoperative SUVmax as a significant predictor of pCR (OR 0.26; $p<0.001$) and RCB class (OR 4.2; $p<0.001$). ***Conclusion:*** Semi-quantitative parameters derived from preoperative [18F]FDG PET/CT are promising predictors of response to NAC in BC patients who are candidates for surgery across different BC subtypes. Our results push the boundaries of BC management and promote the integration of [18F]FDG PET/CT into the decision-making process for preoperative non-invasive assessment of response to NAC.

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Monday, October 21, 2024, 08:00 - 09:30
Hall G1

Technologists' Track Oral Presentations 2: Technologists Committee: Diagnosis and Therapy

OP-311

Confirming patient cohort dose rate demographics to allow personalised restrictions following 177Lu Oxodotreotide therapy

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Aim/Introduction: The Beatson West of Scotland Cancer Centre (BWoSCC) provides a National service for the treatment of NETs using 177Lu oxodotreotide. Therapy patients are treated as inpatients with an overnight stay and receive standardised restrictions on discharge to reduce exposure to members of the public. These restrictions are based on the 95th percentile retention rate determined by Levart1. The aim of this work is to use dose rate measurements of therapy patients at the time of administration and discharge for comparison with published results and to allow a personalised approach to restrictions based on their estimated retention at discharge. ***Materials and Methods:*** Data from 289 patients (143 male & 146 female) were reviewed including dose rates taken at 1m and 2m, both immediately post administration and 24hours post administration, and patient BMI. Patients are typically prescribed 7400MBq per administration. Dose rates were normalised for activity and for BMI. Patients BMI range from 13.5kg/m2 to 42kg/m2 (average from males = 27.2 kg/m2; females = 27.1 kg/m2). ***Results:*** The patients had a mean administered dose of 7435MBq (range 3700MBq-8067MBq). The ratio of dose rates from 2m to 1m was found to be 3.4±0.1 The average retention at discharge was found to be 25%. This compares with an average retention of 24% reported by Levart. Patient dose rates normalised for activity were plotted against BMI with trendlines suggesting a similar relationship between both sexes. Unlike previous work by Bellamy2, there was no statistically significant difference between the dose rates of females and males either with (p-value=0.133) or without (p-value=0.565) normalisation for BMI. ***Conclusion:*** By establishing similar retention levels at discharge, we can use the range of retention rates described by Levart to allow more personalised patient restrictions. ***References:*** 1 Radiation precautions for inpatient and outpatient 177 Lu-Dotatate peptide receptor radionuclide therapy of neuroendocrine tumours D.Levart, E.Kalogianni, B Corcoran, N Mullholland and G.Vivian. EJNMMI Physics 2019 2 Substantial external dose rate variability observed in a cohort of Lu-177 patients independent of BMI and sex M.Bellamy, B.Chu, B Serencsits, B. Quinn et al Radiation Protection Dosimetry 2022.

OP-312

Radiomic analysis on 177Lu-DOTATATE post-treatment scans: imaging optimization and whole body-SPET radiomics comparison

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Aim/Introduction: While the majority of radiomics research on neuroendocrine tumors (NETs) has concentrated on 68Ga-DOTATOC PET images, there is a rising interest in extending radiomics to conventional nuclear medicine imaging. Tipically, 177Lu-DOTATATE RadioLigand therapy (RLT) includes a whole-body planar and an abdominal SPET acquisition. The goal of this study is to optimize the standard procedure for extracting radiomic profiles from planar imaging and to compare planar and SPET radiomics. ***Materials and Methods:*** We conducted a retrospective analysis on 49 patients, from two different centers, affected by well-differentiated progressive, metastatic gastroenteropancreatic NET. All patients received RLT and underwent whole body scans (WBS) 0-2 days after each treatment cycle. We examined a total of 183 WBS and 108 SPETs, all acquired on three dual-headed gamma camera (Siemens E.Cam, GE Discovery NM 630, GE Discovery NM/CT 670). Preprocessing operations included image intensity normalization to ensure all scans were comparable. This was done, using ImageJ software, by dividing each image by the mean counts value of a ROI positioned on the same anatomical region for each patient: the two selected regions were the spleen (S-norm) and the 3rd lumbar vertebra (V-norm). Patients' livers were then manually segmented in LIFEx 7.6.0. Default settings were chosen for texture features extraction. ***Results:*** Texture extraction was performed on all planar and SPET images from one center, given the ongoing nature of the study. Correlations between intensity-based features measured on S-norm and V-norm images showed weak, yet statistically significant r values. Conversely, the correlation between histogram-based and 2nd order features measured on S-norm and V-norm images demonstrated a robust association, reflected in high r values. V-norm intensity-based features exhibited significantly higher values and lower standard deviations when compared to S-norm intensity-based variables. When comparing features measured on planar and SPET scans, a strong correlation was observed between intensity-based variables, whereas the correlation between histogram-based and 2nd order features was not significant. ***Conclusion:*** Initial findings indicated that the most effective intensity normalization approach for 177Lu-DOTATATE images involved proportional scaling to lumbar vertebra activity, resulting in decreased variability compared to scaling to spleen activity. Correlations between features assessed using the two different scaling methods were weak for intensity-based features and strong for histogram and 2nd order features. Except for intensity-based features, radiomic features derived from planar images were found to be incomparable to those obtained from SPET scans.

OP-313

Isolated Limb Perfusion and Nuclear Medicine: How I do it

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Aim/Introduction: Isolated limb perfusion (ILP) is an option for the treatment for with limb soft tissue sarcoma patients, whose removal is risky (neoadjuvant ILP) or impossible (exclusive ILP). Surgical resection of a sarcoma is often difficult and must be done with a safety margin of healthy tissue to avoid the risk of recurrence and later formation of metastasis. In the event the sarcoma has not been removed with enough margins, or with tumoral tissue left in place, a new conventional surgery may not be the best treatment, as it may lead to sacrifice important anatomical structures or even to amputation. ILP combines the administration of TNF (Tumor Necrosis Factor), Melphalan (chemotherapy) and hyperthermy (30°C) using nuclear medicine counting to ensure patient safety. We report on our 25-year experience with ILP and present this methodology in detail. ***Materials and Methods:*** ILP treats the whole affected limb and is performed by isolating the blood circulation with a tourniquet and the use of a heart-lung machine for extracorporeal circulation (ECC). This interrupts all exchanges between the blood circulation of the limb and the rest of the body. Very high doses of TNF and Melphalan can then be administered into the isolated circulation to treat the tumor. With the nuclear medicine, the injection of a Tc-99m Vasculocis (human albumin) in the ECC will monitor the possible threatening leakage of the TNF and Melphalan into the systemic circulation to avoid vital risk for the patient during the procedure. A calculation of the leakage rate can be made in real-time to keep a safe limit of 5%, otherwise the ECC must be immediately interrupted and the limb flushed with physiological solutions. ***Results:*** Between 2000-2023, 128 patients underwent ILPs, with 78 (61%) having a positive leakage from the limb to systemic circulation (mean 1.6%±1.48%, range: 0% to 5%) and 50 (39%) patients had no or negative leakage from the systemic circulation to the limb (mean -0.66%±0.95%, range: -4% to -0.1%). The ECC had to be interrupted in only in 3 cases (2.3%) because of leaks reaching 5% or more. ***Conclusion:*** ILP treatment to patients with sarcoma aims at obtaining a clinically relevant response while keeping their limb without detriment to overall survival. Controlling leaks using nuclear medicine helps avoid a vital risk for the patient and increase procedure safety during the administration of TNF and chemotherapy.

OP-314

The relevance of bone SPECT scintigraphy in the diagnosis and treatment of Unilateral Condylar Hyperplasia (UCH) in St. Antonius Hospital, the Netherlands

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Aim/Introduction: Unilateral condylar hyperplasia is a growth disorder of the condylar mandibles and in some cases of the maxilla. This can result in facial asymmetry due to the disproportional growth of the condyles on one side of the face. There are no known causes of UCH and the growth rate of the affected side of the face is indeterminable. Bone SPECT scintigraphy is regarded as a useful tool in the diagnosis and treatment of UCH by the dental surgeons. With hyperactivity of the affected condyle, a condylectomy is performed to stop the growth disorder. This retrospective analysis was performed to assess outcome of SPECT imaging and clinical decision making. ***Materials and Methods:*** Patients with suspected UCH were intravenously injected with Tc-99m DPD. After an incubation period of 3-4 hours a SPECT scan of the head was acquired using a Siemens dual head gamma camera in a 128 x 128 matrix, a 180 degrees rotation and 45 seconds per view. Because of ALARA in a young patient group, no SPECT/CT was performed. In the quantitative analysis of the 3D reconstruction, a VOI of fixed volume (1.76) was drawn in the right and left condyle. A 10% difference in mean counts was diagnosed as positive UCH. ***Results:*** Between 2019 and 2023 bone SPECT was performed on 103 patients with suspected UCH, 55 females and 48 males. The age ranged from 9 to 52 years, the mean±SD was 19.3±7.4 years. Bone SPECT was positive in 49 patients, negative in 35 patients and discongruent in 19 patients. SPECT was classified discongruent when the results were inconsistent with the clinical findings and the mean activity

at the contralateral condyle exceeded 10%. Repeated bone SPECT in two patients with discongruent results, showed a negative result. Condylectomy was performed in all patients with a positive SPECTscan. Histopathological specimens of the resected condyles showed no abnormalities, no reoperations were performed during follow-up and no significant differences related to sex and age were found. ***Conclusion:*** In our hospital a positive bone SPECT is the main criterion for performing a condylectomy in suspected UCH. If the SPECT result is negative or discongruent, a condylectomy is not performed. Discongruence can be explained by extinguished UCH with compensatory growth or catch-up growth. Compared to literature our rate of discongruence is quite high so repeating the bone SPECT in case of discongruence after at least six months is to be considered.

OP-315

Evaluation of Treatment Efficacy of Radioactive Iodine-131 Treatment for Feline Hyperthyroidism: Western Australian experience.

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Aim/Introduction: This study aimed to evaluate how 99mTc-Pertechnetate scintigraphy informed 131I therapy (RAI) dose determination in treating feline hyperthyroidism. 131I dose determination was calculated based on the percentage uptake and adjusted using a morphology based weighting factor. ***Materials and Methods:*** This was a retrospective internal quality audit following standard of care. A total of 65 cats were treated during the evaluation period. Pre-treatment clinical examination including baseline haematology, serum biochemistry, urinalysis, and resting thyroxine (T4) was performed by a dedicated Veterinarian to assess suitability for scintigraphy and potentially 131I therapy. Where appropriate, thyroid medication was withdrawn 2 weeks prior to appointment. Planar and SPECT imaging was performed to calculate uptake values and assess thyroid morphology. 131I was administered subcutaneously and titrated against an established dose algorithm. The cats remained in a feline purpose-built facility post-treatment until dose reading (at 1m) fell below 1µSv/hour. ***Results:*** Forty-one of sixty-five cats had post-therapy follow-up and represent the following analysis. Study demonstrated a success rate of 90.2% with euthyroid achieved by 6 months post RAI. Post therapy T4 level had a mean of 34.3 nmol/L and the mean change in T4 was 66.2%. Prior to therapy, the mean T4 levels were 102 nmol/L with a range of 9-257 nmol/L with 87.8% of cats above the normal range (13-48 nmol/L). 131I dose ranged between 94MBq-219MBq. There was no statistically significant difference in morphology based on age, gender and 131I dose. While there was no statistically significant variations in baseline T4 or percentage uptake among bilateral symmetrical, bilateral asymmetrical and unilateral disease, ectopic disease had statistically higher T4 (P=0.0176) and uptake (P=0.0002), and all values in or below the T4 normal range were unilateral. ***Conclusion:*** Our West Australian experience demonstrates the feasibility and effectiveness of using 99mTc-Pertechnetate scintigraphy to guide 131I dose determination in the treatment of feline hyperthyroidism. While optimising dose for individual cats provides improved outcomes over standard dosing approaches, there remains room to refine the algorithm used to determine individual 131I doses. ***References:*** Alonzi, C. et al. (2021) Broome MR. (2006) BUCKNELL, D.G. (2000)Busser S, et al., (2021)Edinboro, et al., (2010) Grossi, G. et al. (2019)Matos J, et al. (2022) Morré WA, et al., (2018) Oberstadt, A.E. et al. (2018) Peterson ME. (2020)Peterson ME, Rishniw M., (2022) Peterson ME, Rishniw M. A., (2021) Peterson ME, et al., (2016) Slater, M.R. et al. (1994) Stephens, M.J. et al. (2014) Yu, L., et al., (2022).

OP-316

Scan speed reduction in post-therapy [177Lu]Lu-PSMA SPECT/CT: How fast can we go without affecting accuracy of dosimetry calculations?

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Aim/Introduction: Accurate dose estimation in [177Lu]Lu-PSMA therapy is crucial for organs at risk such as the kidneys. However, the current method involves lengthy scans, causing discomfort for patients with bone metastases common in prostate cancer, financial pressure and image quality problems due to the motion. Our research aims to optimise this process by investigating acceptable scan reduction while maintaining the accuracy of the calculate dose to organs at risk. ***Materials and Methods:*** A total of 11 post-therapy imaging sequences from patients undergoing [177Lu]Lu-PSMA therapy were selected. For each, two post-therapy SPECT/CT scans, performed at 1- and 7-days post-administration of 7.4 GBq of [177Lu]Lu-PSMA were used. The SPECT projection data was acquired using a dual-head camera with a 3/8" NaI detector, medium-energy collimator, an energy window centred at 208 keV, and a lower scatter window, 64 projections per detector, 14 seconds per projection, covering two field of views (FOVs). To simulate shorter scan durations, the original projections were downgraded to 75%, 50%, and 25% of the counts using Hermes Hybrid reconstruction software. Subsequently, each set of projections was reconstructed using Monte Carlo-based OSEM algorithms, incorporating calibration factors for 177Lu quantification. Kidney dosimetry was performed using a mono-exponential model using the ICRP-103 phantom with the Olinda 2.0. The resulting absorbed kidney doses, mean activity and noise level in the kidneys was calculated for all cases. ***Results:*** The relative difference in the calculated absorbed dose for kidneys, when compared to the initial acquisition, was -1.2±3.6, 0.5±3.0, and 0.6±3.7%, for 75%, 50%, and 25% scans, respectively. Activity concentration values in the kidney have changed by an average of 2.0±2.5, 2.4±3.1 and 3.5±4.4%, for 75%, 50% and 25% scans on day 1, and 3.3±6.7, 6.8±11.2, 7.4±12.0%, for day 7 scans. At the same time, the noise propagation of reduced scans on day 7 (9.1, 25.7 and 63.85% increase for scans with 75%, 50% and 25% of counts) was significantly higher than that of day 1 (2.1, 6.4 and 8.9%).*with respect of the original scan with 64 projections/detector, 14s/projection scan ** average ± standard deviation for 11 post-therapy imaging sequences ***Conclusion:*** Our findings demonstrate the feasibility of reducing the scan duration of post-therapy [177Lu]Lu-PSMA scans to 3.7 (25%) and 11.2 (75%) minutes per bed position for day 1 and day 7, respectively, without significantly compromising the accuracy and uncertainty of the post-therapy dose calculation for kidneys.

OP-317

One-Stop-Shop SynNeurGe assessment - Feasibility of a single-day protocol using [^{123}I]-Ioflupane single-photon-emission-computed tomography and cardiac [^{123}I]-Meta-Iodobenzylguanidine scintigraphy in patients with suspected Parkinson's disease

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Aim/Introduction: Due to new advances in molecular and imaging biomarkers, a biological classification of Parkinson's disease (PD) called SyNeurGe [1] has been proposed for research use recently. [123I]-Ioflupane dopamine transporter single-photon-emission-computed tomography (DaT-SPECT) and cardiac [123I]-Meta-Iodobenzylguanidine (MIBG) scintigraphy are included in this biological classification scheme as central imaging biomarkers for the assessment of dopaminergic function and cardiac sympathetic denervation. In order to fulfill this prospectively high imaging demand and optimize diagnostic workup we propose a single-day protocol including DaT and MIBG imaging. ***Materials and Methods:*** We performed a single-day protocol including DaT-SPECT and cardiac MIBG scintigraphy in five patients with clinically diagnosed α-synucleinopathies (4 male; 69.0±8.8 years). The radiotracers were injected simultaneously and cardiac imaging was performed at 3.5 hours after injection followed by brain imaging at 4 hours after injection using standard protocols for MIBG-scintigraphy and DaT-SPECT. In order to exclude relevant binding of MIBG in the brain as well as DaT in the heart we also performed brain scans in MIBG patients as well as chest scans in DaT patients. ***Results:*** Four out of the five patients which were suspected of PD or multiple systems atrophy with Parkinsonian phenotype (MSA-P) showed a significantly reduced DaT-SPECT binding (z-score < -2) in at least one hemisphere (mean z-score: -4.1±1.25) as well as a pathological heart to mediastinum ratio in the MIBG scan (mean H/M ratio: 1.3±0.26). Interestingly the patient with a normal DaT and MIBG scan (mean z-score: -1.58; H/M ratio: 2.29) was clinically suspected of MSA with cerebellar phenotype (MSA-C). Both DaT and MIBG scans could visually be interpreted without any signs of imaging artifacts or decrease in imaging quality. Single tracer imaging confirmed no relevant uptake of [123I]-Ioflupane in the heart or [123I]-MIBG in the brain. ***Conclusion:*** A single day protocol for DaT and MIBG imaging facilities efficient biological characterization of Parkinsonian syndromes. An additional brain FDG-PET scan may be added after dual SPECT imaging to obtain all SyNeurGe neurodegeneration criteria at one day. ***References:*** 1. Hoglinger, G.U., et al., A biological classification of Parkinson's disease: the SynNeurGe research diagnostic criteria. Lancet Neurol, 2024. 23(2): p. 191-204.

OP-318

[18F]Fluorocholine PET/CT significantly reduces the amount of negative scan results compared to [99mTc]-sestamibi and [99mTc]-pertechnetate scintigraphy SPECT/CT

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Aim/Introduction: [99mTc]-sestamibi and [99mTc]-pertechnetate scintigraphy SPECT/CT (Tc-99m) has previously been the preferred method for locating potential parathyroid adenomas in patients with hyperparathyroidism. This procedure however is time-consuming, contributes to a high radiation dose and has a reported moderate detection rate in the literature: 61-88% and many negative exams. [18F]fluorocholine PET/CT (FCH) is a newer procedure with a reported detection rate: 73-97%. High detection rates are important as it enables precise surgical interventions, thus reducing the number of bilateral neck explorations (BNE). The aim of this study was to compare the number of negative scan results between FCH as a replacement of Tc-99m in patients with hyperparathyroidism. ***Materials and Methods:*** Two groups, each consisting of 82 consecutive patients, had scan results compared. The first group were FCH patients; the second group were the last 82 Tc-99m patients prior to the implementation of FCH. Image acquisitions were on a conventional dual-headed gamma camera for planar subtraction, wash-out, SPECT/CT for Tc-99m. FCH was with a LSO/SiPM-based (249 ps. timing resolution) PET/CT system. The scan results had three categories: Negative with no adenomas reported, clearly positive or equivocal with a possible adenoma reported. The difference in reported detection rates between scan-types were analysed using a Chi2 test. FCH findings were compared with histopathology. ***Results:*** The number of patients where the image acquisition failed to detect a potential parathyroid adenoma (negative) was 5 (6%) for FCH compared to 34 (42%) for Tc-99m. Patient scans reported as positive were 59 (72%) for FCH and 22 (27%) for Tc-99m, and equivocal findings were reported in 18 patients (22%) for FCH compared to 26 patients (32%) for Tc-99m. In addition, four patients had a negative Tc-99m SPECT/CT initially and were re-referred for FCH, were three scans now showed a possible adenoma. FCH significantly reduced the number of negative scans and increased the number of positive scans (p<0.00001). Fifty FCH patients had 51 adenomas removed were FCH correctly identified 50 (98%). ***Conclusion:*** In patients with hyperparathyroidism, using FCH leads to a significantly better performance than Tc-99m. In addition, FCH is able to locate parathyroid adenomas in patients with a previous negative SPECT/CT. The very low number of patients with a negative FCH compared with Tc-99m is clinically very important when considering implementing FCH, as it signifies numerous patients avoid BNE and only have to undergo minimal invasive surgery.

OP-319

Evaluation of a reduced dose 123I-Ioflupane in patients examined with SPECT for clinically uncertain parkinsonism

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Aim/Introduction: Dopamine transporter imaging with 123I-Ioflupane is regularly used in patients with clinically uncertain Parkinsonian Syndromes. EANM/SNMMI guideline recommends administering 110-250 MBq and acquiring > 1.5 Mcts in the SPECT images for this examination. The aim of this retrospective study was to evaluate if halving the dose of 123I-Ioflupane (from 185 MBq to 92.5 MBq) affects the reported diagnoses in these patients. ***Materials and Methods:*** 485 patients were included in this study. SPECT-acquisitions (180 min post injection) were performed on a dual head digital SPECT/CT-system with wide energy high resolution parallel-hole collimators, 159 keV±10% energy window, 30 sec/frame, 11-15 cm rotational radius, 360° rotation and 3° angular step. The «standard-dose group» (n=277) and the «half-dose group» (n=208) were compared for discrepancies. The nuclear medicine physicians' reported diagnoses were categorized into «normal», «pathological» or «uncertain». Striatal binding ratios (SBR) for striatum (L/R), putamen (L/R) and caudatus

(L/R) were assessed for quantitative analysis. A Z-test was used to compare differences in proportions between reported diagnoses in the standard-dose group and half-dose group, and the Mann-Whitney U test were applied to compare differences in SBR between patients reported as normal and pathological. An alpha level of 0.05 were used for all statistical tests. ***Results:*** The mean total detected events were 4.6±0.7 Mcts and 2.4±0.4 Mcts in the standard-dose group and the half-dose group respectively. The proportion of patients reported as normal increased significantly with half-dose compared to standard-dose (+0.10, 95%CI [0.01, 0.19], p=0.03), while the proportion of patients reported as pathological and uncertain decreased (-0.08, 95%CI [-0.17, 0.01], p=0.09 and -0.02, 95%CI [-0.07, 0.03], p=0.433, respectively). There were significant differences in median SBR between patients reported as normal and pathological for all regions in the standard-dose group (ΔSBR: 0.96-1.17, p<0.001). For the half-dose group, the differences in median SBR between patients reported as normal and pathological were smaller for all regions (ΔSBR: 0.17-0.48), causing significant differences only for striatum (L), putamen (L) and caudatus (L) (p<0.02). ***Conclusion:*** Half-dose of 123I-Ioflupane fulfills the guidelines' criteria of > 1.5 Mcts in the SPECT-images. However, a significant larger proportion of patients was reported as normal in the half-dose group compared to the standard-dose group. This was probably caused by a smaller difference in SBR values between patients reported as normal and pathological in the two groups, implying that half the dose caused a more difficult diagnostic situation for the physicians.

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Monday, October 21, 2024, 08:00 - 09:30
Hall Y1-Y3

Featured Session: Cardiovascular Committee: Inflammatory Cardiopathies, a New Entity of New Tracers

OP-320
Molecular Imaging of Myocardial Inflammation
F. Caobelli;
University Hospital, Basel, SWITZERLAND

OP-321
FAPi PET/CT in the assessment of myositis-related myocardial involvement
O. Kulterer[1], *K. Kastrati[2], T. S. Nakuz[1], H. Kiener[2], A. Göllner[1], H. Lechner-Radner[2], D. Aletaha[2], P. Mandl[2], M. Hacker[1];*
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Aim/Introduction: Idiopathic inflammatory myopathies (IIM) are rare autoimmune disorders marked by skeletal muscle weakness, atrophy, and consequent physical disability. These disorders often feature extramuscular involvement, manifesting in various complications such as arthritis, cardiac-, skin- or pulmonary involvement, underscoring the systemic impact of IIM (1). Previous research has indicated that patients with IIM-associated interstitial lung disease (ILD) have higher fibroblast activation as compared to non-ILD patients. The aim of our study was to investigate fibroblast activation in the myocardium of IIM-ILD patients with proven cardiac involvement, compared to patients with no previous cardiac history. ***Materials and Methods:*** We enrolled IIM patients with verified cardial involvement as demonstrated via cardiac magnetic resonance imaging (MRI). Additionally, we included patients with inflammatory bowel disease and thyroid carcinoma without known cardiac conditions. All patients underwent FAPi PET/CT imaging. We assessed cardiac FAPi uptake by calculating the target to background ratio (TBR), which involved measuring the maximum standardized uptake volume (SUVmax) of the heart and correcting it for the blood pool. ***Results:*** Among patients with IIM-ILD and confirmed cardiac involvement (n=5), there was a marked increase in TBRmax values as compared to patients undergoing [68Ga]68Ga-DATA5m.SA.FAPi PET/CT imaging for different medical conditions (n=10), p=0,02. This suggests a potential relationship between IIM-related cardiac involvement and increased fibroblast activation within the myocardium. ***Conclusion:*** Our data unveil a notable elevation in fibroblast activation among IIM patients with myocardial involvement as compared to control patients, indicating the potential of FAPi PET/CT as a valuable diagnostic tool for the detection of myocardial involvement in IIM cases. These findings suggest that FAPi PET/C imaging may serve as a tool to identify and assess cardiac complications in IIM patients, facilitating earlier diagnosis and more targeted management strategies. ***References:*** Kastrati K, Nakuz TS, Kulterer OC, Geßl I, Simader E, Mrak D, Bonelli M, Kiener HP, Prayer F, Prosch H, Aletaha D, Langsteger W, Traub-Weidinger T, Blüml S, Lechner-Radner H, Hacker M, Mandl P. FAPi PET/CT for assessment and visualisation of active myositis-related interstitial lung disease: a prospective observational pilot study. EClinicalMedicine. 2024 Apr 10.

OP-322
Patterns of myocardial fibroblast activation in patients with terminal heart failure scheduled for left ventricular assist device implantation
J. Diekmann[1], *A. Schöde[2], C. P. Czerner[1], D. Berliner[3], J. Hanke[2], J. T. Thackeray[1], J. D. Schmitto[2], A. Ruhparwar[2], J. Bauersachs[3], F. M. Bengel[1];*
[1]Hannover Medical School (MHH), Department of Nuclear Medicine, Hannover, GERMANY, [2]Hannover Medical School (MHH), Department of Cardiothoracic Surgery, Hannover, GERMANY, [3]Hannover Medical School (MHH), Department of Cardiology and Angiology, Hannover, GERMANY.

Aim/Introduction: Prior work described cardiac fibroblast activation protein (FAP) overexpression early after acute myocardial infarction and in response to pressure overload. Little is known about FAP patterns in end stage heart failure, which may have implications for outcome and response to left ventricular assist device (LVAD). ***Materials and Methods:*** 9 patients with end stage heart failure underwent PET/CT with 18F-Flurpiridaz and 68Ga-FAPI-46 directly prior to LVAD implantation (7 with ischemic cardiomyopathy, ICM, 2 with dilated cardiomyopathy, DCM). 18F-Flurpiridaz yielded regional perfusion defects, absolute flow (MBF) at rest and functional parameters. FAPI images were analyzed using volume-of-interest technique to determine SUV and extent of cardiac FAP-overexpression (FAP-volume). ***Results:*** Patients presented with high NT-proBNP (14430±15169ng/l) and low LVEF (19±5%). Mean global resting MBF was low (0.61±0.12ml/min/g). Variable FAPI uptake intensity was detected in the left ventricular myocardium (mean SUVpeak 3.1±0.9, range 1.8-4.6). Uptake in other organs (liver, spleen, bone marrow, lungs) was low. Myocardial FAP-volume correlated with creatine kinase (r=0.697, p=0.041) but not with NT-proBNP. Also, FAP-volume did not correlate with parameters of LV function including LVEF, volumes and mass, but showed a significant inverse correlation with

absolute resting myocardial blood flow (r=-0.704 , p=0.040). All 7 patients with ICM had resting perfusion defects. Despite long-term history of myocardial infarction (MI; 6/7 patients, time range 2mo-27yrs prior to PET), elevated FAP-uptake was present in the infarct area, matching the perfusion defect. One patient with history of MI (14 years ago) did not show FAP uptake in the perfusion defect area. In DCM, only one of two patients showed relevant yet diffuse myocardial FAP-expression in the absence of regional perfusion defects. ***Conclusion:*** Extent and severity of myocardial fibroblast activation is highly variable in patients with end stage heart failure scheduled for LVAD. Ongoing active replacement fibrosis in chronic infarct regions needs to be distinguished from interstitial fibrotic activity in viable myocardium. The impact of fibroblast activation patterns on the response to LVAD remains to be determined. Additionally, LVAD implantation provides access to tissue for future ex vivo validation.

OP-323

Visualization and quantification of somatostatin receptor 2 ($SSTR_2$) and $\alpha_v\beta_3$ expression in cardiovascular disease (CVD): Analysis of [^{64}Cu]Cu-DOTATATE and [^{68}Ga]Ga-NODAGA-E[c(RGDyK)]2 (RGD) PET/CT scans from a Phase II trial cohort

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[1]Cluster for Molecular Imaging, Copenhagen University Hospital – Rigshospitalet & Department of Biomedical Sciences, University of Copenhagen, Denmark, Copenhagen, DENMARK, [2]Vascular Research Unit, Department of Vascular Surgery, Rigshospitalet, Copenhagen, DENMARK.

Aim/Introduction: Inflammation and angiogenesis play pivotal roles in the development of atherosclerosis. PET tracers, such as [64Cu]Cu-DOTATATE (64Cu-DOTATATE) and [68Ga]Ga-NODAGA-E[c(RGDyK)]2 (68Ga-RGD), allow non-invasive visualization of somatostatin receptor subtype 2 (SSTR2) and αvβ3 integrin expression, which respectively represent inflammation and angiogenesis(1,2,3). The objective of this study was to explore the suitability of two PET-tracers, 64Cu-DOTATATE and 68Ga-RGD, for detection and quantification of cardiovascular disease (CVD). ***Materials and Methods:*** A total of 52 patients were PET/CT scanned with 64Cu-DOTATATE & 68Ga-RGD. The patients were divided in two groups as 'Control' and 'CVD'. Patients in the control group (N=27) did not have any known CVD or risk factors, e.g. diabetes or hypercholesterolemia. In the other group (N=25), patients either had known CVD or risk factors. Retrospective analysis of the scans involved calculating the mean maximum target-to-background ratios (mTBRmax) in six arterial segments. ***Results:*** 64Cu-DOTATATE and 68Ga-RGD uptake in the CVD group was consistently higher compared to the control group in all aortic segments. Specifically, 64Cu-DOTATATE uptake in the thoracic (3.6±0.4 vs 2.8±0.2, P=0.06), ascending aorta (3.5±0.4 vs 2.7±0.2, P=0.06) for CVD vs. controls. Likewise, uptake of 68Ga-RGD were in the thoracic (2.2±0.1 vs 2.0±0.1, P=0.03) and ascending aorta (2.2±0.1 vs 2.0±0.1, P=0.07). ***Conclusion:*** Based on this retrospective analysis, 64Cu-DOTATATE and 68Ga-RGD both showed higher uptake in the CVD group compared to control group demonstrating that both tracers seem to be able to distinguish between the CVD and controls. ***References:*** 1. Pedersen SF, Sandholt BV, Keller SH, et al. 64Cu-DOTATATE PET/MRI for Detection of Activated Macrophages in Carotid Atherosclerotic Plaques. Arterioscler Thromb Vasc Biol. 2015;35(7):1696-1703. doi:10.1161/ATVBAHA.114.3050672. 2. Dietz M, Kamani CH, Deshayes E, et al. Imaging angiogenesis in atherosclerosis in large arteries with 68Ga-NODAGA-RGD PET/CT: relationship with clinical atherosclerotic cardiovascular disease. EJNMMI Res. 2021;11(1):71. doi:10.1186/s13550-021-00815-53. 3. Tarkin JM, Joshi FR, Evans NR, et al. Detection of Atherosclerotic Inflammation by (68)Ga-DOTATATE PET Compared to [18F]FDG PET Imaging. J Am Coll Cardiol. 2017;69(14):1774-1791. doi:10.1016/j.jacc.2017.01.060.

OP-324

Factors Associated with a Myocardial Uptake on Oncologic Somatostatin-Positron Emission Tomography Investigations and Differentiation from the Myocardial Uptake of Acute Myocarditis

T. Larive, *C. Boursier, M. Claudin, J. Varlot, L. Filipetti, O. Huttin, V. Roch, L. Imbert, M. Doyen, A. Lambert, D. Mandry, Z. Lamiral, E. Chevalier, P. Marie;*
CHRU Brabois, rue du Morvan, Vandœuvre-lès-Nancy, FRANCE.

Aim/Introduction: Myocardial somatostatin-PET uptake is observed in most patients with acute myocarditis (AM) but also in some oncology patients referred for routine somatostatin-PET. This raises concerns about the specificity of somatostatin-PET for detecting myocarditis. The current study aims to identify (i) factors associated with the detection of myocardial uptake on somatostatin-PET recorded for oncology indications and (ii) differential PET criteria that characterize myocardial uptake in AM patients. ***Materials and Methods:*** We analyzed i) factors associated with the detection of myocardial [68Ga]Ga-DOTA-TOC uptake in 508 [68Ga]Ga-DOTA-TOC PETs from 178 patients, performed for a confirmed or suspected oncologic disease (Onc-PET group) and ii) PET criteria that could differentiate myocardial [68Ga]Ga-DOTA-TOC uptake in 31 patients with an MRI-ascertained AM (AM-PET group) from the Onc-PET group. ***Results:*** Significant myocardial uptake was detected in 137 (26.9%) Onc-PETs and was independently associated with somatostatin analog treatment (Exp(Beta) (95 %CI): 0.805 (0.728-0.890), p<0.001) and age (1.005 (1.001-1.009), p=0.012). A comparable model was selected for predicting the myocardial/blood SUVmax ratio (i.e. somatostatin analog treatment (p<0.001) and history of coronary artery disease (CAD) p=0.022)). Myocardial uptake was detected in 12.9% (25/193) of Onc-PETs from patients treated with somatostatin analogs but in 43.4% (59/136) of untreated patients over the median of 64 years of age. Myocardial uptake was apparent in all 31 AM-PETs, with volume and intensity of uptake dramatically higher than in the 137 Onc-PETs showing myocardial uptake. A myocardial/blood SUVmax ratio threshold of 2.20 provided a sensitivity of 87% (27/31) and a specificity of 88% (44/50) for differentiating myocardial uptake between AM-PETs and an Onc-PET group restricted to patients with comparable clinical characteristics to the AM group (≤ 64 years of age, no CAD history, no somatostatin agonists). A myocardial uptake volume threshold of 18 cm3 provided a comparable diagnostic accuracy (sensitivity: 84% (26/31), specificity: 94% (47/50). ***Conclusion:*** Myocardial uptake is detected in 26.9% of somatostatin-PETs recorded for oncology indications. This rate is decreased by somatostatin analog treatments and increased in older individuals. However, somatostatin-PET, analyzed with the quantitative criterion of uptake intensity or volume, is able to identify acute myocarditis and to differentiate it from myocardial uptake of other origins.

OP-325

Utility of 68-Ga-DOTANOC PET/CT in Evaluation of Treatment Response in Patients with Cardiac Sarcoidosis

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AIIMS Delhi, New Delhi, INDIA.

Aim/Introduction: We aimed to assess the utility of 68-Ga-DOTANOC PET/CT (PositronEmission Tomography/Computed Tomography) in evaluation of treatment response in patients with cardiac sarcoidosis (CS), which is characterized by diverse clinical presentations and variable responses to therapy. ***Materials and Methods:*** We conducted a retrospective analysis involving 68-Ga-DOTANOC PET/CT scans from 30 patients diagnosed with CS. 68-Ga-DOTANOC PET/CT imaging was carried out using dedicated PET/CT scanners (Biograph mCT, Siemens Inc. and Discovery PET/CT, GE) approximately 45-60 minutes after intravenous administration of 2-3 mCi of radiotracer. Interpretation of all scans was performed by two experienced nuclear medicine physicians. Quantitative analysis included calculation of SUVmax (maximum standardized uptake value) and the ratio of SUVmax to the mean SUV of the background for the lesion exhibiting the highest uptake. ***Results:*** The study included a total of 30 patients diagnosed with CS. All patients underwent 68-Ga-DOTANOC PET/CT imaging both at baseline and at follow- up after receiving standard treatment regimens. The mean age was 39.5 ± 10.3 years (range 17-61 years), with a male-to-female ratio of 4:3. The median duration between the baseline and follow-up DOTANOC scans was 8.9 ± 2.1 months. In 22/30 patients with CS, DOTANOC scans revealed a reduction in SUVmax values post-treatment compared to baseline scan (mean SUVmax 1.363 ± 0.60 vs. 0.915 ± 0.34). Additionally, there was adecrease in the ratio of SUVmax to the mean SUV of the background post-treatment compared to baseline scan (mean ratio of SUVmax to the mean SUV of the background 2.370± 0.61 vs. 1.286 ± 0.27). This reduction in SUVmax and the ratio correlated with clinical improvement and resolution of inflammatory lesions on follow-up imaging. Among the remaining 8 patients, 7 showed an increase in SUVmax (mean SUVmax 0.865 ± 0.21 vs. 1.174 ± 0.28), while one patient exhibited stable disease on follow-up scan. ***Conclusion:*** 68-Ga DOTANOC PET/CT can be a valuable additional tool for evaluatingtreatment response in patients with cardiac sarcoidosis.

OP-326

ECG-gated $^{[18F]}$-FDG-PET/CT is useful in imaging patients with symptomatic cardiac sarcoidosis

S. Notohamiprodjo, *J. Kraus-Deuringer, A. Villagran Asiares, W. A. Weber, S. G. Nekolla;*
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Aim/Introduction: The diagnosis of cardiac sarcoidosis (CS) with 18F-FDG PET/CT demands proper patient preparation with 12h low carbohydrate, high fat and protein diet. However, patient compliance is not always given, leading to the challenging situation to differentiate between CS granulomas and incomplete suppression of physiological FDG-uptake. We hypothesize that by using ECG-gated FDG-PET/CT the regional myocardial contractile function in CS is substantially decreased compared to normal functioning myocardium. ***Materials and Methods:*** In this pilot study, we investigated 10 patients with confirmed cardiac sarcoidosis and 6 oncological patients without heart disease who underwent FDG-PET/CT as control population. ECG-gated digital FDG-PET/CT was performed after overnight fasting protocol to suppress physiological myocardial FDG-uptake. To assess the contractile function, count-based method for measuring myocardial wall thickening from gated FDG-PET images was used. The diastolic-to-systolic wall-thickening was calculated as percent increase from diastolic thickness. Lower limit of normal wall-thickening was defined as mean wall thickening - 2 standard deviations. The extension/number of segments of FDG-uptake was determined. Polar maps of motion and thickening parameter, histograms and cine-images of wall thickening were generated. ***Results:*** Myocardial FDG-uptake of control population showed diffuse but almost heterogeneous uptake pattern without focal spots. The regional variation of FDG-uptake was 14%. The myocardial wall-thickening was highly dependent from LVEF and the average wall-thickening was found as 53.7%. In CS patients average myocardial wall-thickening in areas of enhanced FDG-uptake was 15.3%, significantly lower than in control population ($p < 0.05$). ***Conclusion:*** In a hypothetic case where differentiation between CS granuloma and incomplete suppression of physiological myocardial FDG-uptake is challenging, analysis of myocardial wall-thickening with gated PET/CT may be helpful.

OP-327

In cardiac sarcoid, comparison of cardiac MRI late gadolinium enhancement distribution and F^{18} FDG-PET-CT metabolic activity related to ventricular tachycardia

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[1]Royal Papworth Hospital, Cambridge, UNITED KINGDOM,
[2]Cambridge University Hospitals, Cambridge, UNITED KINGDOM.

Aim/Introduction: To compare cardiac MRI and FDG PET-CT characteristics in cardiac sarcoid with reference to incidence of ventricular tachycardia ***Materials and Methods:*** Single centre retrospective series of 38 patients with histologically confirmed extra-cardiac sarcoid and consecutive paired cardiac MRIs and fluorodeoxyglucose (FDG) PET-CT, compared to electrophysiology outcomes within 3 months of either examination. The distribution of late gadolinium enhancement (LGE) and FDG accumulation were compared on a segmental level using the 17-segment model denotation of left ventricular anatomy with extension to include the right ventricle. Patients with known ischaemic heart disease were excluded. Wilcoxon signed rank test was conducted to examine the differences between the distributions of total segments displaying LGE and those indicating FDG uptake. ***Results:*** There was a statistically significant difference ($z = -3.78$, $p < 0.001$) between the distributions of LGE and FDG uptake. Among the study participants, the median number of segments exhibiting LGE was 4 (mean = 4.92, SD = 2.93, range = 2 to 13), whereas for segments demonstrating FDG uptake, the median was 0 (mean = 2.08, SD = 3.83, range = 0 to 15). The location of matched late gadolinium enhancement and FDG accumulation were basal, mid and apical septum as well as basal to mid anterior wall. Patients without VT had a median maximum standardised uptake value (SUVmax) value of 0.1, in contrast to a median SUVmax of 3.8 in those with VT. Patients without VT had a median of 0.2 FDG uptake segments (total segments displaying FDG uptake) compared to a median of 3.0 segments in those with VT. This difference was statistically significant ($U = 95.5$, $z = -2.19$, $p = 0.028$), suggesting that the presence of VT was associated with higher median FDG uptake segment values. There was no significant difference in number of LGE segments (or myocardial fibrosis burden) in the patients with or without VT. Left ventricular ejection fraction (LVEF) % displayed a significant negative correlation with SUVmax,

r = -0.33, p = 0.046, suggesting that reduced LVEF % values may coincide with elevated metabolic activity. ***Conclusion:*** In the presence of cardiac MRI confirmed cardiac sarcoid, PET-CT is useful for assessment of metabolic activity in patients with histologically confirmed extra-cardiac sarcoid. Patients with VT had a higher number of segments displaying FDG uptake and a higher SUVmax compared to those without VT.

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Monday, October 21, 2024, 09:45 - 11:15
Hall 1

CME 6 - Oncology & Theranostics Committee - Radioligand Therapy in NEN

OP-329
Peptid-Radio-Rezeptor-Therapie in combination trials
T. Brabander;
Erasmus MC, Nuclear Medicine, Rottedam, NETHERLANDS.

OP-330
Peptid-Radio-Rezeptor-Therapy retreatment
I. Karfis;
Jules Bordet Institute, Nuclear Medicine, Brussels, BELGIUM.

OP-331
Peptid-Radio-Rezeptor-Therapie response assessment: morphological vs functional criteria?
V. Ambrosini;
IRCCS Azienda Ospedaliero-Universitaria di Bologna, Nuclear Medicine, Bologna, ITALY.

OP-332
Emerging radiopharmaceuticals for Peptid-Radio-Rezeptor-Therapie in NEN
C. Deroose;
UZ Leuven, Nuclear Medicine, Leuven, BELGIUM.

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Monday, October 21, 2024, 09:45 - 11:15
Hall 4

Special Track 6 - Neuroimaging Committee - Round Table: Molecular Imaging of Brain Connectivity

OP-333
Brain PET imaging 2.0: how can molecular imaging capture brain connectivity?
A.Sala;
GIGA-Consciousness, Liege, BELGIUM.

OP-334
Disease-specific patters of brain disconnectivity
A. Drzezga;
University of *Cologne, Department of Nuclear Medicine, Cologne, GERMANY.*

OP-335
Establishing causal spreading of tau and amyloid with molecular imaging
J. Sepulcre;
Athinoula A. Martinos Center for Biomedical Imaging, Harvard Medical School, Charlestown, UNITED STATES OF AMERICA.

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Monday, October 21, 2024, 09:45 - 11:15
Hall X9-X12

LIPS Session 6 - Inflammation and Infection Committee - Incidental Inflammatory/Infective Findings with PET Tracers

OP-336
Incidental inflammatory/infective findings with ^{18}F-FDG
G. Treglia;
Imaging Institute of Southern Switzerland, Ente Ospedaliero Cantonale, Division of Nuclear Medicine, Bellinzona, SWITZERLAND.

OP-337
Incidental inflammatory/infective findings with choline/PSMA
D. Albano;
ASST Spedali Civili of Brescia, Department of Nuclear Medicine, Brescia, ITALY.

OP-338
Incidental inflammatory/infective findings with other radiotracers
E. Arslan;
Istanbul Training and Research Hospital, Istanbul, TÜRKIYE.

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Monday, October 21, 2024, 09:45 - 11:15
Hall X1-X4

M2M Track - TROP Session: Radiopharmaceutical Sciences + Translational Molecular Imaging & Therapy Committee: From Synthesis to Clinical Translation

OP-339
Synthesis and Evaluation of CYP11B2 selective PAY derivatives for Primary Aldosteronism Imaging
Y. Yagi[1,2], *H. Kimura[2,3], R. Fuseda[3], T. Murakami[4], M. Omokawa[5], S. Kise[2], M. Sone[6], H. Saji[7];*
[1]Kyoto college of Medical Science, Nantan, JAPAN, [2]Kanazawa University, Kanazawa, JAPAN, [3]Kyoto Pharmaceutical University, Kyoto, JAPAN, [4]Kyoto University Hospital, Kyoto, JAPAN, [5]Okayama University, Okayama, JAPAN, [6]St. Marianna University School of Medicine, Kawasaki, JAPAN, [7]Kyoto University, Kyoto, JAPAN.

Aim/Introduction: Primary aldosteronism (PA) is a form of secondary hypertension resulting from the overproduction of aldosterone in the adrenal gland, accounting for 5-10% of hypertension cases. It is a heterogeneous disorder with treatments varying based on unilateral or bilateral nature. Unilateral PA can be cured by surgery, making an accurate diagnosis crucial. However, invasive adrenal vein sampling is often required

because non-invasive methods such as CT and MRI are not enough for diagnosis. We think a non-invasive nuclear medicine diagnostic method can improve PA diagnosis. The development of a nuclear medicine molecular probe specific for CYP11B2, overexpressed in PA patients, was proceeded. We selected the tetrahydropyridoquinolinone structure, which has been reported to have selective CYP11B2 inhibitory activity, and synthesized and evaluated its derivatives. ***Materials and Methods:*** We designed and synthesized five tetrahydropyridoquinolinone derivatives (PAY-1~5). Evaluation of their inhibitory activity for CYP11B2 and selectivity over CYP11B1 has proceeded with V79 cells transfected with these enzymes. The derivatives were then radiolabeled with I-125, followed by a radiotracer biodistribution experiment in healthy mice. Finally, we performed in vitro autoradiography (ARG) using adrenal slices from PA patients to evaluate the selectivity for CYP11B2 and CYP11B1. ***Results:*** We obtained iodine-contained PAY-1,2 for SPECT and fluorine-contained PAY-3,4,5 for PET with relatively good yields. Inhibition assay revealed that PAY-1, an iodine-containing six-membered ring compound, had the highest selectivity (Ratio: 223.95). We obtained [125I] PAY-1 with an RCY of 50%. [125I]PAY-1 biodistribution experiment showed accumulation in the adrenal glands (8.67±1.74 %ID/g at 5 min). In vitro ARG analysis using human adrenal slices showed higher accumulation of radioactivity in the CYP11B2 region than in the CYP11B1 region. This result is consistent with cell experiment results. Therefore, these results suggest [125I] PAY-1 has high selectivity for CYP11B2. ***Conclusion:*** The newly designed radioiodeinated PAY-1 may be promising SPECT probes for primary aldosteronism imaging. ***References:*** [1] |J. Med. Chem. 54, 2307-2319. (2011).

OP-340

Development of iodine-123-based PSMA radiohybrid conjugates as a diagnostic counterpart for targeted alpha therapy with actinium-225

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Aim/Introduction: Macropa-PSMA conjugates used for targeted alpha therapy with actinium-225 are extended with an albumin binder.[1,2] Further to improving the pharmacological behaviour in vivo, the introduction of an iodine-containing albumin binder provides the basis for the development of a radiohybrid approach. In addition to the complexation of the alpha emitter 225Ac (t1/2=9.9 d), the introduction of the easily accessible SPECT-compatible radiohalogen 123I (t1/2=13.2 h) into the same molecule is possible. Advantageously, the ideal physical half-life and mild radioiodination conditions allows the imaging of longer circulating radionuclide conjugates. ***Materials and Methods:*** The PSMA-binding motif based on the PSMA-617 structure was synthesised by multi-step peptide coupling and conjugation of the macropa-type complexing agent by Cu-catalysed click chemistry. The labeling precursor was synthesized by replacing the 4-(p-iodophenyl)butyrate with a trimethyltin group to enable labelling with iodine-123 by electrophilic aromatic substitution. To determine the binding affinity, LNCaP cells were incubated with nonradioactive conjugates (with and without lanthanum-139) in a competition assay and spiked with [133La]La-PSMA-617 as a competitive radionuclide conjugate. The influence of the complexing agent and the metal ion loading on the binding affinity was evaluated. ***Results:*** The monomer [123I]I-mcp-M-alb-PSMA was prepared from the tin precursor (DMSO, Iodogen, 20 min, rt, RCY: 49%). The dimer [123I]I-mcp-D-alb-PSMA was labelled under the same conditions. Iodine-127 was added after completion of radiolabelling to iodinate the second stannyl group (RCY: 20%). Both radionuclide conjugates were purified by HPLC. No influence of chelator loading on cell binding was observed. The IC50 and Ki values were comparable across the analogues (mcp-M-alb-PSMA: Ki = 8.46 nM (7.05 - 10.14), La-mcp-M-alb-PSMA: Ki = 8.46 nM (6.72 - 10.66) / mcp-D-alb-PSMA: Ki = 2.35 nM (2.03 - 2.71), La-mcp-D-alb-PSMA: Ki = 2.21 nM (1.64 - 2.96)). Preliminary SPECT images show a biodistribution of [123I]I-mcp-M-alb-PSMA which is comparable with that of [225Ac]Ac-mcp-M-alb-PSMA.[1] ***Conclusion:*** The synthesis of the tin precursors and subsequent radiolabelling with iodine-123 provided two new radionuclide conjugates which act as diagnostic counterparts to the corresponding 225Ac radionuclide conjugates. The introduction of iodine-123, with or without metal ion loading of the macropa chelator, did not alter the PSMA binding affinity. The addition of the albumin binding domain opens up a new aspect for theranostic use as a hybrid radiopharmaceutical and has created the new radiohybrid pair 123I/225Ac. ***References:*** [1] F. Reissig, et al., Theranostics 2022, 12, 7203. [2] F. Reissig, et al., Cancers 2021, 13.

OP-341

Development, synthesis and evaluations of a PET tracer towards 5T4 oncofetal antigen

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Aim/Introduction: Trophoblast glycoprotein, the so-called 5T4, is an oncofetal antigen selectively identified in numerous human cancers [1]. Its expression is mechanically associated with the spread of the cancer cells [2]. This stimulates the development of 5T4-targeting drug therapeutics in preclinical and clinical stages. The aim of current study was to develop a 5T4-specific PET tracer based on a camelid-derived single chain antibody (VHH). ***Materials and Methods:*** A VHH library was constructed by camel immunization. Phage display biopanning and periplasmic extract enzyme-linked immunosorbent assay (ELISA) were carried out to evaluate the specificity of the VHHs toward 5T4. [68Ga]Ga-NOTA-H006 was labeled via the conjugation of 1,4,7-triazacyclononane-1,4,7-triacetate (NOTA) to the selected VHH. The radiotracer was investigated on 5T4 antigen to determine the binding affinity. Biodistribution and MicroPET/CT imaging studies were performed at 30, 60 and 90 min post-injection using nude mice bearing BxPC-3 or MDA-MB-468 xenograft. ***Results:*** A library with a capacity of 1.2 x 1012 colony-forming units was built following successful camel immunization. VHH encoded H006 with a median effect concentration (EC50) of 0.16 nM was selected. After conjugation, [68Ga]Ga-NOTA-H006 with the molar activities of 6.48-54.2 GBq/μmol was prepared with high radiochemical purity (>98%). The radiotracer was stable (RCY>95%) in the final formulation up to 2h storage at room temperature, and it displayed low nanomolar affinity towards 5T4 antigen in vitro. MicroPET/CT revealed a clear visualization of BxPC-3 and MDA-MB-468 xenografts in nude mice. The tissue distribution of [68Ga]Ga-NOTA-H006 showed specific accumulation in BxPC-3 xenografts (3.78 ± 1.37% ID/g at 30 min post-injection) which declined over time (1.86 ± 0.39% ID/g at 90 min post-injection). The slice cut from BxPC-3 xenograft was then confirmed to be 5T4 antigen positive using immunohistochemical

staining. ***Conclusion:*** [68Ga]Ga-NOTA-H006 was successfully developed and its 5T4-specificity was confirmed in vitro and in vivo. This offers opportunities for future studies to image the pathological expression of 5T4 oncofetal antigen in cancer patients. An investigator initiated trial is ongoing to explore the utility of [68Ga]Ga-NOTA-H006 in clinic, together with its kinetics in terms of tumor imaging quality and dosimetry in cancer patients (NCT06162988). ***References:*** [1] Hole et al. Int J Cancer. 1990;45:179-84[2] Southgate et al. PLoS One. 2010;5.

OP-342

Development of an Estrogen-related Receptor Gamma (ERRγ) Targeting PET Tracer for Inflammation Imaging

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Aim/Introduction: Estrogen-Related Receptor gamma (ERRγ) has been focused as a novel target for treating inflammation because it plays an important role in various metabolic disorders such as hepatic gluconeogenesis, microbial infection, and type 2 diabetes. A derivative of 4-hydroxytamoxifen, DN200434, is a highly potent and selective inverse agonist to ERRγ (1, 2). Positron emission tomography (PET) imaging technique is a promising tool for diagnosis of diseases noninvasively. In this study, we aimed to develop a DN200434 derivative PET tracer [18F] DN202716 for inflammation imaging. ***Materials and Methods:*** The precursor which had a tosyl living group was reacted with 18F in presence of K222 and K2CO3 in DMSO at 120℃ for 20 min, and then TFA was added to deprotect MOM. The reaction mixture was purified using semipreparative HPLC, and the purity and molar activity of the product was measured by analytical HPLC. The final product was formulated to 5% ethanol in saline solution. In Vitro cell binding assay was conducted in LPS-treated Raw 264.7 cells. Biodistribution study was performed in CPA1 mutated mice (5-weeks-old male mice for acute inflammation model, and 10-weeks-old male and female mice for chronic inflammation models), a PET image was acquired in thigh inflammation-induced C57BR/6 model mouse using turpentine oil. ***Results:*** [18F] DN202716 showed 11.0% of radiochemical yield and over 95% of radiochemical purity. Thee molar activity was 54.1 GBq/μmol. [18F]DN202716 had high stability (over 96%) in both mice and human serum for 3 hours. [18F]DN202716 binding in LPS-treated cells was 2.2-fold higher than in normal cells. In PET images, we found the uptake of [18F]DN202716 in inflammatory right thigh. The mean ROI value of the right thigh was 1.72-fold higher than the ROI of normal left thigh. The biodistribution results showed the increased uptake of [18F]DN202716 in liver, intestine, pancreas, and kidney which are known as ERRγ-expressed organs (3) in all inflammation-model groups than in normal group. ***Conclusion:*** We successfully synthesized an ERRγ targeting PET tracer [18F] DN202716 and analyzed it in vitro and in vivo. This tracer showed increased uptake to ERRγ induced cells and inflammatory regions in animal study. From these results, we expected that the [18F] DN202716 would be a novel PET imaging tracer for inflammation diagnosis. ***References:*** (1) Kim J, Woo SY, Im CY, et al. J Med Chem 2016;59:10209-27.(2) Singh TD, Song J, Kim J, et al. Clin Cancer Res, 2019;25:5069-81.(3) Heard, D.J.; Norby, P.L.; Holloway, J.; Vissing, H. Mol. Endocrinol. 2000, 14, 382-392.

OP-343

One for all: core-radiolabeled nanomaterial as platform for multimodal imaging and therapy

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Aim/Introduction: An important part of making new radiometal tracers is creating an effective chelate. A good chelate should have excellent in vivo stability, the ability to easily conjugate with biomolecules, and a wide range of radiometals that can be used. In this study, we focus on the potential of extremely small iron oxide nanomaterials (IONP) as universal "chelators" for both diagnostic and therapeutic radiometals.[1] ***Materials and Methods:*** For the synthesis of single- and double-doped xxM-IONPs, a fast microwave-driven methodology was used. The synthesis was carried out at 100 °C within 10 min and nanoradiotracers were subsequently purified using size-exclusion chromatography. [2] The radiolabeling yield, radiochemical purity, and stability in human serum were evaluated for all synthesised nanotracers. In vivo multimodal imaging was conducted with double doped 68Ga177Lu-IONP, these nanoparticles were injected into healthy mice, and PET/SPECT/CT images were acquired 1 h post-injection. MRI phantoms of 68Ga177Lu-IONP were created to demonstrate the possibility of performing non-nuclear imaging simultaneously with these nanosystems. 177Lu-IONP were used for intratumoral treatment of glioblastoma in a mouse model. ***Results:*** Nine different radiometals were integrated into the core of the nanoparticles. These incorporated isotopes cover the full spectrum of possible uses in nuclear medicine, including 68Ga, 67Ga, 111In, 201Tl, 99mTc, 64Cu, 89Zr, and therapy with 223Ra and 177Lu. The capability of IONP to incorporate several radiometals simultaneously allows for the use of these nanoparticles not only as imaging probes in nuclear medicine, but also as theranostic agents and hybrid probes. The PET/SPECT images obtained using the selected 68Ga177Lu-IONP NPs showed that the signal efficiency was not diminished by the presence of another emitter in the core of the nanoparticle. Finally, we ran a pilot study on the ability of the 177Lu-IONP as therapy against glioblastoma after intratumoral injection, results show how tumour growth is stopped after nanotracer injection. ***Conclusion:*** We carried out a systematic study on the radiometal core doping of iron oxide nanoparticles. Nine different radioisotopes were successfully incorporated, and double doping was demonstrated to be feasible, including isotopes such as 177Lu and 223Ra.The in vivo dual imaging behaviour and efficiency were assessed with 68Ga177Lu-IONP, which is suitable for being used for theranostic purposes. Finally, we demonstrated the therapeutic potential of this approach using a glioblastoma model. ***References:*** [1] Sneddon, Deborah, Current Opinion in Chemical Biology, 2021/ Vol 63, 152-162.[2] Pellico, Juan, et al. ACS Appl. Mater. Interfaces, 2021/13 38, 45279-45290.

OP-344

Development of a Novel Small-Molecule Radiopharmaceutical Pair for Theranostics Targeting Metabotropic Glutamate Receptor 1 in Melanoma

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Aim/Introduction: Metabotropic glutamate receptor 1 (mGluR1), a key player in glutamatergic signaling, is frequently overexpressed in human tumors,including melanoma, while being absent in normal peripheral organs.1 This makes mGluR1 a promising target for cancer theranostics.2 Here, we designed and developed a novel small-molecule radiopharmaceutical pair, 3-iodo-N-[4-[6-(methylamino)pyrimidin-4-yl]-1,3-thiazol-2-yl]-N-[^{11}C]methylbenzamide ([^{11}C]1) and 3-211At-astato-N-[4-[6-(methylamino)pyrimidin-4-yl]-1,3-thiazol-2-yl]-N-methylbenzamide ([211At]1), for theranostic applications in melanoma. ***Materials and Methods:*** [^{11}C]1 was synthesized by reacting a N-desmethyl precursor with [^{11}C]CH3OTf in the presence of NaOH at room temperature for 5 min. Radiolabeling of [211At]1 was achieved by reaction of aryl tin precursor with NCS-containing 211At/MeOH solution. The theranostic potential of the radiopharmaceutical pair was explored for PET imaging and radiotherapy in mGluR1-expressing B16F10 melanoma-bearing mice. ***Results:*** [^{11}C]1 and [211At]1 were obtained with a radiochemical purity of greater than 99% and radiochemical yields of 18.9 ± 5.0 % and 41.2 ± 2.2 %, respectively, based on the total radioactivity of used radionuclides. In vivo PET imaging of [^{11}C]1 clearly visualized the targeted melanomas with good tumor-to-background contrast. Ex vivo biodistribution study confirmed the sustained accumulation of [^{11}C]1, reaching 12.29 ± 2.44 %ID/g tissue at 90 min in the melanomas, with rapid clearance from nontarget organs post injection. In the therapeutic studies, [211At]1 exhibited significant and durable antitumor efficacy with a single treatment (2.96 MBq) in the melanoma model, compared to the controls (0.38 ± 0.02 cm3 vs. 7.88 ± 1.28 cm3 at 13 days post-therapy). No significant changes in body weight, liver function, or kidney function were observed throughout the examination period in melanoma mice injected with 2.96 MBq of [211At]1. ***Conclusion:*** The novel small-molecule radiopharmaceutical pair successfully visualized mGluR1-expressing melanomas using [^{11}C]1 with high contrast PET images, and further treated by [211At]1 without significant toxicity. These results highlight the potential of [^{11}C]1 and [211At]1 as theranostic agents for managing mGluR1-expressing tumors, warranting further investigation in clinical oncology theranostics. ***References:*** 1. Pollock PM, et al. Nat Genet. 2003; 34:108-112. 2.Xie L, et al. Cell Rep Med. 2023;4:100960.

OP-345

An [^{18F}]trifluoroborate-derived BPA ([^{18F}]BBPA) for preclinical boron neutron capture therapy

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Aim/Introduction: Boron amino acids (BAAs), which uniquely replace the traditional carboxyl group (-COOH) with a trifluoroborate group (-BF3), facilitate the dual use of ^{18}F-labeled positron emission tomography (PET) and boron neutron capture therapy (BNCT) while maintaining an identical chemical structure, differing only in the isotopic form of fluorine used. Trifluoroborate-derived boronophenylalanine (BBPA), a derivative of boronophenylalanine (BPA), has shown potential for replicating the biodistribution characteristics of BPA due to its transportation via the large neutral amino acid transporter type-1 (LAT-1). This study aims to expand on previous research by comprehensively synthesizing and developing BBPA for application in PET-guided BNCT and standalone BNCT, testing its efficacy and boron delivery efficiency in preclinical settings. ***Materials and Methods:*** BBPA was synthesized as a derivative of BPA, incorporating two boron atoms to enhance boron delivery efficiency. Preclinical imaging studies were conducted to assess tumor uptake and boron concentration in tumor tissues using B16-F10 tumor-bearing mice. Different doses of BBPA and BPA were intravenously injected into these mice. The concentration of boron in tumor tissues was quantitatively measured, and the tumor response to BNCT treatment was compared between BBPA and BPA. ***Results:*** Clinical studies highlighted the superior tumor uptake of [^{18F}]BBPA-PET, showing a remarkable tumor-to-normal brain ratio (T/N ratio, 18.7 ± 5.5, n = 11), which exceeds that of common amino acid PET tracers. This has led to [^{18F}]BBPA receiving FDA and CFDA approval for clinical trials. In preclinical studies, BBPA exhibited higher tumor boron concentrations compared to BPA, with 17.4 ± 3.4 ppm achieved at a dose of 250 mg/kg of BBPA versus only 7.6 ± 1.2 ppm with the same dose of BPA. BBPA-based BNCT demonstrated excellent therapeutic effects, significantly inhibiting tumor growth with lower doses compared to BPA, indicating that BBPA could potentially require reduced dosages in clinical settings, enhancing treatment efficacy and patient safety. ***Conclusion:*** In conclusion, this study not only marks a significant stride in the synthesis and development of a novel BAA but also underlines its potential as a dual-function theranostic agent for both PET imaging and BNCT. The dual functionality of BBPA, combined with its effective targeting and retention in tumor tissues, firmly establishes it as a promising candidate in the realm of oncological theranostics. The outcomes of this research are poised to make a substantial impact on precision medicine in cancer therapy, offering new avenues for enhanced patient care and outcomes.

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[^{177}Lu]Lu-labelled DOTA-MGS5: radiopharmaceutical formulation and dosimetry evaluation for clinical application

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Aim/Introduction: DOTA-MGS5 is a new minigastrin analogue that exhibits improved tumour-to-kidney ratio and in vivo stability, making it a promising candidate for targeting cholecystokinin-2 receptor (CCK2R) expressing neoplasms such as medullary thyroid carcinoma (MTC) and small cell lung cancer (SCLC). For clinical translation of peptide receptor radionuclide therapy with [177Lu]Lu-DOTA-MGS5, an automated synthesis procedure was established and preclinical tests were performed for the radiopharmaceutical formulation. Based on these studies a first in-human dosimetry study could be performed allowing a preliminary dosimetric evaluation. ***Materials and Methods:*** The radiolabelling process was validated using a cassette-based synthesis module, DOTA-MGS5 in GMP quality and a no-carrier added [177Lu]LuCl3 produced from highly enriched ytterbium-176. Product specifications and analytical procedures were defined according to the European Pharmacopoeia monographs available for other radiopharmaceuticals. Biodistribution studies with the radiopharmaceutical formulation were carried out in female BALB/c nude mice xenografted with A431-CCK2R cells. Preclinical dosimetry studies were conducted

to extrapolate dosimetry estimates for dose-limiting organs in humans. A first dosimetry study using [177Lu]Lu-DOTA-MGS5 (1500 MBq, <100 µg) was carried out in a patient with advanced SCLC to evaluate the feasibility of peptide receptor radionuclide therapy (PRRT). ***Results:*** The cassette-based production of [177Lu]Lu-DOTA-MGS5 with a molar activity of >30 MBq/µg resulted in a high radiochemical purity (RCP) of >98%. The final product showed high stability over time, with RCP >96% up to 24 hours after synthesis. The new radiopharmaceutical demonstrated a favourable biodistribution profile in A431-CCK2R xenografted BALB/c nude mice. A high uptake of 31.9±12.8% was confirmed in A431-CCK2R xenografts at 4h p.i. combined with low accumulation of radioactivity in non-target tissues resulting in a tumour-to-kidney ratio >10 and a tumour-to-stomach ratio >6. Pharmacokinetic data obtained in mice and dosimetry extrapolation from mice to humans supported the feasibility of PRRT. In the preliminary patient-specific dosimetry study calculated from the 3D SPECT/CT data up to 4 d p.i. and serial blood sampling up to 2 d p.i., a low risk of kidney and bone marrow toxicity (absorbed doses of <1 Gy/GBq and <0.03 Gy/GBq, respectively) was shown and an absorbed dose >10 Gy/GBq was calculated for tumour lesions. ***Conclusion:*** Various results from preclinical testing support the clinical translation of [177Lu]Lu-DOTA-MGS5 in patients with CCK2R-expressing neoplasms. In the preliminary patient dosimetry performed in a patient with SCLC, a high tumour dose and low radiation burden to non-target tissue were demonstrated, allowing the start of fractionated therapy with [177Lu]Lu-DOTA-MGS5.

OP-347

Harvesting [^{68}Ga]GaCl$_3$ from solid and liquid targets: a versatile and high-yielding cassette-based process

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Aim/Introduction: In response to a growing demand for Gallium-68, its cyclotron-mediated production from solid and liquid Zinc-68 targets is gathering increased interest. This methodology allows generating the nuclide in greater quantities than those afforded by Germanium-68 generators (< 2.0 GBq), reducing the cost per dose and resulting in more patients diagnosed. Cyclotron-produced Gallium-68 is usually extracted from the target in a matrix of nitric acid and [68Zn]Zn(NO3)2. Post-irradiation, Gallium-68 must therefore be separated from unwanted impurities (mainly Zinc-68) and formulated in a solution suitable for radiolabelling purposes. We herein report a fully industrialized, high-yielding method for the purification process of [68Ga]GaCl3 from liquid and solid target crudes on a miniAllinOne synthesis module.1 ***Results:*** The process occurs as follows. The dissolved target crude is buffered and passed through two different strong-cation-exchange cartridges in a trapping-elution sequence, ensuring the separation of the nuclide of interest from the parent Zinc-68 and other metallic impurities. The obtained solution complies with monograph 3109 of the Eur. Ph., and its formulation in 5.0 mL 0.1N HCl makes it compatible with existing labeling methodologies. The dissolution of the solid target is an automated feature whenever applicable, for extra 15 minutes of processing. The decay losses of this increased timing are largely compensated by the greater activities of Gallium-68 that solid target irradiation can afford. The resulting plug-and-play process allows the isolation of pure [68Ga]GaCl3 in 18 minutes with uncorrected yields up to 75% (tested up to an output of 10 GBq). After completion of the purification process, recycling of the parent nuclide Zinc-68 is also made possible through its collection in a vial separate from main wastes. ***Conclusion:*** A fully automated process and a set of consumables have been developed for the purification of cyclotron-produced Gallium-68 on the miniAllinOne. This readily available kit is compatible with solid and liquid targets from any supplier, and allows Zinc-68 recovery while delivering state-of-the-art yields of [68Ga]GaCl3 in full compliance with applicable regulations. By setting a new standard in terms of versatility, ease of use and production yields, this process paves the way for a convenient use of cyclotron-produced Gallium-68 in routine clinical practice. Validation of this process at greater activities (> 10 GBq) is ongoing. ***References:***

[1] Patent International Publication Number WO2020/118426 A1.

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Monday, October 21, 2024, 09:45 - 11:15
Hall Y4-Y9

Cutting Edge Science Track - TROP Session: Dosimetry Committee: Advancements in Clinical Dosimetry

OP-348

Bone Metastases Model for Red Marrow Dosimetry during ^{177}Lu-DOTATATE Treatment

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Aim/Introduction: Treatment with 177Lu-DOTATATE is generally well tolerated, though bone marrow toxicity can become dose-limiting and persisting. A difficulty in measuring the activity concentration in the bone marrow arises from the existence of infiltrating bone metastases. This study introduces a method for estimating the dose contribution from infiltrating bone metastases to the absorbed dose to the red marrow. ***Materials and Methods:*** 48 patients treated with 177Lu-DOTATATE at Sahlgrenska University Hospital were included in this study. The absorbed doses to the red marrow were calculated using a hybrid planar and SPECT-image methodology and an incorporated compartment model to estimate the specific and nonspecific activity concentration in the red marrow and in infiltrating bone metastases. To identify patients exhibiting notably high uptake from bone metastases, a ratio was calculated between the SPECT uptake in the lumbar vertebrae and the nonspecific activity concentration at 24-hour image. For these patients, a bone metastases model was used to assess the dose contribution from infiltrating metastases. ***Results:*** The median absorbed dose to the red marrow after the first treatment cycle in patients with bone metastases was 0.37 Gy/7.4 GBq (range, 0.29-0.68) using the bone metastases model, and 0.46 Gy/7.4 GBq (range, 0.15-1.55) without the bone metastases model. The median absorbed dose for all patients was 0.35 (0.15-0.74) Gy/7.4 GBq after treatment cycle one, utilizing the bone metastases model. The absorbed dose was significantly correlated to the response of platelets and became stronger when incorporating the bone metastases

model. ***Conclusion:*** A compartment model assessed specific and nonspecific uptake activity concentrations to estimate the absorbed dose to the red marrow. Using the bone metastases model to evaluate the dose contribution from bone metastases in patients with high uptake resulted in stronger correlations between absorbed dose to the red marrow and platelet response. This highlights the need and possibility of bone metastases modelling.

OP-349

Optimizing ^{225}Ac SPECT acquisition times by using a sparse view imaging protocol: a feasibility study

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Aim/Introduction: Post-therapeutic SPECT can provide valuable information for dosimetry and response assessment following [225Ac]Ac-PSMA therapy. However, our current 1 hour imaging protocol is challenging for some patients due to severe skeletal pain. As sufficient acquisition time per projection is essential to get a measurable signal above the background level, an alternative option to reduce the overall SPECT acquisition time could be to reduce the number of projections to a necessary minimum, optimized with regard to the desired quantitative accuracy and resolution. ***Materials and Methods:*** A total of five patients injected with 7.7±0.2 MBq of [225Ac]Ac -PSMA-I&T were analyzed. All patients underwent two post-therapeutic SPECT/CT acquisitions at 24 and 48 h post-injection on a Siemens Symbia Intevo T16 system equipped with a HEGP collimator (32 projections per head, 128x128 pixel, 210 s per projection). The acquired SPECT scans were used to create two datasets. One dataset included all 32 projections (1 h acquisition time), while the other dataset included only half of the projections (16 projections and 30 min total acquisition time). Quantitative SPECT reconstructions for both, the 440 keV and 218 keV photopeaks, were carried out via an in-house MAP-EM, including CT-based attenuation correction, resolution modelling and transmission-dependent scatter correction. The RBE-weighted (RBE=5) absorbed doses for kidneys (n=9, segmented using CT) and lesions (n=9, isocontour of 80% of a peak VOI at 24 h post-injection) were calculated using a mono-exponential fit and local dose deposition for both 213Bi (440 keV) and 221Fr (218 keV). ***Results:*** The RBE-weighted absorbed doses for the 1 h SPECT were higher for both photopeaks and regions compared to an acquisition time of 30 min (440 keV: kidneys: +2.6±7%, lesions: +11.7±13%; 218 keV: kidneys: +1.1±7%, lesions: +3.7±16%). For 8 out of 9 kidneys, the differences in the absorbed doses were less than 8% between 1 h and 30 min acquisition time for both photopeaks. For only 2 (440 keV) and 4 (218 keV) out of 9 lesions, the difference in the absorbed doses were less than 10% between 1 h and 30 mins. ***Conclusion:*** Halving of the acquisition time for 225Ac SPECT by using a minimum number of projections may be suitable for the kidneys (differences mostly within 10%), which represent an important risk organ. However, results from this analysis indicate 32 projections being superior over 16 projections for smaller target volumes like lesions.

OP-350

The Impact of Assumptions on Kidney Absorbed Doses When Modelling Redistribution of Daughters for Alpha-Emitter Based Somatostatin Receptor Therapies

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Aim/Introduction: Kidney absorbed doses can be simulated for potential alpha-emitter based somatostatin receptor therapies by using data from patients undergoing [177Lu]Lu-DOTATATE therapy and modelling daughter redistribution. Here, we investigate the impact of various assumptions for initial conditions of the biokinetic models for 225Ac, 227Th, 212Pb, 212Bi, and 213Bi by change in kidney absorbed doses. ***Materials and Methods:*** Probe measurements at five time-points post-injection of nine patients undergoing [177Lu]Lu-DOTATATE therapy were used to estimate whole body (WB) time-integrated activity coefficients (TIACs). TIACs for kidneys, tumours, livers, and spleens were estimated from four post-therapy SPECT/CT images per patient. All TIACs were adjusted for the physical half-lives of 225Ac, 227Th, 212Pb, 212Bi, and 213Bi. All alpha decays and 36% of 212Pb decays were assumed to release daughters from the chelator, and ICRP biokinetic models for simulating all daughters' redistributions were run in Simbiology (MATLAB v2023b, MathWorks). For the base model, kidney TIACs were put in the 'Other kidney tissue' compartment, tumours TIACs were put in a compartment exchanging daughters with plasma at the rate of 'soft tissues with slow turnover', spleen TIACs were put in the spleen compartment, and liver TIACs were put in the 'Liver 1' compartment. The remaining WB TIACs were split between the soft tissue compartments exchanging daughters with plasma with fast and intermediate turnover according to the fast and slow exponentials in the fitted time-activity curve. Free daughters released before injection were put in the 'Plasma' compartment and the amount was based on a parent half-life passing between production and injection. The models were rerun when altering these initial conditions and the resulting kidney absorbed doses were compared. ***Results:*** Removing free daughters from the injection on average decreased kidney absorbed doses by 3%, 53%, 20%, 0.2%, and 7% for 225Ac, 227Th, 212Pb, 212Bi, and 213Bi, respectively. For 227Th, moving kidney TIACs from 'Other kidney tissue' to 'Urinary path' on average increased the absorbed kidney doses by 164%. Otherwise, only relocating the remaining WB TIACs changed the average kidney absorbed doses by more than 3%. Relocating remaining WB TIACs minorly affected the result for 227Th, 212Bi, and 213Bi (<4%), but it changed the average kidney absorbed doses from the base model by -6% to 37% for 225Ac and by -24% to 36% for 212Pb. ***Conclusion:*** Assumptions made when modelling daughter redistribution can majorly impact absorbed dose estimates and should be considered carefully.

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Comparing the Impact of Dosimetry at Different Scales for Alpha and Beta Emitters in Molecular Radiotherapy Using Monte Carlo Simulations

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Aim/Introduction: Heterogeneous uptake of radiopharmaceuticals in the kidneys can result in heterogeneous irradiation of kidney structures with varying radiation sensitivities. We investigated the alpha and beta kidney absorbed dose distributions at different scales for therapies with 90Y, 177Lu, 212Pb, and 225Ac, calculated S-factors, and applied them based on data from patients receiving 177Lu-DOTATATE therapy. ***Materials and Methods:*** Three kidney models were created, at the whole kidney, cortex-medulla, and nephron scale. 68Ga-DOTATOC PET/CT images from 5 patients undergoing 177Lu-DOTATATE therapy were used to create the whole kidney and cortex-medulla models. Contrast-enhanced CT images and the PET images were used for modelling renal cortex and medulla. The nephron model consisting of 18 nephrons divided into glomeruli and tubules was created based on information from literature using Blender. Dose deposition for the alpha and beta emissions 177Lu, 90Y, 225Ac, and 212Pb were simulated with GATE. Simulations used all kidney activity in the whole kidney, in only medulla, in only cortex, in only glomeruli, and in only tubules, and S-factors were calculated. Furthermore, the biological uptake and clearance of kidney activity were estimated from four post-therapy SPECT images of the modelled patients. Based on a 68Ga-DOTATOC PET/CT, 80% of the kidney time-integrated activity was put in the cortex for the cortex-medulla model. The simulated kidney activity was adjusted for 90Y, 225Ac, and 212Pb according to their physical half-lives. ***Results:*** General S-factors calculated for the cortex-medulla model are given in Table 1. When applied to DOTATATE therapy, absorbed doses to the whole kidney were (1.7±0.4)×10-3, (4.11.0)×10-4, (4.7±1.4)×10-3, and (8.1±2.3)×10-2 Gy per injected MBq for 90Y, 177Lu, 212Pb, and 225Ac, respectively. Absorbed doses to medulla were (1.72.0)×10-3, (5.06.0)×10-4, (2.61.1)×10-3, and (5.81.8)×10-2 Gy per injected MBq for 90Y, 177Lu, 212Pb, and 225Ac, respectively, and absorbed doses to cortex were (1.30.3)×10-3, (3.11.0)×10-4, (4.53.1)×10-3, and (9.24.8)×10-2 Gy per injected MBq for 90Y, 177Lu, 212Pb, and 225Ac, respectively. ***Conclusion:*** Regions with high activity concentrations receive a higher fraction of the delivered dose for alpha emitters than with beta emitters, as expected. Applied for DOTATATE therapy, if the activity concentration is higher in the medulla as derived from the 68Ga-DOTATOC PET, shorter range alpha radiation will irradiate less of the radiosensitive glomeruli than beta radiation.

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Image-Based Bone Marrow Dosimetry in Patients Undergoing [^{177}Lu]Lu-PSMA Radioligand Therapy

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Aim/Introduction: For patients with metastasized castration-resistant prostate cancer (mCRPC) undergoing [177Lu]Lu-PSMA radionuclide therapy, bone marrow irradiation is a dose-limiting factor [1, 2]. Monitoring of the absorbed dose to the bone marrow is advisable to minimize side effects. However, quantification of the activity concentration in the bone marrow is especially challenging for patients suffering from mCRPC due to the presence of bone lesions and the limited resolution of SPECT imaging. The aim of this study is to investigate the uncertainty of image-based bone marrow activity estimation for [177Lu] Lu-PSMA treatment of mCRPC. ***Materials and Methods:*** Pre-therapeutic [18F]F-PSMA-1007 PET images of 175 patients prior to the first cycle of [177Lu]Lu-PSMA treatment were used to generate virtual patient phantoms with realistic bone lesions. To define the bone lesions, segmented (using TotalSegmentator [3]) CT images were registered to the PET images, an SUV threshold of 2 was applied to bones to remove non-specific uptake, followed by Otsu thresholding within the bone compartment. Two criteria were used for patient and lesion selection: the minimum volume per lesion was set to 1 ml and the minimum total lesion volume was set to 10 ml. These virtual phantoms were filled with the expected activity concentrations at 24 h p.i. in bone lesions, kidneys, and background compartment, as extracted from SPECT images of five patients after the first treatment with 7.4 GBq [177Lu]Lu-PSMA-I&T. These activity maps and density maps derived from the patient CT were used to simulate SPECT projection data with SIMIND [4]. An in-house MAP-OSEM algorithm with attenuation correction, scatter correction and Gaussian resolution modelling enabled was used to reconstruct the SPECT images. ***Results:*** As expected, the recovery coefficient (RC) in the bone lesions strongly depends on the lesion volume and shape. For an exemplary virtual patient, the RC varied between 11% and 66% for lesions with a volume between 1 ml and 15 ml. In contrast, the RC for the bone marrow compartment in the vertebrae S1, L5-L1, T12-T1, and C7-C1 was found to be 182%. ***Conclusion:*** The preliminary results indicate a significant overestimation of the bone marrow activity in the presence of bone metastases. Ongoing work is currently being done to find and compare methods for a more accurate estimation of bone marrow activity. ***References:*** [1] DOI: https://doi.org/10.1186/s13550-019-0548-z[2] DOI: https://doi.org/10.2967/jnumed.118.225235[3] DOI: https://doi.org/10.5281/zenodo.6802613[4] DOI: https://doi.org/10.1016/0169-2607(89)90111-9.

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Predicting cycle 1 salivary gland absorbed dose before ^{177}Lu-PSMA-617 radioligand therapy using pre-therapy ^{68}Ga-PSMA-11 PET uptake metrics

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Aim/Introduction: Xerostomia associated with absorbed dose (AD) to salivary glands is a concern during PSMA radioligand therapy (RLT). We aimed to predict cycle 1 AD to salivary glands from 68Ga-PSMA-11 PET uptake metrics. ***Materials and Methods:*** Sixteen patients undergoing standard 7.4 GBq 177Lu-PSMA-617 RLT received SPECT/CT imaging at 3-4 timepoints post- cycle 1. Baseline 68Ga-PSMA-11 PET/CT scans were available per standard clinical protocol. Two methodologies were used for salivary gland segmentation and 177Lu dosimetry. 1) Deep-learning (DL) / Monte Carlo (MC): DL tools were used to separately segment parotid and submandibular glands on CT of PET/CT and SPECT/CT. Voxel-level dosimetry included MC-based dose-rate estimation and dose-rate fitting/integration. 2) Thresholding/S-value: semi-automated PET (SPECT) thresholding was used to segment parotid and submandibular glands. PET (SPECT) threshold values of 50% (37%) and 48% (51%) of maximum for parotid and submandibular glands were determined from 68Ga and 177Lu phantom experiments. Organ-level dosimetry included time-activity fitting and S-value from ICRP 89, which

PET activity concentration (Bq/mL) exceeding the mean served as a predictor for a binary outcome classifier (defined as AD exceeding the mean) and was tested using leave-one-out cross-validation (LOOCV). ***Results:*** Cycle 1 mean ADs to parotid, submandibular, and combined salivary glands were 3.0±1.6 Gy, 3.9±2.3 Gy and 3.2±1.6 Gy, respectively from the DL/MC method, while mean AD to salivary glands from the thresholding/S-value method was 2.7±1.7 Gy. The correlation with mean AD was stronger when using PET activity concentration compared with using SUV metrics (mean/peak/max). With the DL/MC method, the mean cycle AD to parotid ($r=0.86$; $p<0.001$), submandibular ($r=0.61$; $p<0.001$) and salivary glands ($r=0.81$; $p<0.001$) showed a significant correlation with PET activity concentration. Mean AD to salivary glands was also significantly correlated with the PET activity concentration ($r=0.75$; $p<0.001$) using the thresholding/S-value method. The LOOCV results for prediction of AD gave an area-under-the-curve of 0.88 (sensitivity=0.79; specificity=0.64) for DL/MC and 0.93 (sensitivity=0.98; specificity=0.75) for thresholding/S-value. ***Conclusion:*** A moderately-strong correlation was obtained between AD to salivary glands and activity concentration on pre-therapy 68Ga-PSMA-11 PET, which was robust across different segmentation approaches and AD calculation methods. Following independent validation, such models for predicting ADs pre-therapy may enable patient-specific planning of RLT, which is especially important when considering dose escalation.

OP-354

Lu177 Radioligand therapy: Potential for Modifying Administered Activity to Maximize the Probability of Complication Free Tumor Control

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Aim/Introduction: Therapeutic Index (TI=tumor-to-kidney absorbed dose (AD) ratio) has been reported to decrease with subsequent cycles for PSMA-617 radioligand therapy (RLT), which suggests administering more activity initially for improved outcomes. However, the utility of such TI is unclear in terms of response or toxicity. Tumor control probability (TCP) and normal tissue complication probability (NTCP) models are sigmoidal curves ranging from 0-1 in a dose domain generated from clinical data. Complication-free TCP can be estimated as P+=TCP(1-NTCP) as proposed for external-radiotherapy. For example, a TI of 10 may represent tumor/kidney AD ratios of 0.1Gy/0.01Gy, 40Gy/4Gy, or 1000Gy/100Gy; for these ADs, P+ will be ~0 (TCP~0,NTCP~0) , 1 (TCP~1,NTCP~0), and 0 (TCP~1,NTCP~1), respectively. The goal is to report TCP, NTCP, and P+ using clinical RLT data, and then for a hypothetical optimal treatment, adjust patient cycle 1 administered activity (AA) to demonstrate potential to maximize P+. ***Materials and Methods:*** 18 patients received multiple time-point SPECT/CT-dosimetry after their first cycle of PSMA-617 RLT at University of Michigan. Whole body tumor volume (WBTV) was segmented with a 5Gy threshold applied to the Monte Carlo-generated AD map. Kidneys were segmented via deep learning and biological effective dose (BED) was calculated following Baechler (MedPhys 2008) and scaled assuming 6 cycles. Kidney NTCP was taken from MIRD pamphlet 20. Michigan WBTV absorbed dose (WBTVAD) and corresponding PSA response (50% decline) were combined with Violet et al (JNM 2019) WBTVAD and PSA responses for 47 total observations. Logistic regression was performed to create TCP. The clinical WBTVAD and kidneyBED were used to calculate TCP, NTCP, and P+ . A hypothetical AA was then set to maximize P+ for each patient. Changes between the hypothetical and clinical results are summarized. ***Results:*** For clinical data the avg+-std for TCP, NTCP, P+, WBTVAD, kidneyAD and AA was 0.40+-0.33, 0.06+-0.23, 0.39+-0.34, 13.3+-8.6Gy, 3.3+-2.1Gy and 7.20+-0.16 GBq, respectively. After retrospectively selecting AA to maximize P+ the TCP, NTCP, P+, and AA was 0.70+-0.35, 0.04+-0.05, 0.68+-0.36, and 13.5+-6.0 GBq, respectively. Maximizing P+ increased AA in 17/18 patients. The TCP, NTCP, P+, and AA change was +28%, -2%,+29%, and +85%, respectively. TI did not change as AA scaled assuming no saturation effects. ***Conclusion:*** Maximizing P+ increased AA and TCP and decreased NTCP, while TI remained constant. When designing optimal RLT protocols, complication free tumor control should be considered rather than TI alone. Future work should investigate additional TCP endpoints and include marrow NTCP.

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Inter-center variability of dosimetry methodology and the impact on reported absorbed dose for [^{177}Lu]Lu-PSMA.

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Aim/Introduction: As [177Lu]Lu-PSMA is increasingly being used, standardization of dosimetry methodology is crucial to make absorbed dose (AD) outcomes more comparable across institutions and trials. Methodologies to determine AD vary widely. Therefore, we aim to highlight potential variability and identify the main contributing factors. ***Materials and Methods:*** Ten patients with oligometastatic hormone-sensitive prostate cancer underwent 5 timepoint SPECT/CT imaging after administration of 3 GBq [177Lu]Lu-PSMA-617. All data were collected and reconstructed at a single center and shared with two other centers with extensive dosimetry experience. Each center performed dosimetry calculations according to local practice. To compare differences in AD between centers the coefficient of variation (CV) was computed for every patient in each region (kidneys, salivary glands, liver and tumor lesions (n=21)). After harmonizing volumes, activity delineation and time-activity curve (TAC) fitting methods, the change in mean CV between centers was compared to determine the impact on AD variability. ***Results:*** The mean lesion AD across all centers was 13.7 Gy with a mean CV between centers of 63.0% (range: 14.3%-113.6%). The mean AD per center is reported in Table 1. Likewise, for the kidneys, salivary glands and liver the mean AD across all centers was 1.9, 2.2 and 0.4 Gy respectively, the mean CV between centers was 16.9% (range: 8.1%-25.7%), 36.4% (range: 12.2%-52.9%), and 23.5% (range: 9.8%-42.2%) respectively. After homogenizing the organ and lesion volumes across all centers (Table 1), the mean CV decreased to 37.0% for lesions and decreased to 33.8% for the salivary glands. The mean CV between centers remained relatively unchanged for the liver at 23.2%, but increased to 22.0% for the kidneys. Data analysis is in progress for homogenization across centers of activity delineation and TAC fitting methods. ***Conclusion:*** Inter-center variability in AD was highest in tumor lesions, followed by

the salivary glands and liver, while the kidneys showed the most agreement across centers. The variability in lesions and, to a lesser extent, in the salivary glands, is partly explained by challenging volume determination, as volume homogenization resulted in a decrease in CV for these regions. For larger regions, such as the liver and kidney, volume determination does not explain the differences in AD and even resulted in an increase in the mean CV for the kidneys, suggesting that the AD variability in these regions is primarily due to other factors (likely activity delineation and TAC fitting). Evaluation of these factors is currently ongoing.

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Evaluation of Different Segmentation Methods for Lesion Dosimetry in mCRPC Patients Treated with ^{177}Lu-PSMA-617: Experience from the Canadian Cancer Trial Group PR.21 Trial (NCT 04663997)

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Aim/Introduction: Lesion dosimetry in radiopharmaceutical therapies (RPTs) is challenging due to the difficulties in segmentation to determine both the true mass and activity of each lesion. A robust and simple segmentation method is crucial to determine absorbed dose (AD)-response relationships. We aim at finding a method to track dosimetry of qPSMA-determined tumor burden at the per-patient level for tumour dosimetry in 177Lu-PSMA-617 therapies of metastatic castration resistant prostate cancer (mCRPCa) patients. ***Materials and Methods:*** Ten mCRPCa patients treated with 177Lu-PSMA-617 were included in this study, each had prior PET/CT and two post-therapeutic SPECT/CTs. A reference segmentation method (method I) was established using qPSMA segmentation approach based on liver uptake and noise on 68Ga-PSMA-11 PET/CT and refined by manual adjustments by a nuclear medicine physician. The total tumour mass (TTM) was estimated from volume assuming unit density. Activity was quantified for each lesion with partial volume correction using simulated recovery coefficients (RCs). Method II used the same TTM; activity was determined by expanding regions by 1 cm in all directions. Methods III, IV, V were segmented on SPECT; both mass and activity were calculated from same VOIs. Method III used a gradient tool, method IV involved the qPSMA approach on SPECT, method V used threshold above 25% of SUVmax determined for the Whole Body. We performed monoexponential fitting and integration for each lesion to get Time-Integrated Activity coefficients (TIACs) and used OLINDA/EXM with spherical models and mass scaling to estimate ADs. We compared TTM, TIAC, and AD for each method against the reference method using mean square difference (MSD) and assessed their correlation. ***Results:*** Method II gave MSDs of 95.9 for TIAC assessment and 1.8 for AD. Method III showed MSDs of 28090.5 for TTM, 2.6 for TIAC, 3.4 for AD. Method IV gave MSDs of 175560.9 for TTM, 34.4 for TIAC, 3.6 for AD. Method V resulted in MSDs of 1123182.8 for TTM, 22.6 for TIAC, and 2.2 for AD. Method II had the strongest correlation with Method I (the reference) with 0.93, followed by Method III at 0.68, Method IV at 0.6, and Method V at 0.56. ***Conclusion:*** Results suggest that Method II can be reliable for tracking dosimetry of qPSMA-determined tumor burden. This method simplifies the process by eliminating the need for RC measurements and allows to identify more lesions by taking advantage of the diagnostic PET. SPECT-derived methods showed poorer correlation with the reference method.

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Monday, October 21, 2024, 09:45 - 11:15
Hall Z

Clinical Oncology Track - Featured Session: Oncology & Theranostics Committee: Haemato - Oncology

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^{18}F-FDG PET/CT imaging biomarkers in patients with Recurrent/Refractary Multiple Myeloma at baseline and post CAR-T Therapy for predicting clinical outcomes.

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Aim/Introduction: To assess the predictive value of 18F-FDG PET/CT imaging biomarkers for patients with recurrent/refractory Multiple Myeloma (RRMM) at pre-CAR-T therapy, and in patient follow-up at 1 and 3-months after the therapy. ***Materials and Methods:*** 69 patients with RRMM treated with Chimeric antigen receptor T-cell (CART-T) therapy from April 2018 to January 2024, were enrolled. Two patients died due to ICANS. Following IMPeTUS criteria, bone marrow (BM) uptake, focal lesions (FL), paramedullary (PMD) and extramedullary disease (EMD) were recorded, considering a Deauville Score (DS) ≥ 4 as positive for any of the mentioned variables. ***Results:*** Tumour burden variables showed impact on progression-free survival (PFS). Patients with positive PET (52 [77.6%]) had significantly inferior PFS (median 8.2 months vs. 27.5; p=0.02). Patients with more than 10 lesions at baseline had significantly inferior PFS (median 7.1 months vs. 22.3; p=0.008) and overall survival (median 23.1 months vs. NR; p=0.003) than those without focal lesions. EMD was associated with worse PFS (median 3.7 months vs. 12; p=0.03). One-month after CAR-T 16/49 (32.7%) patients had complete response by PET (PETCR), and 3-months after CAR-T 15/29 more patients (51.7%) achieved PETCR. Patients without PETCR 1-month after CAR-T had shorter OS (median 13.2 months [95% CI 10.5-15.8] versus NR (p = 0.01); than those with PETCR. Patients without PETCR 3-month after CAR-T had shorter OS (median 7.8 [95% CI 1.2-14.6] versus 25.3 months [95% CI 14-36,6] (p = 0.02); than those with PETCR. Volumetric PET biomarkers MTV >590 and TLG>1640 were associated with lower PFS ([median 3.7 vs. 14.5 months; p=0.02] and [median 3.7 vs. 15.6 months; P=0.005], respectively). ***Conclusion:*** Baseline FDG-PET/CT tumour burden and metabolic response have prognostic value in MMRR patients treated with CAR-T cells. PETCR at 1 and 3 months after CAR-T cells predicts longer OS.

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Validating novel ^{18}F-FDG PET/CT-based approaches in multiple myeloma

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Aim/Introduction: To validate novel approaches to 18F-FDG PET/CT evaluation with respect to clinically relevant parameters in MM. ***Materials and Methods:*** 83 MM patients underwent 18F-FGD PET/CT before treatment in the context of a multicentre, randomized, phase 3 trial (GMMG-HD7). PET/CT data analysis was based on the IMPeTUs criteria, which take into account bone marrow (BM) metabolic status based on the 5-point Deauville score (DS), the number and metabolic status of focal 18F-FDG-avid lesions, paramedullary disease, extramedullary disease, number of osteolysis and presence of fractures. Low-dose CT data were further evaluated according to the degree of medullary density in the appendicular skeleton based on two novel approaches: the first approach measured CT values (CTv) over the site with the highest HU in all humeri and femurs. The second approach was based on automatic digital quantification of CT data to determine the proportion of voxels affected by plasma cell infiltration in humeri and femurs (cCTv). Correlation analysis was performed between imaging, histopathological, cytogenetic and clinical data. Results were considered significant for $p<0.05$. ***Results:*** According to IMPeTUs, an increased BM 18F-FDG uptake (DS≥4) was associated with significantly higher BM plasma cell infiltration rate (mean values: 67.5% for DS≥4 vs. 30.1% for DS<4) and plasma levels of β2-microglobulin (mean values: 5.5 mg/L for DS≥4 vs. 2.5 mg/L for DS<4), and lower levels of haemoglobin (mean values: 11.0 g/dL for DS≥4 vs. 12.6 g/dL for DS<4). Moreover, the presence of fractures was associated with significantly higher BM plasma cell infiltration rate (mean values: 48.5% vs. 33.6%), plasma levels of β2-microglobulin levels (mean values: 5.0 mg/L vs. 2.6 mg/L), and Lower levels of haemoglobin (mean values: 11.4 g/dL vs. 12.4 g/dL). CT analysis revealed a significant moderate positive correlation between the quantitative CT parameters, CTv and cCTv, and the degree of BM plasma lell infiltration rate (r= 0.33 and 0.28, respectively), plasma levels of β2-microglobulin (r= 0.33 and 0.27, respectively) as well as a moderate negative correlation with haemoglobin (r= -0.21 and -0.20, respectively). Furthermore, patients with increased BM 18F-FDG uptake (DS≥4) showed significantly higher CTv (mean values: 44.6 HU for DS≥4 vs. 11.8 HU for DS<4) and cCTv (mean values: 5.8 HU for DS≥4 vs. 5.4 HU for DS<4) values. ***Conclusion:*** Novel approaches for the interpretation of 18F-FDG PET/CT data correlate with clinically relevant parameters in MM and may provide a reliable tool towards the optimisation and standardisation of PET/CT interpretation in MM.

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Assessing the theranostic potential of SSTR imaging in advanced multiple myeloma patients - the SCARLET trial

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Aim/Introduction: Established evidence of somatostatin receptor subtype 2 (SSTR2) overexpression in multiple myeloma (MM) patients, demonstrated on SSTR imaging (scintigraphy1 or PET/CT2), led us to design the SCARLET (Somatostatin reCeptors imAging in ReLapsing and rEfractory mulTiple myeloma patients) prospective phase II trial (NCT04379817). This study aims to assess SSTR2 overexpression on 68Ga-DOTATATE PET/CT in symptomatic relapsing and refractory MM (rrMM) patients as a preparatory step before a SSTR-based theranostic trial. ***Materials and Methods:*** Nineteen rrMM patients (10 women and 9 men) have currently been included in this trial (initially planned for 20 patients). All patients had stage II or III disease at the time of diagnosis according to the Durie-Salmon staging system and had received at least three previous lines of treatment at study inclusion. Patients underwent 18F-FDG and 68Ga-DOTATATE PET/CT scans within a maximum interval of 4 weeks with a standardised image acquisition protocol. Target lesions were defined as unequivocal tumoral uptake higher than the femoral bone marrow background uptake. For each radiotracer, a maximum of 15 target lesions were selected. ***Results:*** The median time interval between 18F-FDG and 68Ga-DOTATATE PET/CT was 9 days. Patient-based analysis showed that 16 of the 19 patients had one or more target lesions on 68Ga-DOTATATE PET/CT, with the same proportion of patients having one or more target lesions on 18F-FDG PET/CT. Two patients had no target lesions on either PET scan. The disease was mainly osteomedullary, and six patients had para- and/or extramedullary disease. 68Ga-DOTATATE PET identified more lesions than 18F-FDG in 7 patients, with no 18F-FDG+/68Ga-DOTATATE- lesions. Conversely, 18F-FDG PET/CT identified more lesions than 68Ga-DOTATATE in 7 patients as well. Three patients had a perfect match. Two 68Ga-DOTATATE PET scans were not interpretable due to diffuse uptake. Based on imaging criteria, 10 of the 19 patients could be eligible for peptide receptor radionuclide therapy (PRRT). ***Conclusion:*** In heavily pretreated rrMM patients, 68Ga-DOTATATE PET/CT identified half of the study population as candidates for a SSTR-based theranostic approach. 68Ga-DOTATATE PET/CT could be used as a PET companion diagnostic tool to select patients for 177Lu-PRRT or targeted alpha therapy. ***References:*** 1Agool A et al. Somatostatin receptor scintigraphy might be useful for detecting skeleton abnormalities in patients with multiple myeloma and plasmacytoma. Eur J Nucl Med Mol Imaging. 2010;37(1):124-130.2Sonmezoglu K et al. The role of 68Ga-DOTA-TATE PET/CT scanning in the evaluation of patients with multiple myeloma: preliminary results. Nucl Med Commun. 2017;38(1):76-83.

OP-360

Application of ^{18}F-FAPI combined with ^{18}F-FDG imaging in assessment of myelofibrosis: a retrospective case series study

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Aim/Introduction: Myelofibrosis is a rare hematopoietic stem cell neoplasm characterized by bone marrow (BM) inflammation, marked BM fibrosis (BMF), and inefficient hematopoiesis. The direct and noninvasive methods to assess systemic BMF are still currently unavailable. We aim to evaluate the application of fluorine 18 (18F)-labeled FAP inhibitor (18F-FAPI) PET/MRI combined with 18F-fluorodeoxyglucose (18F-FDG) PET/CT imaging in assessing myelofibrosis. ***Materials and Methods:*** We retrospectively collected 18 patients with myelofibrosis (8 primary

and 10 secondary) from April 2022 to November 2023. The extent and intensity of 18F-FDG or 18F-FAPI accumulation in BM were graded on a 5-level scale and scored by a 12-point scale, in which the whole body was divided into 6 regions and each region had a maximum of 2 points. The spleen volume (SV) and radioactive uptake were measured. The imaging findings, laboratory parameters, and grades of BMF from BM biopsy were analyzed by PASW Statistics 18 software. A P-value <0.05 was considered statistically significant. ***Results:*** 1) The relationship of imaging and histopathology in subgroups with different grades of BMF (Grade 0-1, n=6 vs. Grade 2-3, n=12): The subgroup with grade 2-3 of BMF had a higher grade and score of 18F-FAPI imaging, respectively (P<0.05). No significant differences between subgroups were observed in those of 18F-FDG imaging and laboratory parameters (P>0.05). The grade of BMF was positively correlated with the grade (r=0.739) and score (r=0.553) of 18F-FAPI imaging, respectively (P<0.05). The grade (r=0.518), score (r=0.684), and the SUVmax in the spleen (r=0.757) of 18F-FAPI imaging were positively correlated with the SV, respectively (P<0.05). No significant correlations were shown between the grade of BMF and those of 18F-FDG imaging (P>0.05). 2) The characteristic imaging patterns of 18F-FAPI plus 18F-FDG imaging in myelofibrosis: Three imaging patterns were presented in this series, including (A) mismatch of both BM and spleen (n=11), (B) match of BM and mismatch of spleen (n=3) and (C) match of both BM and spleen (n=4). The grade of 18F-FAPI in pattern C was higher than that in pattern A (P<0.01). The scores of 18F-FAPI in patterns B and C were higher than those of pattern A (P<0.05), respectively. ***Conclusion:*** Our data indicate that the 18F-FAPI imaging can reflect more accurately the grade of BMF than the 18F-FDG imaging in myelofibrosis. The characteristic imaging patterns of 18F-FAPI combined with 18F-FDG imaging may be able to represent the different disease stages of myelofibrosis. Further prospective studies are necessary.

OP-361

Paramedullary disease in Multiple Myeloma after treatment: is there a possible prognostic role of Whole body low dose CT (WBLDCT) vs ^{18}F-FDG-PET/CT?

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Aim/Introduction: The post-therapy assessment of paraskeletal plasmacytoma(PM) in multiple myeloma(MM) is still based on lesion persistence and/or its change in size on WBLDCT. Indeed, anatomically evident PM lesions on WBLDCT often persist in ^{18}F-FDG PET/CT(FDG-PET/CT) complete metabolic responders. The aim of this study was to evaluate whether WBLDCT and FDG-PET/CT before and after therapy have prognostic value in this subgroup of patients, in view of future improvements of imaging response criteria. ***Materials and Methods:*** We retrospectively reviewed FDG-PET/CT and low-dose CT(CT) images of patients newly diagnosed with symptomatic MM and carriers of PM lesions, who underwent first-line therapy during the period from October 27,2016 to June 12,2021. In addition, a small subgroup of patients with a diagnosis of solitary plasmacytoma(PSO) was also reviewed. Inclusion criteria were a baseline FDG-PET/CT scan and a subsequent negative FDG-PET/CT scan prior to starting maintenance therapy. Negative FDG-PET/CT was defined applying the Deauville scores(DS) for focal lesions, PM lesions and bone marrow uptake and defining complete metabolic response(CMR) as uptake below liver background(DS <4). FDG-PET/CT parameters reported according to the Italian-Myeloma-Criteria-for-PET-Use(IMPeTUs), CT morphological and technical parameters, and various baseline laboratory data were tested in univariate and multivariate analyses for their impact on clinical outcomes. ***Results:*** We reviewed 42 patients with a median follow-up of 41 months; 39 affected by MM, 3 by PSO. Post-therapy SUVmax of the PM lesions was a significant parameter of adverse PFS and post-therapy Deauville Score 3(DS3) in the PM lesions(PM-DS3) distinguished a subgroup of patients with significantly worse prognosis regarding PFS(medianPFS 27mo vs not reached, HR=3.45, p-value=0.05), confirmed as an independent factor in multivariate analysis; furthermore, there was a trend towards worse OS(medianOS 52mo vs not reached, HR=2.99, p-value 0.16).In patients undergoing autologous stem cell transplantation only (n=32), PM-DS3 was significant in predicting PFS(median 27mo vs 74mo, p-value=0.015) and OS(median 39mo vs not reached, p-value=0.03). CT was not able to stratify patients into prognostic subgroups if we exclude some morphological parameters, as the transverse diameter before maintenance as a numeric variable(PFS, HR=1.86, p-value=0.02), with no significant impact on OS(HR: 1.1, p-value=0.82) and the absence of cortical bone regeneration in the multivariate analysis. ***Conclusion:*** Pre-maintenance PM-DS3 has been shown to be representative of adverse outcomes. Our results demonstrate the added value of FDG-PET/CT when compared to WBLDCT alone, and highlight the possibility of refining future PET monitoring or adapted therapy in this patient population.

OP-362

Prognostic utility of baseline ^{18}F-FDG PET/CT in patients with relapsed and refractory multiple myeloma treated with bispecific monoclonal antibodies.

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Aim/Introduction: To establish the prognostic value of 18F-FDG PET/CT in patients with relapsed/refractory multiple myeloma (RRMM) prior to treatment with bispecific monoclonal antibodies (BsAbs). ***Materials and Methods:*** 116 patients with RRMM eligible for BsAbs treatment underwent 18F-FDG PET/CT from June 8, 2018, to April 5, 2024. Following IMPeTUS criteria, bone marrow (BM) uptake, focal lesions (FL), paramedullary (PMD) and extramedullary (EMD) disease were assessed, considering a Deauville Score (DS) ≥ 4 as positive for any of the mentioned variables. Tumor Metabolic Volume (MTV) and Total Tumor Glycolysis (TLG) were calculated for each lesion. Skeleton was segmented using automatic segmentation software and MTV and TLG were calculated for bone (MTV-B and TLG-B), EM (MTV-E and TLG-E) and total disease (MTV-T and TLG-T). Patient outcome was analyzed using Kaplan-Meier method and Cox regression. ***Results:*** 18F-FDG PET/CT was positive in 101 (87.1%) patients, with diffuse BM uptake with DS≥4 in 59 (5.9%) patients. FL were detected in 88 (75.9%) patients, with DS≥4 in 80 (69.0%); PMD in 57 (49.1%) patients and EMD in 44 (37.9%). Tumour burden variables showed an impact on progression-free survival (PFS). Patients with MTV-T > 336 (26 [27.1%]) had significantly inferior PFS (median 2 months vs. 9; p<0.001). Among EM patients, those with MTV-E > 60 had significantly inferior PFS (median 2 vs. 9 months;

p=0.02). Regarding overall survival (OS) among EM patients, those with MTV-E > 60 and those with MTV-T > 336 had significantly inferior OS (median 4 months vs. 14; p=0.005). ***Conclusion:*** Extramedullary tumor burden prior to BsAbs treatment in RRMM patients significantly reduces PFS and OS. Patients with MTV > 336 also had significantly inferior PFS.

OP-363

^{18}F-FDG PET/CT in Assessing and Predicting the Early Response to Daratumumab in Patients with Relapsed/Refractory Multiple Myeloma: Preliminary Results from an Italian Multicentric Prospective Observational Study (DaRMyPET)

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Aim/Introduction: Daratumumab is an anti-CD38 monoclonal antibody currently used for treatment of patients with multiple myeloma (MM). Aim of our prospective study is to determine whether 18F-FDG PET/CT is effective in assessing and predicting early response to daratumumab in patients with relapsed/refractory MM. ***Materials and Methods:*** We selected 54 consecutive patients with relapsed/refractory MM (26M; mean age 70.9 years), scheduled for second- or third-line treatment with daratumumab (in combination with either bortezomib or lenalidomide), and enrolled in an Italian multicentric observational prospective study (DaRMyPET) to perform 18F-FDG PET/CT before (baseline-PET/CT) and after 6 months of treatment (interim-PET/CT). At both baseline and interim PET/CT, the following qualitative and semi-quantitative parameters were analysed: focal active intra-medullary, para-medullary and extra-medullary MM lesions (number and site), SUVmax and SUVmean of the most active lesion, ratio between lesion SUVmax and liver parenchyma or mediastinal blood-pool SUVmean (rSUV-liver and rSUV-med, respectively), summed MTV and TLG of active MM lesions contoured using three different methods (Deauville score ≥ 4; lesion SUVmax > 2.5; lesion SUVmax ≥ 1.5 times than liver SUVmean). Based on an integrated clinical-laboratory evaluation, haematological response was assessed after 6 months of treatment (according to the International Myeloma Working Group criteria). Potential differences in interim and baseline PET/CT parameters between patients with haematological complete or non-complete response (i.e. in partial-response/disease-progression) were statistically analysed (statistical significance set at p<0.05; suggestive association till p<0.10). ***Results:*** Finally, 39/54 patients who performed both baseline and interim PET/CT and with assessable haematological response at 6 months after treatment were analyzed: 26/39 in complete response; 13/39 in non-complete response. From interim PET/CT, significantly higher median SUVmax and rSUV-liver were found in patients with non-complete response than in those with complete response: 3.91 (IQR 3.31-5.20) vs 2.70 (IQR 2.44-3.94) for SUVmax (p=0.03); 2.00 (IQR 1.35-2.62) vs 1.12 (IQR 0.88-1.46) for rSUV-liver (p=0.023); suggestive association with non-complete response was found for higher median SUVmean: 2.26 (IQR 2.04-2.98) in non-complete responders vs 1.77 (IQR 1.46-2.27) in complete responders (p=0.057). From baseline PET/CT, summed MTV using lesion SUVmax > 2.5 was significantly higher in non-complete than in complete responders: 31.10 (IQR 5.47-85.73) vs 2.80 (IQR 0.53-29.59), p=0.04. ***Conclusion:*** Metabolic parameters from 18F-FDG PET/CT are valuable biomarkers for assessing and predicting early haematological response to daratumumab in patients with relapsed/refractory MM.

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Metabolic Dilemmas of Myeloma; Quandaries Between Laboratory, FDG and FCH

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Aim/Introduction: Multiple myeloma(MM), malignancy of the bone and resultant organ damage. The assessment of disease relies on clinical-laboratory findings as well as imaging modalities. FDG PET-CT is a curated choice, although its sensitivity can be limited especially for minimal-residual-disease (MRD). IMPeTUs criteria have been shown to enhance the sensitivity. Recently, preliminary investigations with F^{18}-Fluorocholine (FCH) PET-CT in limited study cohorts have suggested superior diagnostic performance compared to FDG. Our objective is to delineate the diagnostic-efficacy of molecular imaging in MM patients, refine imaging-parameters and correlate these methods with clinicopathological-laboratory findings. ***Materials and Methods:*** Patients aged-18-years and older with myeloma, who have undergone FDG (60th min.) and FCH (10th and 60th min.) PET-CT examinations within 4-weeks were included. In this retrospective-single-center study with ethics-committee-approval; the association between both imaging modalities and clinical-laboratory parameters were investigated. The study entails a comparative analysis of the diagnostic performances of FDG and FCH according to IMPeTUs-criteria. A-total-body semiquantitative analysis was generated similar to SIOPEN method (8-skeletal, 2-soft tissue region multiplied by SUVmax) and was referred as 'hTepe score'. To classify the patients with dual-imaging, NETPET score-alike 5-point MyPET score was calculated as well. Correlations between imaging and clinic-laboratory findings were investigated. ***Results:*** Thirty-five patients (F/M: 13/22) were included to this study. The mean age was 62(±10) years. All, but one patient, had biologically proven active myeloma. Metabolic-active lesions were detected by FDG and FCH in 17(49%) and 32(91%) of the patients, respectively. Median marrow Deauville-Score (DS) was 3(min-max: FDG:2-5; FCH:3-4) in both methods. Median hypermetabolic-focus scores were 1: no-focus (min-max: 1-4) and 4: >10 focus (min-max: 1-4). For skeletal system assessment, FCH demonstrated higher sensitivity in both patient-based and region-based analyses compared to FDG,

exhibiting superior performance; in extramedullary-disease equal performance was observed in both methods, but no patient was MyPET4-5(FDG>FCH)(Table-1). Sensitivity, accuracy, and AUC values for ROC analysis were 50%(CI: 32-67), 51.4%(CI: 34-68), 0.750 for FDG and 94.1 %(CI: 80-99), 94.1 %(CI: 80-99), 0.971 for FCH, respectively. Moderate correlation was seen for hTepe-score, with CD138-marrow-infiltration, hemoglobin, albumin-globulin, secreted-immunoglobulin, lambda-light-chain and proteinuria for FCH; CD138-marrow-infiltration, globulin and proteinuria for FDG. Other laboratory values had no correlation with any of the imaging parameters. ***Conclusion:*** FCH emerges as a viable option in MM, particularly when FDG fails to demonstrate metabolic activity or yields inconclusive results. It excels in detecting MRD and correlation with clinicopathologic-laboratory results.

OP-365

Volumetric histogram-based analysis of standardized uptake values and apparent diffusion coefficients for early immunotherapy assessment in relapsed/refractory multiple myeloma: preliminary results of a PET/MRI study

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Aim/Introduction: This study evaluates histogram-based PET and diffusion-weighted MRI (DWI) parameters derived from volumetric FDG PET/MRI segmentation for differentiating partial (PR) and complete metabolic response (CR) to immunotherapies, specifically Chimeric Antigen Receptor T-cell (CAR-T) therapy and bispecific T-cell engager (TCE) antibodies, in relapsed/refractory multiple myeloma (MM). ***Materials and Methods:*** Between July 2023 and March 2024, eleven MM patients (seven males, mean age 64.6 years, range 59-74 years) underwent FDG PET/MRI scans before and after receiving either CAR-T cell therapy (n=8) or bispecific antibodies (n=3), with a mean interval of 67.5 days. Whole-body DWI was acquired at diffusion weights of 50 and 800 s/mm^2 and ADC maps calculated. Volumes of interest (VOIs) were segmented on baseline DWI (b800) for selected lesions (high signal-to-background ratio, no motion or susceptibility artifacts, no overlap with adjacent structures, n=75, nbone=61) using a semi-automated threshold-based technique. These were transferred to baseline PET and follow-up imaging after deformable registration. Quantitative DWI (ADCmean, ADCkurtosis, ADCskewness) and PET metrics (SUVmax, SUVmean, SUVkurtosis, SUVskewness) were extracted from each lesion and compared between pre- and post-therapeutic scans (absolute change, percent change). Patients were classified into two subgroups, PR and CR, based on the post-therapeutic Deauville score (DS). Diffuse post-therapeutic bone marrow activation was evaluated as not attributable to myeloma (DSx). Group differences (nPR=4, nCR=7) were assessed using Mann-Whitney U test. P-values were adjusted using the Benjamini-Hochberg correction. The effect size was quantified using Cohen's d to evaluate the magnitude of differences between groups, with values of 0.2, 0.5, and 0.8 indicating small, medium, and large effects. Additionally, ROC (Receiver Operating Characteristic) curve analysis was performed to assess the diagnostic performance of each parameter to distinguish subgroups. ***Results:*** The absolute and percent changes in ADCmean demonstrated a good discriminative power for differentiating PR from CR (AUCs = 0.73 and 0.74) with medium to large effect sizes (Cohen's d = 0.75 and 0.65; p-values = 0.0189), highlighting their potential in distinguishing metabolic responses effectively. Absolute ADCskewness showed the largest effect size (Cohen's d = 0.96, p-value = 0.0099) but low discrimination (AUC = 0.23). In contrast, percent changes in SUVskewness had a minimal effect size (Cohen's d = 0.05), indicating limited differentiation capability. ***Conclusion:*** This small patient cohort indicates that ADC measurements may be suited for immunotherapy monitoring relapsed/refractory MM, offering a quantitative tool to potentially assist clinical decision-making.

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Monday, October 21, 2024, 09:45 - 11:15
Hall Y10-Y12

Featured Session: Thyroid Committee: Nuclear Medicine Imaging in Parathyroid Disorders

OP-366

Present and Future Perspective in Nuclear Medicine Imaging of Parathyroid Disease

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OP-367

Critical Role of ^{99m}Tc-SESTAMIBI Scintigraphy with SPECT/CT in expeditious management of PTH dependent severe hypercalcemia

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Aim/Introduction: Severe hypercalcemia (serum Ca2+ levels: >/= 14mg/dl) is a metabolic emergency, frequent cause being sporadic primary hyperparathyroidism (PHPT), due to parathyroid adenomas. While some may be asymptomatic, most show rapid evolution of clinical symptoms that can be potentially fatal. Focussed parathyroidectomy is the cornerstone in managing these patients, yielding excellent short and long-term outcomes. The present study aims to evaluate the role of expeditious 99mTc-SESTAMIBI scintigraphy combined with single-photon emission computed tomography (SPECT/CT) imaging in patients with PTH dependent severe hypercalcemia. ***Materials and Methods:*** Records of patients with severe hypercalcemia (serum Ca2+ - >/=14mg/dl) who underwent 99mTc-SESTAMIBI scintigraphy at our center from January 2016 to March 2024 were retrospectively evaluated. The scintigraphy protocol included intravenous administration of 99mTc-SESTAMIBI, followed by early and late planar imaging at 20 minutes and 2 hours post-injection respectively. Additionally, SPECT/CT

imaging was conducted at 50 minutes post-injection for precise anatomical localization. Imaging findings were correlated with intra-operative findings and pre/post-operative biochemical parameters. ***Results:*** 38 patients (16-men & 22-women, median age: 37 years) with severe hypercalcemia underwent 99mTc-SESTAMIBI scintigraphy for pre-operative localization of parathyroid adenoma at our center, with the most common clinical manifestations being nephrolithiasis, bone pain and fractures. The median parathormone (PTH, normal range:15-65pg/ml) and calcium levels (normal range: 8.5-10.5mg/dl) were 1337pg/ml (152-4352pg/ml) and 15.1mg/dl (14.0-20.3mg/dl) respectively. The ready availability of 99mTc-SESTAMIBI scintigraphy (median waiting time: 3 days) and its ability to rule out ectopic glands reduced the time interval between clinical presentation/diagnosis and surgery (median time: 7 days, range: 1-45 days). Serum calcium levels normalized in all operated patients. 34 patients (89%) had a single parathyroid adenoma, while 4/38 (11%) patients had more than one parathyroid adenoma on scintigraphic evaluation. The median antero-posterior diameter of the adenomas was 2.35cms (0.5-6.7cms). Of the 44 lesions identified overall, 20/44 (45.4%) were right inferior parathyroid adenomas (most common), followed by 13/44 (29.6%) left inferior parathyroid adenomas. 6/44 (13.6%) and 5/44 (11.4%) were right superior and left superior parathyroid adenomas respectively. ***Conclusion:*** In life threatening PTH dependent severe hypercalcemia, expeditious 99mTc-SESTAMIBI scintigraphy with SPECT/CT shortened the time gap between clinical presentation/diagnosis and surgery while accurately localizing the culprit adenoma and ruling out ectopic glands at the same time, thereby enabling timely focussed parathyroidectomies that resulted in in biochemical cure and improvement of clinical outcomes.

OP-368

How [18F]Fluorocholine PET/CT Can Replace Three Preoperative Diagnostics to Localise Parathyroid Adenomas in Patients Suffering from Primary Hyperparathyroidism: A Cost-Effectiveness Analysis

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Aim/Introduction: We conducted a cost-effectiveness analysis in which we compared a preoperative one-stop-shop imaging strategy based on partial-body (from skull-base to heart-base) [18F]Fluorocholine PET/CT with current best practice in which [18F]Fluorocholine PET/CT is only recommended after negative or inconclusive ultrasonography and [99mTc]Tc-methoxy isobutyl isonitrile SPECT/CT for patients suffering from primary hyperparathyroidism. We investigated whether the one-stop-shop strategy performs as well as current best practice but at lower costs. ***Materials and Methods:*** We developed a cohort-level state transition model to evaluate both imaging strategies while respecting an intraoperative parathyroid hormone-monitored treatment setting as well as a traditional treatment setting without intraoperative parathyroid hormone monitoring. The model reflects patients' hospital journeys after primary referral for biochemically diagnosed hyperparathyroidism. A cycle length of twelve months and a lifetime horizon were used. We conducted probabilistic analyses simulating 50,000 cohorts to assess joint parameter uncertainty. The incremental net monetary benefit and costs for each quality-adjusted life year were estimated. Furthermore, threshold analyses were performed regarding the tariff of partial-body [18F]Fluorocholine PET/CT and the sensitivity of [99mTc]Tc-methoxy isobutyl isonitrile SPECT/CT. ***Results:*** The simulated long-term health effects were similar for both imaging strategies. Accordingly, the one-stop-shop imaging strategy did not result in reduced patient outcomes. A tariff of less than €900 for partial-body [18F]Fluorocholine PET/CT was required to be cost-saving compared to current best practice. These results applied to both treatment settings. The decision to implement either imaging strategy depended on available local resources as well as meeting patient preferences. The one-stop-shop strategy reduced the number of hospital visits, travel times, waiting times, hospital waste and radiation burden, and enabled easy resource capacity allocation. All are fundamentally preferable regarding logistics, environmental impact and interference in patients' lives. ***Conclusion:*** The one-stop-shop imaging strategy based on partial-body [18F]Fluorocholine PET/CT can replace three preoperative diagnostic modalities, and both preoperative strategies can be used interchangeably. Daily clinical practice grounds such as available capacity allocation and patient preferences should inform policy-making on whether a hospital should implement the one-stop-shop imaging strategy.

OP-369

Crucial elements of parathyroid gland assessment in PET/CT with [11C]-methionine.

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Aim/Introduction: PET/CT with [11C]MET is one of the useful preoperative diagnostic techniques for patients with tertiary hyperparathyroidism (THP). Some drugs used in dialysis patients may potentially influence the results of this imaging. Lean body mass (LBM) in these patients may change significantly (depending on the time since the last dialysis).The aim of the study was to assess the usefulness of determining SUV in lesions visible in [11C]MET PET/CT for total body weight (TBM) and LBM and to determine the impact of calcimimetics on SUV in [11C]MET PET/CT in the group of patients with THP. ***Materials and Methods:*** We analyzed results of 18 PET/CT performed in patients with THP after administration 5 MBq/kg body weight of [11C]MET using a Discovery 710 GE Medical Systems scanner.In each parathyroid gland found in PET/CT, SUVmax for TBM and LBM was measured, and the tumor/background ratio (TBR) was determined (reference point - the right thyroid lobe. In the analyzed group, 9 patients were treated with calcimimetics, which were not withdraw before PET/CT. ***Results:*** The mean SUVmax in parathyroid gland was 5.85 ± 2.05 and 4.23 ± 1.29 for TBM and LBM respectively, while the TBR for TBM was 2.85 and for LBM 2.87 (p=0.97).There were no statistically significant differences in SUVmax between the groups of patients treated and not treated with calcimimetics.For TBM, the mean SUVmax was 6.76 ± 2.56 in the subgroup with, and 5.91 ± 1.85 without calcimimetics (p=0.51). For LBM, 4.83 ± 1.82 and 4.42 ± 1.25, respectively (p=0.65). ***Conclusion:*** SUV for TBM is sufficient in the quantitative assessment of parathyroid

glands in [11C]MET PET/CT and does not need to be corrected for LBM.Calcimimetics has no impact on [11C]MET uptake in the parathyroid glands, and withdraw such treatment is not necessary before PET/CT in patients with THP.

OP-370

Role of 18F-Fluorocholine PET-CT in the Localization of Ectopic Lesions in Patients with Primary Hyperparathyroidism

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Aim/Introduction: In primary hyperparathyroidism (PHPT), there are times when a parathyroid adenoma is ectopic in location. In these patients 18F-Fluorocholine PET-CT (18F-FCH PET-CT) is helpful for lesion localisation and this can have a major impact on planning patient management.In the present study we retrospectively evaluated the role of 18F-FCH PET-CT in detection of ectopic parathyroid adenomas in all patients of PHPT that underwent this imaging at our institution from January, 2017 to December, 2021. ***Materials and Methods:*** Data from January, 2017 to December, 2021, of 240 patients that underwent 18F-FCH PET-CT was collected. 28/240 patients with PHPT found to have FCH avid lesions in ectopic locations. The scans were interpreted by a Nuclear Medicine physician and they were graded as positive, suspicious, indeterminate and negative. ***Results:*** In these 28 patients (14 males, 14 females) the mean age was 46.1 years, mean intact parathyroid hormone (iPTH) was 254 pg/mL (±330) and S. Calcium was 11.4 mg/dl (±1.1). 5/28 had prior neck surgery for parathyroid adenoma.Overall, 18F-FCH PET-CT was able to detect 33 lesions (including both positive & suspicious) & 2 lesions that were indeterminate. 6/28 patients had more than 1 lesion and remaining had only a single lesion. 17 culprit lesions were lateralized to right and 16 to left. In relation to thoracic inlet, 11/33 lesions were superior to the inlet and 22/33 were inferior to the inlet. A detailed description of the locations of the ectopic adenomas in given in Table 1. 8/28 patients underwent surgical excision while 20/28 were managed conservatively till last follow up available.In the 8 operated patients, 18F-FCH PET-CT was able to detect a culprit lesion in all patients, with a total of 8 lesions being excised.A per patient analysis demonstrated 18F-FCH PET-CT was able to correctly detect the culprit lesion(s) in 8/8 patients, 4/8 with an adenoma, 3/8 with hyperplasia and 1/8 with parathyroid carcinoma, giving us a lesion detection rate of 100%. ***Conclusion:*** This study helps highlight the role of 18F-FCH PET-CT in localizing ectopic parathyroid lesions in PHPT patients, as demonstrated by us in our cohort of 240 PHPT patients, in whom 18F-FCH PET-CT was able to localize the culprit parathyroid lesions in 28 patients and helped guide surgical management in 8 patients.

OP-371

Evaluation of the Diagnostic Efficacy of [11C] Choline PET/CT in the Detection and Localization of Parathyroid Adenomas in Patients with Clinical Hyperparathyroidism

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Aim/Introduction: Choline PET/CT is the preferred method for detecting hyperfunctioning parathyroid glands in patients with clinical hyperparathyroidism (cHPT), given its growing accessibility and superior diagnostic performances compared to conventional imaging. The objective of this study was to evaluate the robustness of [11C]Choline PET/CT in accurately identifying and localizing hyperfunctioning parathyroid glands in preoperative settings. ***Materials and Methods:*** This retrospective single-centre study included 110 patients (aged 61.63±11.63 yo) with biochemically proven cHPT who underwent preoperative localization of parathyroid adenomas using [11C]Choline PET/CT between 01/2022 and 03/2023. Information on parathormone (PTH) levels, calcium metabolism, [99mTc]MIBI scintigraphy and neck ultrasound results were collected for each patient; in patients who underwent surgery, histopathological results were noted. Three nuclear medicine physicians conducted qualitative image analysis, evaluating presence and anatomical localization of eventual adenomas, and interobserver agreement was assessed using Fleiss multirater kappa. In cases where a parathyroid was defined as ectopic, the surgical definition was used as the reference standard. Sensitivity was calculated at the patient level based on the surgical definition provided for ectopic cases and on pathology results. ***Results:*** In the cohort, mean PTH, serum calcium and ionized calcium fraction were 130.97±66.38 pg/mL, 2.76±0.94 mmol/L, and 1.56±0.85 mmol/L, respectively. 63 patients (57%) had prior [99mTc]MIBI scintigraphy, with uncertain (n=9) or positive (n=6) results observed in 15 individuals. [11C]Choline PET/CT was positive in 90/110 cases resulting in a detection rate of 82%. In 6 cases (5%), [11C]Choline PET/CT identified more than one parathyroid adenomas. The three reviewers reached moderate interobserver agreement for both parathyroid localisation (Fleiss κ = 0.560, 95% CI: 0.558-0.561) and exam positivity (Fleiss κ =0.643, 95% CI: 0.640-0.646). [11C]Choline PET/CT was deemed positive in 66 cases and negative in 20 cases by all reviewers. In 20/110 patients, the parathyroid gland detected on PET was defined as ectopic by at least one reader (Fleiss κ = -0.016), and 25% were correctly localized according to surgical definition. 22 patients with a positive PET exam underwent surgery, their disease being confirmed by the pathological examination of the excised gland, resulting in sensitivity and positive predictive value of 100%. ***Conclusion:*** Our findings emphasize the diagnostic efficacy of [11C]Choline PET/CT in individuals with cHPT. While the overall detection rate of parathyroid adenomas is promising, the moderate interobserver agreement, particularly related to difficulties in accurately localizing ectopic parathyroids, calls for a refinement of interpretation criteria to improve the accuracy of this imaging technique.

OP-372

A New Promising Tool for Primary Hyperparathyroidism: 68Ga-Trivehexin PET/CT

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Aim/Introduction: Primary hyperparathyroidism (PHPT) poses a common medical challenge, requiring precise localization of hyperfunctioning lesion/(s) to guide curative surgery. Upregulation of integrin expression by parathyroid hormone-related peptide has been documented (1). However, the relation between integrin expression and parathyroid hyperfunction is not

known. Integrin (αVβ6) targeted imaging using 68Ga-Trivehexin has shown promising results in pancreatic ductal adenocarcinoma and head and neck tumors (2). In this study, we present the first-in-human use of 68Ga-Trivehexin PET/CT for enhancing the diagnostic efficacy of PHPT in comparison to 99mTc-MIBI SPECT-CT (MIBI Scan). ***Materials and Methods:*** Patients diagnosed with PHPT based on biochemical analyses were included. Serum calcium, phosphorus, and parathyroid hormone levels were recorded. Each participant underwent cervical ultrasonography, MIBI Scan, and 68Ga-Trivehexin PET/CT imaging. Additional 4D CT and 18F-Cholin PET/CT were performed in selected patients. The final diagnosis was concluded by either PTH wash-out (WO) or at least two correlated imaging findings. 68Ga-Trivehexin PET/CT and other imaging/WO results were compared. ***Results:*** Ten of 13 patients had sporadic PHPT while 3 patients were diagnosed with MEN-1 syndrome (Table. 1). 10 lesions of 7 patients underwent WO, and the remaining were diagnosed by imaging findings. Of 13 patients, 17 parathyroid lesions were identified. In one patient; cervical USG, 4D CT, MIBI Scan, 18F-Cholin PET/CT, and 68Ga-Trivehexin PET/CT could not localize any lesion. In patient-based analyses; MIBI Scan was positive in 10/13 (77%) patients; while 68Ga-Trivehexin PET/CT yielded 11/13 (85%) patients. Furthermore, 68Ga-Trivehexin PET/CT demonstrated parathyroid lesions in 2 of 3 patients who had negative MIBI Scans and 18F-Cholin PET/CT. In lesion-based analyses; MIBI Scan revealed 10/17 (59%) lesions, while 68Ga-Trivehexin PET/CT identified 16/17 (94%) lesions. Nine of 10 MIBI-positive lesions were positive in 68Ga-Trivehexin PET/CT; only one of them was negative. Of note, 68Ga-Trivehexin PET/CT clearly delineated 4 of the lesions which showed mild MIBI uptake, and identified 7 additional lesions not detected by MIBI Scan. Additionally, 18F-Cholin PET/CT yielded false positive uptake on the cervical lymph nodes of 2 patients which correlated by WO (Table. 2). ***Conclusion:*** 68Ga-Trivehexin PET/CT shows diagnostic superiority in the detection of hyperfunctioning parathyroid tissue justifying further investigation to delineate the clinical utility of this novel imaging modality in PHPT management. ***References:*** 1.Bhatia V,Mula RV,et al.Parathyroid hormone-related protein regulates integrin α6 and β4 levels via transcriptional and post-translational pathways. ExpC ellRes.2013Jun10;319(10):1419-30.2.Quigley NG,Steiger K,et al.PET/CT imaging of head-and-neck and pancreatic cancer in humans by targeting the"Cancer Integrin"αvβ6 with Ga-68-Trivehexin. EurJNuclMedMolImaging.2022Mar;49(4):1136-1147.

OP-373

Pre-operative ^{18}F-Fluorocholine PET/4D-MRI in primary hyperparathyroidism

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Aim/Introduction: 18F&#8211Fluorocholine (18F&#8211FCH) PET/CT offers excellent sensitivity in detecting hyperfunctioning parathyroid tissue, leveraging the metabolic information provided by PET and the anatomical localization from CT. Dynamic 4D&#8211MRI does not involve ionizing radiation and provides valuable functional information in addition to high&#8211resolution anatomical imaging. Accordingly, 18F&#8211FCH PET/4D&#8211MRI seems a potentially interesting diagnostic tool for patients with primary hyperparathyroidism (pHPT). Our study aimed to evaluates 18F&#8211FCH PET/4D&#8211MRI in the preoperative work&#8211up of pHPT patients and compare 18F&#8211FCH PET with 4D&#8211MRI. ***Materials and Methods:*** Patients with pHPT underwent 18F&#8211FCH PET/4D&#8211MRI between January 2022 and June 2023 were retrospectively retrieved. 18F&#8211FCH PET (merged with anatomical axial T1&#8211weighting imaging), and 4D&#8211MRI (axial T1&#8211weighted, T2 fat&#8211saturated, diffusion, and dynamic 4D contrast&#8211enhanced T1&#8211weighted) were independently interpreted. 18F&#8211FCH PET/4D&#8211MRI was analyzed jointly by one nuclear medicine physician and one radiologist. For each modality, sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and accuracy, were calculated according to per&#8211gland analysis on surgically treated patients. Histology associated with perioperative PTH blood level decrease was used as a gold standard. ***Results:*** 67 pHPT patients were evaluated by 18F&#8211FCH PET/4D&#8211MRI, and 24 (96 glandes) were surgically treated at time of writing. Sensitivity, specificity, PPV, NPV, and overall accuracy of 18F&#8211FCH PET were 96.2%, 94.7%, 89.3%, 98.5%, and 94.2%, and of 4D&#8211MRI were 73.1%, 100%, 100%, 90.9%, and 88.1%. The integrated use of PET/4D&#8211MRI allowed the right classification of all glands also leading the correction of three peri&#8211thyroid FP and one FN results of 18F&#8211FCH PET. 18F&#8211FCH PET and PET/4D&#8211MRI were more sensitive than 4D&#8211MRI ($p<0.001$). 18F&#8211FCH PET and 18F&#8211FCH PET/4D&#8211MRI performed similarly ($p<0.001$). Analysis of 4D&#8211MRI dynamic parameters revealed a rapid time&#8211to&#8211peak enhancement of parathyroid adenomas (22.0&#1774.6 seconds) and normal thyroid tissue (22.7&#1774.3 seconds) followed by a rapid washout. Parathyroid adenoma showed a statistically significant higher contrast&#8211enhancement than the thyroid parenchyma (&#916Signal Intensity (SI): 4135.6 versus 2919.5, $p<0.001$). Conversely, cervical nodes showed a delayed time&#8211to&#8211peak enhancement (41.6&#17712.4 seconds) and a prolonged gadolinium washout. ***Conclusion:*** 18F&#8211FCH PET/4D&#8211MRI allows precise localization of hyperfunctioning parathyroids adenomas, and the analysis of contrast&#8211enhancement patterns could reduce FP PET results. Despite a lack of significant improvement in diagnostic sensitivity compared to standard 18F&#8211FCH PET/CT, it reduces patient radiation exposure. However, 18F&#8211FCH PET/4D&#8211MRI is not widely available, and the acquisition time is longer, limiting its accessibility compared to standard PET imaging.

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Imaging Armamentarium of Hyperparathyroidism; New Player FCH PET-CT-US

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Aim/Introduction: Hyperparathyroidism(HPTH) is a common endocrinopathy that leads to several morbidities. Therefore, correctly identifying the possible resectable parathyroid disease is crucial. Conventional methods like ultrasound(US) and Tc99m-MIBI scintigraphy(MIBI) may fail to demonstrate the parathyroid pathology. To help these patients, new functional modalities such as F^{18}-Fluorocholine PET-CT (FCH) were introduced. Moreover, FCH combined with the expert US may be synergistic in improving lesion detection. The study aims to assess the performance of FCH PET-CT and additional expert US. ***Materials and Methods:*** Patients with HPTH, equivocal, or negative conventional imaging results who underwent FCH PET-CT imaging were included. The

parathyroid lesion detection rate of FCH PET-CT and additional data obtained with FCH-guided expert USG were analysed. Laboratory, pathology, and follow-up data of the patients were obtained, and the relationship between imaging and clinicopathologic state was assessed. ***Results:*** The study included 119 patients(F/M: 90/29).The median age was 56 (min-max: 13-79 years). Seventy-one patients(n:100,71%) had symptoms related to HPTH; the rest had only hypercalcemia.US and MIBI were negative for 69/119 and 77/119 patients and equivocal for 27/119 and 22/119 patients, respectively.FCH-PET-CT showed parathyroid pathology for 80 (67%) patients, and four had multiglandular disease. The median short-axis and SUVmax of the lesion were 6(3-22) mm and 3.8(1.2-11), respectively. Most lesions were orthotopic (Table 1 66, 55%). CT components of FCH were unremarkable for 52(44%) patients, and FCH-US was able to identify the lesions for 58%(25) of these groups, and the majority were orthotopic. For 12(18%) patients, FCH-US cannot identify the lesions that can be seen on the PET-CT due to ectopic locations (retrosternal, etc.). For 38(37%) patients, FCH-US improved reader confidence or revealed new suspicious lesions. In nine patients, FCH was interpreted as negative, but expert US found true positive parathyroid lesions (mean size-SUVmax: 5.4(±0.6) mm, 3.1(±0.2) respectively), which makes the detection rate of FCH PET-CT-US as 75% (89/119). 56/89 patients were operated, and all of them had revealed parathyroid pathology. The mean follow-up period was 22.4(±1.6) months for these patients(n:51) and 44/51 patients were under remission after 6-months of the operation. ***Conclusion:*** FCH PET-CT-US, operated by the same physician like a one-stop-shop approach, maybe a real problem solver, especially in HPTH patients whose parathyroid lesions could not be found by the conventional modalities. FCH PET-CT-US may surpass any modality used alone to detect the origin of hyperparathyroidism and keep the patients in remission.

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Monday, October 21, 2024, 09:45 - 11:15
Hall G2

TROP Session: Cardiovascular Committee: Cardiac Amyloidosis: Can We Do More?

OP-375

Transthyretin V30M Amyloidosis Phenotype Insights through a [^{99m}Tc]Tc-DPD Scintigraphy Perspective

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Aim/Introduction: Transthyretin (ATTR) V30M amyloidosis is a rare hereditary disease caused by the systemic deposition of mutated transthyretin. Technetium- 99m-3,3-diphosphono-1,2-propanodicarboxylic acid (DPD) scintigraphy is a widely recognized noninvasive diagnostic method for ATTR cardiac amyloidosis (CA). However, the type of amyloid fibrils appears to influence its sensitivity, including the clinical presentation. This study aims to clarify the genotype-phenotype relationship, unravelling future therapeutic approaches. ***Materials and Methods:*** We conducted a retrospective study of Portuguese patients with V30M mutation observed at nephrology consultations from 2014 to 2024; 104 cases who underwent DPD scintigraphy and echocardiography, with evidence of amyloid deposition or symptoms, were included. Diagnostic criteria for CA: interventricular septal (IVS) thickening ≥13 mm (without other attributable cause) or a Perugini score ≥ 2 (positive DPD) and no plasma cell disease. SPECT/SPECT-CT was performed in 40(54.1%) and 9(75%) Perugini 0 and 1 cases, respectively. Comorbidities present at DPD scintigraphy performance were collected; the Gillmore score was calculated for cardiorenal assessment. ***Results:*** Nearly half of the patients (51) developed CA, counting 18(35%) positive DPD, 10(20%) inconclusive DPD (score 1), and 23(45%) negative DPD cases. The latter two, compassing non-positive DPD CA, developed symptoms in the third decade of life, at median, similarly to patients without CA. Overall, DPD scintigraphy sensitivity for CA was six times lower in patients with early compared to late-onset (›50 years old): 10.3% versus 66.7%. The female/male ratio ranged from 2:1 in non-CA to 1:1 in non-positive DPD CA and 1:6 in positive DPD CA subjects. (p=.025). Neuropathy was universal; non-positive DPD CA patients had higher ocular (p=.038) and gastric (p=.040) involvement and were likely to have previously received liver transplant (p=.003)- table I. Heart failure was more common in positive DPD CA(p=.042), although echocardiographic features of CA differed poorly among the two groups(table II); 17(16.3%) patients died, with a mean follow-up of 40.3 ± 3.5 months. Mortality was five times higher in patients with abnormal Gillmore score - present in 21(63.6%) non-positive DPD CA cases - and 3.5 times higher when IVS hypertrophy, with no significant difference regarding Perugni score. ***Conclusion:*** Our series reinforces the age-dependent sensitivity of DPD scintigraphy in ATTR V30M amyloidosis, possibly related to the null (Perugini score 0) or weak (score 1) uptake by full-length (type B) amyloid fibrils. The existence of different phenotypes, albeit, underlines the influence of a cofactor in tissue amyloid deposition, opening the way for a new staging system.

OP-376

Perugini grade 1 cardiac tracer uptake on [^{99m}Tc] Tc-hydroxydiphosphonate bone scintigraphy in transthyretin variant carriers - diagnostic for cardiac amyloidosis?

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Aim/Introduction: Individuals carrying a pathogenic transthyretin gene variant (TTRv) are at high risk for developing hereditary ATTR (ATTRv) amyloidosis, a progressive protein misfolding disease. Screening for cardiomyopathy (ATTRv-CM) is crucial for early detection of subclinical cardiac amyloidosis and prompt treatment initiation. Perugini grade 2 or 3 cardiac tracer uptake on bone scintigraphy is considered diagnostic for ATTR-CM, provided cardiac light chain amyloidosis is ruled out. In the case of Perugini grade 1 cardiac tracer uptake, additional criteria must be met. However, in a population with a high a priori risk of developing ATTRv amyloidosis, namely TTRv carriers, Perugini grade 1 cardiac tracer uptake might already be diagnostic for ATTRv-CM. To investigate this hypothesis, we analysed our cohort of TTRv carriers. ***Materials and Methods:*** In this retrospective study, we examined our entire cohort of TTRv carriers and ATTRv amyloidosis patients. We collected information on symptoms, cardiac biomarkers, fat biopsy for amyloidosis

deposition, echocardiography, electrocardiography, cardiac magnetic resonance imaging, and bone scintigrams from patient records. A descriptive analysis was conducted to assess potential indicators for ATTRv-CM. ***Results:*** Twelve individuals initially had Perugini grade 1 cardiac tracer uptake on bone scintigraphy. Two individuals already met the additional diagnostic criteria for ATTRv-CM at the time of bone scintigraphy. Over a median follow-up of 2.5 years (range 2-4), four individuals progressed to Perugini grade 2 uptake, confirming ATTRv-CM. Among the remaining six individuals, two had positive fat biopsies and increased wall thickness on echocardiography at the time of bone scintigraphy, strongly suggesting ATTRv-CM. Furthermore, cardiac parameters deteriorated in these patients during a follow-up of 3 years. Among the other four individuals, initially lacking signs of ATTRv-CM, one developed increased wall thickness and positive fat biopsy after 11 years. The remaining three individuals developed potential signs of cardiomyopathy during a median follow-up of 8 years (range 3-8), but the evidence was insufficient to diagnose ATTRv-CM, either due to the absence of a positive fat biopsy or the absence of increased wall thickness on echocardiography. (Table 1) ***Conclusion:*** In conclusion, our study demonstrates that a significant number of individuals with Perugini grade 1 cardiac tracer uptake either have or develop ATTRv-CM within 11 years after bone scintigraphy. Furthermore, cardiac parameters deteriorate in all TTRv carriers with Perugini grade 1 tracer. Our data suggest that grade 1 tracer uptake is diagnostic for early ATTRv-CM in TTRv carriers.

OP-377

Development of a Nomogram for Predicting Positivity in Cardiac Amyloidosis Scintigraphy

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Aim/Introduction: Cardiac ATTR amyloidosis is a disease in which amyloid fibrils accumulate in the heart and cause restrictive type cardiomyopathy. In recent years, scintigraphic imaging with bone agents has become the gold standard imaging in diagnosis. Since clinical findings are nonspecific, there is a need for appropriate patient selection for scintigraphic imaging. This study aims to develop a nomogram that predicts scintigraphy positivity in cases with suspected cardiac ATTR amyloidosis by using clinical, demographic, laboratory and other imaging data. ***Materials and Methods:*** The data of 504 patients who underwent cardiac scintigraphic imaging with Tc99m-PYP between 2019-2024 were retrospectively scanned from the hospital digital archive. Patients with Perugini Grade 2/3 myocardial involvement on scintigraphic imaging were considered positive. The level of difference in clinical, demographic, laboratory and other imaging findings between scintigraphically positive and negative patients was evaluated by T-test and chi-square test. A scoring system was developed using a regression model that included parameters determined to have high predictive power in univariate analysis. A clinical nomogram was developed based on a multivariable logistic regression model using parameters with high predictive value. The contribution of this predictive nomogram to clinical management was evaluated by decision curve analysis. ***Results:*** The average age of 504 patients who met the inclusion criteria was 63±14 years, 274 (54.4%) were male and 230 (45.6%) were female. A total of 32 (6.3%) patients had Grade 2/3 scintigraphic positivity. In the positive patient group, mean age (68.4 vs. 62.4; p=0.018), mean interventricular septal thickness (IVST) (16.4 vs. 14.7 mm; p=0.009) and frequency of carpal tunnel syndrome (CTS) (32.3% vs. 10.4%; p<0.001) was significantly higher. In multivariate logistic regression analysis, age (RR: 1.051; p=0.003), IVST (RR: 1.168; p<0.001) and the presence of CTS (RR: 5.883; p<0.001) were determined as independent predictors for scintigraphy positivity (AUC: 0.722; Table 1). A scoring system was developed using age (18-98 years and score 1-8, respectively), CTS (absent-present and score 0 to 5, respectively) and IVST (8-42 mm and score 2 to 10, respectively) parameters (score 3-18 and probability 0.003%-95%). ***Conclusion:*** According to the study findings, a nomogram-based clinical scoring system was developed that predicts scintigraphy positivity using parameters frequently used in clinical practice such as age, IVST and CTS. If confirmed with larger series, this approach can contribute to development of appropriate patient selection criteria for cardiac amyloidosis scintigraphy.

OP-378

T-Amylo: validation of an artificial intelligence tool as a method for screening and selection of patiens candidate for ^{99m}Tc-DPD scan.

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Aim/Introduction: To demonstrate the usefulness of T-AMYLO®, an artificial intelligence (AI)-generated algorithm, as a predictive model of risk in patients who are candidates for cardiac scintigraphy with 99mTc-DPD for suspected transthyretin deposition amyloidosis (TTR-CA). ***Materials and Methods:*** Application of the T-AMYLO® predictive model for TTR-CA to a sample of 232 patients with suspected TTR-CA (60% male; mean age 77.4 ± 9.8 years; 31.4% referred for ventricular hypertrophy) who had undergone 99mTc-DPD scintigraphy between January 2022 and December 2023. T-AMYLO® assesses demographic (age and sex) and clinical variables (interventricular septal thickness, carpal tunnel syndrome or low ECG voltages), assigning a risk for TTR-CA. Three risk groups were obtained: high, intermediate and low. The risk obtained in each patient was correlated with the gammagraphic result. The concordance between tests was calculated (Cohen's Kappa index; KI) and the diagnostic accuracy of the model was checked. ***Results:*** Based on the risk groups according to T-AMYLO®, 59 patients (25.5%) were classified as high risk, 66 (28.4%) as intermediate risk and 107 (46.1%) as low risk. 35.3% of patients (82/232) had a positive 99mTc-DPD scan for TTR-CA. Of these, 63.4% (52/82) were associated with high risk, 24.4% (20/82) with intermediate risk, and 12.2% (10/82) with low risk. The 93.4% of patients (97/104) classified as low risk for TTR-CA had negative scintigraphy, while 83.9% (52/59) with high risk associated positive scintigraphy, obtaining an IK between both tests of 0.78 (good concordance). Regarding the intermediate risk group, 30.3% of patients (20/66) had a positive scintigraphic result. ***Conclusion:*** T-AMYLO® predictive model is a screening tool that improves the selection of patients who are candidates for 99mTc-DPD cardiac scintigraphy, avoiding unnecessary diagnostic tests in patients at low risk of TTR-CA.

OP-379

Multidisciplinary approach for the early detection of amyloid in patients who undergo carpal tunnel syndrome or lumbar stenosis surgery. Results of an ongoing study.

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Aim/Introduction: Carpal tunnel syndrome(CTS) and lumbar stenosis(LS) seem to precede the manifestations of cardiac amyloidosis(CA) due to transthyretin amyloidosis(ATTR), so they could represent early markers of CA. CTS is more commonly present in CA due to wild-type ATTR(ATTRwt), although it can also be present in its hereditary variant(ATTRv) and in primary amyloidosis caused by immunoglobulin light chain deposition(AL). Therefore, in this ongoing study, our aim is to evaluate the prevalence of amyloidosis in patients undergoing CTS or LS surgery, in an endemic area of the TTR mutation Val50Met(ATTRv). ***Materials and Methods:*** After recruitment,265/429 patients were included.238/265 were operated(184 CTS,54 LS) in whom an intraoperative biopsy was obtained(ligamentum flavum in LS; synovial tissue/flexor retinaculum in CTS) for histopathological analysis using Congo Red staining for amyloid detection and immunohistochemistry(IHC) or mass spectrometry(MS) for subtyping in amyloid A(AA), kappa, lambda and ATTR. Blood and urine test to rule out a monoclonal component and a cardiac scintigraphy(CS) with 99mTc-DPD to detect myocardial uptake were performed, which analysis was visual by Perugini scale. A cardiac SPECT/CT was performed in cases with a positive planar imaging, according to the ASNC/EANM guidelines. During follow-up of positive patients, clinical data suggesting CA were noted. ***Results:*** Total of 205 biopsies were obtained(155 CTS,50 LS), 16 of them were amyloid positive(8 CTS,8 LS). IHC for AA, kappa and lambda were negative. IHC for ATTR and MS analysis are still pending. 33 operated patients without biopsy(29 CTS,4 LS). 203 laboratory tests and CS have been performed: 5/203 CS were positive(grade 1-3). 4 of them underwent CTS surgery and 3/5 positive-CS had also positive biopsies for amyloid(2/5 without biopsy).In 14/203 laboratory tests, a monoclonal component was detected. 150/178 completed cases have all tests negative). To date, positivity for amyloid has been obtained in 18/238 cases(7.6%) and 18/147(12.2%) if an occupational risk for CTS was excluded: 16 positive biopsies (2/16 with a positive blood test for monoclonal component, 3/16 with positive CS and 11/16 with negative blood/urine test and CS) and 2 positive CS without biopsy and normal blood/urine test. In the follow-up(3.10 years) of patients with positivity, 27.8%(5/18) manifests cardiomyopathy, 4 of them with positive CS, and 88.9%(16/18) have previously other orthopedic manifestations. ***Conclusion:*** The estimated prevalence of amyloidosis in our series of surgically treated patients with CTS or LS is 7.6% and 12.2% if an occupational risk for CTS was excluded. These are preliminary data from an ongoing study.

OP-380

Interobserver agreement viewing planar, SPECT or SPECT/CT scans for suspected transthyretin cardiac amyloidosis: A multicenter study comparing ^{99m}Tc-3,3-diphosphono1,2-propanodicarboxylic acid and ^{99m}Tc-pyrophosphate

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Aim/Introduction: This study aims to determine the interobserver agreement in interpreting separate planar, SPECT and SPECT/CT images of 99mTc-3,3-diphosphono1,2-propanodicarboxylic acid (99mTc-DPD) and 99mTc-pyrophosphate (99mTc-PYP) scans in patients with suspected transthyretin cardiac amyloidosis (ATTR), and in comparison, to a reference standard: complete study interpretation. Both tracers were included to allow indirect comparison between the two most common tracers used for ATTR scintigraphy. ***Materials and Methods:*** The study cohort comprised 90 patients scanned for suspected ATTR. Planar images from consecutive patients were retrospectively reviewed to include 15 scans with each visual score (VS): 0, 1 and 2 or 3, from both 99mTc-DPD and 99mTc-PYP scans. Readers from six medical centers, reviewed separate components of the scan: planar, SPECT or SPECT/CT images, in 3 separate sessions. The readers assigned VS 0-3 and an interpretation category (INCT): Not suggestive, equivocal or strongly suggestive of ATTR. Consensus interpretation of complete scans, including planar and SPECT/CT images, served as reference standard. The Interobserver agreement was determined using interclass correlation test. Interclass correlation coefficient (ICC) estimates and 95% confidence intervals were calculated. Analyses were conducted to compare the scores given by the 6 readers and the most frequent judgment of the 6 readers (Mode), with reference standards, to assess total agreement (representing accuracy). ***Results:*** Interobserver agreement for VS and INCT was excellent for both 99mTc-DPD and 99mTc-PYP scans for separate components of the imaging protocol (ICC>0.9). The agreement was consistently better for 99mTc-DPD (ICC range 0.975 - 0.987 versus 0.880 - 0.973) but did not reach statistical significance. VS and INCT total agreement of readers with reference standard was consistently higher in 99mTc-DPD (62%-96% and 82%-98%, respectively) compared to 99mTc-PYP (33%-80% and 38%-91%, respectively). The total agreement based on the most frequent rating was significantly worse for 99mTc-PYP VS compared to 99mTc-DPD VS of planar images (p=0.004), and for VS and INCT of SPECT images (p<0.001) but not in SPECT/CT image interpretation. Visual scoring and INCT total agreement were significantly related to scan component only for 99mTc-PYP (p<0.001). ***Conclusion:*** This study demonstrates excellent interobserver agreement for visual interpretation of separate components of the imaging protocol for both 99mTc-DPD and 99mTc- PYP scans. However, compared to reference standard consensus reading of complete exams, 99mTc-PYP underperforms compared to 99mTc-DPD in planar and SPECT but not in SPECT/CT image interpretation. SPECT/CT should be a considered a required component of 99mTc- PYP scans for suspected Cardiac ATTR amyloidosis.

OP-381

Automatic Quantification In Gated-Spect ^{99m}tc-Dpd Studies As A Method For Calculating The Extension Of Affected Myocardium By Transtyretin Cardiac Amyloidosis (Ttr-Ca)

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Aim/Introduction: To establish the percentage of myocardium affected by transthyretin deposits in patients with positive 99mTc-DPD scan for TTR-CA, using automatic quantification tools in gated-SPECT (g-SPECT). ***Materials and Methods:*** Analysis of 60 patients with a gammagraphic diagnosis of TTR-CA (46 males; mean age 83.9 ± 5.8 years; 83% Perugini grade 3) who underwent a g-SPECT-CT study centred on the thorax. Images were processed with Myovation Evolution GE® and QPS/QGS GE® software. Segmented cardiac polar maps were obtained and the "extent of defect" (ED) parameter was calculated. This parameter was derived using a score that calculates the percentage of pixel counts < 2.5 standard deviations. The percentage extent of affected myocardium defined as the inverse of the SD (1-DE) was calculated. Finally, significant differences were sought according to degree of uptake, sex or age. ***Results:*** The average value of affected myocardium was 72.2% ± 20.4 (68.6% ± 23.2 in patients with Perugini grade 2 and 73% ± 20% in patients with Perugini grade 3). 22% (13/60) had myocardial involvement <50%, 30% (18/60) between 51-75%, 22% (13/60) between 76-90% and 26% (16/60) >90%. Statistical differences found were that the smallest extent of myocardium involved (<50%) was more frequent in patients with Perugini grade 2 (40%; p=0.0416). In contrast, greater extent (>90%) was more frequent in women (50%; p=0.0387) and in patients aged <70 years (75%; p=0.0236). ***Conclusion:*** The use of automatic quantification methods in g-SPECT allows an approximate calculation of the percentage of myocardium with 99mTc-DPD deposits (or affected myocardium by TTR-CA). This calculation may be useful in the follow-up of these patients and in monitoring the therapeutic response of the disease.

OP-382

Prognostic implications of quantitative cardiac [^{99m}Tc]-DPD uptake in transthyretin amyloid cardiomyopathy

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Aim/Introduction: Transthyretin amyloid cardiomyopathy (ATTR-CM) is associated with poor survival, and the prognostic implications of quantitative left ventricular (LV) [99mTc]-3,3 diphosphono-1,2 propanodicarboxylic acid ([99mTc]-DPD) uptake remain poorly understood. We aimed to investigate the relationship between quantitative LV [99mTc]-DPD uptake, cardiac structure and function, and their association with outcomes in patients with ATTR-CM. ***Materials and Methods:*** Eighty-three ATTR-CM patients underwent [99mTc]-DPD single-photon emission computed tomography/computed tomography (SPECT/CT) and two-dimensional speckle-tracking echocardiography. ***Results:*** ATTR-CM patients were divided into two cohorts based on the median of the standardized uptake value (SUV) retention index (low LV uptake: <5.47 mg/dL, n=41; high cardiac uptake: ≥5.47 mg/dL, n=42). We observed significant differences between cohorts in LV global longitudinal strain (LV-GLS: p=0.015), right ventricular longitudinal strain (RV-LS: p=0.026), NT-proBNP (p=0.007), troponin T (p=0.010), 6-minute walk distance (6MWD: p=0.023) and National Amyloidosis Centre (NAC) ATTR stage (I: p=0.021, III: p=0.004). We furthermore observed significant correlations (r, Spearman's correlation coefficient) between the SUV retention index and longitudinal cardiac function (LV-GLS: r=0.369, p<0.001; RV-LS: r=0.251, p=0.029), cardiac biomarkers (NT-proBNP: r=0.330, p=0.002; troponin T: r=0.265, p=0.017), exercise capacity (6MWD: r=-0.249, p=0.028) and disease stage (NAC ATTR stage: r=0.325, p=0.003]. ATTR-CM patients with high SUV retention index experienced adverse outcomes [composite endpoint: all-cause mortality or cardiovascular-related hospitalization, hazard ratio (HR): 1.124, 95% confidence interval (CI): 1.060-1.192, p<0.001]. ***Conclusion:*** In ATTR-CM, quantitative LV [99mTc]-DPD uptake correlates with longitudinal cardiac function, cardiac biomarkers, exercise capacity, disease stage, and enhanced cardiac and is associated with adverse outcomes.

OP-383

Prognostic and Therapeutic Evaluation of Quantitative Right Ventricular Uptake with ^{99m}Tc-DPD SPECT/CT in Transthyretin Cardiac Amyloidosis

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Aim/Introduction: To characterize right ventricle (RV) uptake derived from quantitative 99mTc-DPD SPECT/CT and evaluate its role in predicting outcomes and evaluating therapeutic effectiveness in transthyretin amyloid cardiomyopathy (ATTR-CA) patients. ***Materials and Methods:*** A total of 53 confirmed ATTR-CA patients were analyzed using quantitative 99mTc-DPD SPECT/CT, to determine maximum standardized uptake values (SUVmax) for the left ventricle (LV) and right ventricle (RV) free wall. SUVmax values were adjusted by dividing them with blood pool uptake, resulting in weighted SUVmax (wSUVmax). RV uptake was categorized as high or low based on the RV wSUVmax. ***Results:*** Patients with high RV uptake demonstrated significantly elevated levels of serum NT-proBNP ($P < 0.05$), IVS thickness ($P < 0.01$), and Gillmore staging ($P < 0.05$) compared to those with Low RV uptake. During a median follow-up of 16 months, multivariable Cox analysis revealed LV and RV wSUVmax as independent predictors of major adverse cardiac events (MACEs) as the primary endpoint. Longitudinal analysis of 20 patients on Tafamidis therapy as a secondary endpoint demonstrated a significant reduction in both LV wSUVmax ($P < 0.01$) and RV wSUVmax ($P < 0.01$) post-therapy. Moreover, patients with lower LV or RV wSUVmax at baseline experienced better treatment outcomes. ***Conclusion:*** High RV uptake quantified by SPECT/CT in ATTR-CA signifies advanced disease burden and worse prognosis. LV and RV wSUVmax emerged as useful imaging markers for monitoring the treatment effectiveness.

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Monday, October 21, 2024, 09:45 - 11:15
Hall F

e-Poster Presentations Session 6: Physics Committee: Radiomics, Artificial Intelligence, Quantification

EPS-106

Development and validation of ^{18}F-PSMA PET/MR-based radiomics model to predict biochemical recurrence-free survival after radical prostatectomy

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Aim/Introduction: Biochemical recurrence (BCR) is a critical indicator of prognosis in patients with prostate cancer undergoing radical prostatectomy (RP). Reliable prediction models are essential to identify patients at risk of BCR and to implement targeted adjuvant therapies. This study aims to develop and validate a clinical-radiomics model based on preoperative ^{18}F-PSMA PET/MR to predict BCR-free survival in prostate cancer patients undergoing RP. ***Materials and Methods:*** This retrospective study was conducted on 221 prostate cancer patients confirmed by histopathology and treated with RP. The cohort was randomly divided into a training set (155 patients) and a validation set (66 patients). All patients undergoing a preoperative ^{18}F-PSMA PET/MR scan. Radiomic features were extracted using the Lifex software from PET, DWI, and T2-weighted images, including 117 features in total. A radiomic signature was developed using the Least Absolute Shrinkage and Selection Operator (LASSO) regression model. The performance of the radiomic signature in predicting BCR-free survival was assessed using Harrell's concordance index (C-index) and incorporated into a multimodal analysis with clinicopathological variables. ***Results:*** The radiomic signature, including five features, demonstrated a C-index of 0.84 (95% CI: 0.76-0.92) in the training cohort and 0.81 (95% CI: 0.71-0.91) in the validation cohort. In multivariate analysis, the radiomic signature remained an independent predictor of BCR-free survival (HR: 3.15, 95% CI: 2.21-5.37, $p < 0.001$). Adding the radiomic signature to a base model including clinicopathological variables significantly enhanced predictive performance (C-index: 0.88, 95% CI: 0.80-0.96, $p < 0.001$). ***Conclusion:*** We developed and validated a novel clinical-radiomics model based on ^{18}F-PSMA PET/MR that can predict BCR-free survival in patients undergoing RP for prostate cancer. This model could help identify patients at higher risk of BCR, thus enabling personalized risk stratification and tailored treatment strategies.

EPS-107

Improving Clinical Progression Prediction in Prostate Cancer: Utilizing Radiomics of Normal Tissue in Negative PSMA PET/CT Scans for Patients with Biochemical Recurrence

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Aim/Introduction: Prostate-specific membrane antigen (PSMA) PET/CT is commonly used for prostate cancer patients with biochemical recurrence (BCR). However, the long-term implications of PET/CT negativity are unclear. Our study evaluates radiomics features of normal tissue in negative [18F]DCFPyL PET/CT scans to predict clinical progression in BCR patients. ***Materials and Methods:*** This subgroup analysis is based on a prospective clinical trial. 95 patients (mean age: 74.16 years) with BCR after primary treatment with curative intent, negative on [18F]DCFPyL PET/CT and followed without active treatment. TotalSegmentator was employed to automatically segment hip bone, liver, lung, sacrum, and prostate bed (without prostatectomy) from 3D CT images . Clinical progression (CP) and clinical progression-free survival (CPFS) after negative PSMA PET/CT were determined based on routine follow-up imaging. Radiomics features, including intensity-based and GLSZM, GLRLM, and GLCM-based features, were extracted using Lifex 7.3.0 [2]. Feature selection methods were LASSO, MRMR, and NCA. Selected features were employed in classification tasks with various ML algorithms: KNNs, Linear Discriminant Analysis, Logistic Regression, ADABoosted, SVMs, kernel-based methods, Neural Network, Random Forest, RUSBoosted Trees, and Subspace KNN. Performance was assessed via 5-fold cross-validation, reporting mean results of 50 iterations for robustness. ***Results:*** Thirty patients (31.8%) experienced CP within various areas on their follow-up scans with a median CPFS of 38.75 months (range: 7.5-71 months). Analysis of negative [18F] DCFPyL PET scans revealed that radiomics features including intensity, GLRLM, and GLSZM from the lung, along with intensity from the hip bone, liver, and prostate bed, and GLSZM of the sacrum, showed the highest predictive power for CP. For instance, the overall performance of Fine KNN with NCA feature selection showed predictive power for CP with an accuracy of (78±2.9)%, F-score of (84±2.2)%, precision of (83±1.8)%, sensitivity of (86±3.6)%, and specificity of (61±4.5)%. We performed multivariate Cox regression to examine the association of the normal tissue radiomics features with CP. The selected features by LASSO i.e. intensity features from the hip bone, liver, and lung, along with GLCM from the hip and liver, and GLSZM from the hip bone were examined. Among these, intensity-based Kurtosis of the lung demonstrated the strongest association with the outcome (hazard ratio=1.21, P-value < 0.001). ***Conclusion:*** This study establishes a radiomics signature from apparently normal tissue in negative [18F]DCFPyL PET/CT scans of BCR patients, predictive of CP. These features offer potential predictive value for CP and CPFS, providing valuable insights that could guide treatment decisions in such cases.

EPS-108

Multicollinearity and redundancy of the PET radiomic feature set

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Aim/Introduction: Radiomic feature sets contain many strongly correlating features. The aim of this study was to map this multicollinearity in five [18F]FDG-PET cohorts with different tumour types and identify non-redundant features. ***Materials and Methods:*** Five [18F]FDG-PET radiomic cohorts were analysed:

non-small cell lung carcinomas (N=35), pheochromocytomas and paragangliomas (N=40), head and neck squamous cell carcinomas (N=54), [18F]FDG-positive thyroid nodules with indeterminate cytology (N=84), and gastric carcinomas (N=206). Lesions were delineated and 105 radiomic features were extracted with a fixed bin size of 0.5 or 0.55 g/mL using PyRadiomics. Interpolated voxel sizes were standardised per cohort and ranged from 3.18×3.18×3.00 mm^3 to 4.00×4.00×4.00 mm^3. In all cohorts, Spearman's rank correlation coefficient (ρ) matrices of features were calculated and it was determined which features showed (very) strong (ρ>0.7 and ρ>0.9) correlations with any other feature in all five cohorts. Cluster analysis of an averaged correlation matrix for all cohorts was performed at a threshold of ρ=0.7 and ρ=0.9. For each cluster, a representative, non-redundant feature was selected. ***Results:*** Seventy-two and 90 out of 105 features showed a (very) strong correlation with any other feature in all five cohorts. Cluster analysis resulted in 35 and 15 non-redundant features at thresholds of ρ=0.9 and ρ=0.7, respectively. Non-redundant features at ρ=0.9 are (* marks non-redundancy at ρ=0.7): intensity features energy, kurtosis*, maximum*, and skewness; shape features elongation*, flatness, least axis length, sphericity*, surface-to-volume-ratio*, and volume*; total lesion glycolysis; grey level co-occurrence matrix features cluster shade*, correlation*, inverse difference moment normalized, inverse measure of correlation 1* and 2, inverse variance*; grey level run length matrix features grey level nonuniformity*, long run (high grey level) emphasis, and low grey level zone emphasis; grey level size zone matrix features grey level nonuniformity, high grey level zone emphasis, large area high/low grey level emphasis, low grey level zone emphasis*, size zone nonuniformity (normalized*), and small area (low grey level) emphasis; grey level dependence matrix features large dependence high grey level emphasis* and small dependence low grey level emphasis*; and neighbouring grey tone difference matrix features busyness, contrast, and strength. Seventy or 90 redundant features could be omitted at thresholds of ρ=0.9 and ρ=0.7, respectively. ***Conclusion:*** At least two-third of the radiomic feature set could be omitted, because of strong multicollinearity. More redundant features could be identified using a less conservative threshold. Future research should indicate whether multicollinearity of the radiomic feature set is similar in other modalities.

EPS-109

Radiomic feature variability in response to deep-learning image enhancement algorithms:a phantom and sarcoma patient evaluation.

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Aim/Introduction: PET/CT imaging data contains a wealth of quantitative information that combined with other 'omic data can provide valuable contributions to tumour characterisation. However, the dependence of PET radiomics on reconstruction technique limits reproducibility and generalisability. Here, we characterise the response of radiomic features to two research deep-learning (DL) image enhancement algorithms from a manufacturer in a phantom simulating heterogeneity and sarcoma patient data. Both DL-enhancement algorithms are trained to generate time-of-flight (TOF) block sequential regularisation expectation maximisation (BSREM) like images. The first algorithm, DLT, uses a BSREM-non-TOF image as the input with potential applications in systems with high sensitivity low temporal resolution crystals [1]. The second, DLE, uses a TOF ordered-subset expectation maximisation (OSEM) image as the input, to achieve a BSREM-TOF like image at lower computational cost [2]. ***Materials and Methods:*** A modular heterogeneous phantom was filled with F^{18} [3]. Five repeat acquisitions of the phantom were acquired on a GE Discovery 710 PET/CT scanner. A retrospective sarcoma clinical dataset from the same department was also analysed, with segmentation performed by an experienced nuclear-medicine radiologist (n=15, 17 tumours). First DL-enhanced images were compared to the respective algorithm input images. Then the DL-enhanced images were compared to the gold-standard BSREM-TOF images the algorithms were trained to emulate. Ninety-three radiomic features were extracted (first order and texture features excluding shape, imaging biomarker standardisation initiative compliant). The significance of the difference between images was tested for each radiomic feature ($p<0.05$, Bonferroni-corrected for 93 features). ***Results:*** In phantom data when comparing input to DL-enhanced images a high proportion of features measured as significantly different (DLT:35.6%, DLE:40.8%), this decreased when comparing DL-enhanced images to the gold-standard reconstruction method (DLT:5.5%, DLE:6.7%). In the tumour data a smaller difference was observed (DLT:24.7%, DLE:20.4% vs. DLT:19.4%, DLE:16.1%). Patterns of radiomic feature variability were similar in patient and phantom images; 74.2% of highly variable phantom features (mean percentage difference >15%) also measured as highly variable in tumour data. ***Conclusion:*** In unseen data, DL-enhancement techniques affect radiomic feature values as compared to input images. However, DL-enhanced images behaved, at the quantitative level of radiomic features, similarly to the 'gold-standard' images the algorithms are trained on. These results offer insight into the performance of the DL algorithms, and demonstrate the potential of DL algorithms in harmonisation for radiomics. ***References:*** Mehranian et al. EJNMMI 2022;49(11):3740-3749; Mehranian et al. EJNMMI 2022;49(2):539-549; Kalisvaart et al. Med Phys. 2022;49(5):3093-3106.

EPS-110

Automated 68Ga-PSMA-PET Total Metabolic Tumor Volume (TMTV) extraction for predicting PSA change in 177Lu-PSMA therapy

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Aim/Introduction: An automated method to extract TMTV from 68Ga-PSMA-PET images is proposed. It is used to assess the predictive capability of PET images towards PSA change. ***Materials and Methods:*** 58 patients who completed 1 to 6 cycles of 177Lu-PSMA were analyzed. Patients were categorized into responders and non-responders based on PSA nadir which refers to the difference between the initial PSA and the lowest PSA value observed throughout the course of treatment. Lesional uptake was automatically separated from physiological uptake, followed by a threshold based on the mean uptake in physiological areas, to obtain the Total Metabolic Tumor Volume (TMTV). SUV mean in TMTV regions was plotted against response status for 68Ga-PSMA-PET, ^{18}F-FDG-PET, and 177Lu-PSMA-SPECT imaging (24h after

injection, 1st cycle). A subset analysis focused on bone lesions (TMTVbones). A fully connected multi-layer neural network (NN) model was trained to predict the outcome with TMTV statistical values (mean, max, min, ···) as input. ***Results:*** Statistical analysis revealed significant differences in TMTV between responders and non-responders for 68Ga-PSMA and 177Lu-SPECT (p-value 0.03 and 0.005 respectively). However, ^{18}F-FDG did not demonstrate predictive value, alone or in combination with 68Ga-PSMA. The NN prediction model utilizing 68Ga-PSMA's TMTV statistics achieved the highest performance, with an AUC of 0.76. TMTVbones did not improve the results. ***Conclusion:*** Automated TMTV extraction from 68Ga-PSMA-PET and 177Lu-PSMA-SPECT confirms predictive potential for PSA change with a simple NN model. ^{18}F-FDG did not provide additional predictive value. These findings underscore the importance of pre-treatment imaging modalities in guiding personalized therapy decisions and optimizing patient outcomes. ***References:*** Moazemi S et al. Decision-support for treatment with 177Lu-PSMA: machine learning predicts response with high accuracy based on PSMA-PET/CT and clinical parameters. Ann Transl Med. 2021.

EPS-111

UNIRIV: a French database to identify factors predictive of response and toxicity in the treatment of metastatic prostate cancer with 177Lu-PSMA.

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Aim/Introduction: The UNIRIV project is a French multicenter study aiming to identify predictive factors of response and occurrence of toxicities in the treatment of metastatic prostate cancer with 177Lu-PSMA. A radiomic method is used to search for links between the quantitative parameters of pre-treatment 68Ga-PSMA PET/CT imaging, and the biological, clinical and dosimetric results of post-treatment patients. However, obtaining diagnostic biomarkers requires very large volume of data, which necessitates the centralization of data from several partner centers. The construction of this multimodal and multicenter database constitutes the first step of the UNIRIV project. The UNIRIV project benefits from funding from the French UNIBASE 2 program. ***Materials and Methods:*** The data to be centralized for each patient was identified. The availability of data to be mobilized by partner centers was verified. Data sources and the digital and/or manual means of extraction and transfer used by partner centers were evaluated. Data Protection Impact Assessment (DPIA) was carried out. ***Results:*** Data to be centralized per patient include quantitative parameters extracted from 68Ga-PSMA PET/CT imaging (SUVmax, SUVpeak, SUVmean, total tumor volume, quantification and quality of tumor uptake of 68Ga-PSMA), biological data (PSA tumor marker, Gleason score, white blood cell count, absolute neutrophil count, platelet count, etc.), and clinical data (PCWG3 criteria, improvement of clinical symptoms, analgesic effect of treatment). Eleven centers are participating in the UNIRIV project, and will provide multimodal data. Their data will be hosted and centralized in a secure project space, whose digital infrastructure is currently being built by the data center of the French National Federation of Cancer Centers (UNICANCER). An initial data set is available, and will serve as a test for remote transfer, storage and analysis operations. ***Conclusion:*** Building a multi-modal, multi-center database is a long and difficult process. UNIRIV is the first French nuclear medicine database project to centralize clinical, biological and imaging data.

EPS-112

The utility of textural characteristics derived from ^{18}F-FDG PET-CT in pathological response prediction following neoadjuvant chemotherapy in locally advanced breast cancer patients

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Aim/Introduction: Breast cancer is the most frequent cancer among women around the world with second highest morbidity. PET-CT is an indispensable tool for staging and assessing response in breast cancer. The radiomics is a new area of research in PET-CT imaging, serving as an additional tool to predict the treatment response of tumor. We have assessed the relevance of textural characteristics derived from ^{18}F-FDG PET-CT scan in predicting the pathological complete tumor response (pCR) following neoadjuvant chemotherapy in patients with locally advanced breast cancer. ***Materials and Methods:*** A total of 83 histopathologically proven locally advanced breast cancer patients underwent baseline ^{18}F-FDG PET-CT. The primary lesion was segmented through semiautomatic mode with 40% SUVmax threshold and textural characteristics were extracted. The patient then received neoadjuvant chemotherapy followed by surgery. Surgical histopathology reports were utilized for pCR assessment. The predictive performance of different radiomic parameters for identifying pCR or non-pCR was evaluated using univariate and multivariate logistic regression. The variable exhibiting a significant p-value (less than 0.05) was analyzed using a receiver operating characteristic (ROC) curve. We additionally analyzed correlation of textural characteristics of the primary tumor with immunohistochemistry markers at dual time point imaging at 1 and 2 hours. ***Results:*** The subjects' mean age was 51 +/- 10.5 years (28-76 years). Most of the patients (41%) were in clinical stage IIIB, and 35% were IIIC. Among the 83 patients, a total of 23/83 (27.7%) patients exhibited pCR. 60/83 (72.3%) patients were categorized as non-pCR. Four parameters, namely approximate volume, Run Length Non-Uniformity, Grey Level Non- Uniformity, and Zone Size Non-Uniformity (ZSN) showed p value <0.05 in univariate logistic regression analysis for prediction of pCR. In ROC curve, ZSN had area under curve of 0.703 at cut-off value of 170.13, with a sensitivity of 66.7% and specificity of 69.6%. for prediction of pCR. In 1-hour data, none of the radiomic parameters showed any significant correlation with immunohistochemistry markers. However, in 2-hour data, significant correlation of many radiomic parameters with ER, PR and Mib-1 index was seen. ***Conclusion:*** This correlation analysis indicates associations between radiomic parameters on PET-CT and pCR as well as immunohistochemistry markers, providing insights into the potential use of these features in understanding tumor characteristics and assessment of treatment outcome.

EPS-113

Clinical Evaluation of Deep Learning Corrected PET Imaging for Lesion Detection and Quantification

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Aim/Introduction: Ensuring the reliability of AI for clinical use, particularly in AI-generated medical imaging, is a significant concern due to potential false findings. There are currently limited recognized standards or methods for managing and testing medical AI systems, especially those related to AI-generated imaging. Many evaluations focus solely on image-based metrics rather than assessing clinical applicability. Our objective is to develop a systematic clinical evaluation method specifically for AI-generated PET imaging, with a primary focus on lesion detection and quantification. ***Materials and Methods:*** We conducted a clinical evaluation using whole-body PET images from 359 patients administered with 18F-FDG, 18F-PSMA, 68Ga-DOTA-TOC, 68Ga-DOTA-TATE, 68Ga-FAPI, acquired with clinical PET scanners, namely the Biograph Vision (Siemens Healthineers), United Imaging uMI 780 (United Imaging), Discovery MI (General Electric Healthcare) in Shanghai and Bern. PET imaging generated by three deep learning (DL) models (2D, 3D and Decomposition-based [1]) used for attenuation and scatter correction (ASC) were compared with CT-based ASC imaging. Image quality was assessed using a Likert scale across six anatomical regions: head, neck, chest, abdomen, pelvis, and limbs. All lesions were identified and delineated on all datasets to evaluate lesion detectability and alterations in SUVmax values. ***Results:*** Image quality scores indicated that CT ASC-PET images and Decomposition-based DL PET images were comparable ($p<0.05$) across all anatomical regions, whereas 2D and 3D DL PET scores were significantly lower ($p>0.05$). Regarding lesion detectability, both 2D (FPR=0.3%, FNR=5.0%) and 3D (FPR=0.5%, FNR=7.3%) DL ASC PET exhibited false positives and false negatives, whereas only one false positive was observed with Decomposition-based DL ASC PET (FPR=0, FNR=0.06%). The mean absolute percentage deviation (MAPE) calculated between SUVmax values from DL ASC and CT ASC PET revealed that Decomposition-based DL PET achieved the lowest estimation error across all anatomical regions in all datasets. ***Conclusion:*** The systematic comparison of the three groups of DL images demonstrates that Decomposition-based DL PET images outperform 2D and 3D DL PET images in terms of qualitative image quality, lesion detectability, and semi-quantitative evaluations, achieving image quality comparable to CT ASC-PET images. ***References:*** [1] Guo, R. et al., Nat Communications 13, 5882 (2022).

EPS-114

Deep learning-based synthesis of TSPO PET from T1 weighted MRI images only

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Aim/Introduction: Chronic pain-related biomarkers can be found using a specific binding radiotracer called [^{11}C]PBR28 able to target the translocator protein (TSPO), whose expression is increased in activated glia and can be considered as a biomarker for neuroinflammation[1]. However, PET imaging is expensive, requires the use of ionizing radiation and the proximity of a cyclotron. Structural (i.e. T1-w MRI) images may encode information relevant to neuroinflammation because the latter also involves some morphological/structural changes in the glial cells. We here aimed to develop a deep learning model able to synthesize PET images of the brain from T1w MRI only. ***Materials and Methods:*** Our dataset includes 204 patients (28 healthy controls, 87 knee osteoarthritis cases, and 89 chronic lower back pain cases), undergoing simultaneous 3T MRI and [^{11}C]PBR28 (TSPO)-PET imaging. Prior to PET/MR imaging, all subjects were injected with a dose in the range 9-15mCi. T1-weighted MRI and PET images were coregistered, skull-stripped, and normalized using FSL and python. The 3D U-Net architecture was specifically adapted for the task of synthesizing PET images from MRI inputs[2]. The core of the model's design is a depthwise separable convolution-based encoder, which incorporates four layers of downsampling. This minimizes the number of parameters necessary to deal with 3D images without overfitting or generating prohibitive memory footprints. The model is trained with a balanced loss between binary cross-entropy and mean squared error for 50 epochs using the Adam optimizer. ***Results:*** Voxel-wise analysis incorporated the mean squared error (MSE) to gauge reconstruction accuracy, with percentage difference maps highlighting spatial error distribution, the normalized difference and the contrast-to-noise ratio. A low MSE of 0.0034+/-0.0010 for raw synthesized PET indicated minimal voxel-wise intensity error. Smoothing the synthesized PET images further reduces MSE. NormDiff showed a mean close to zero, confirming an unbiased reconstruction of PET intensities. Smoothing the synthesized images further lowered this measure, indicating improved reconstruction accuracy. CNR calculations yielded similar mean values across raw and smoothed synthesized images, demonstrating the preservation of diagnostic characteristics in synthesized PET. ***Conclusion:*** We introduced a novel and non-invasive method to transform current diagnostic and therapeutic strategies for chronic pain conditions offering an opportunity to monitor neuroinflammation in chronic pain patients more frequently with a reduced cost. This facilitates personalized treatment and the acquisition of large-scale studies, potentially leading to a better understanding of the complex mechanisms of chronic pain and to the discovery of new therapeutic targets. ***References:*** [1]Loggia,https://doi.org/10.1093/brain/awu377;[2]Weng,https://doi.org/10.1109/ACCESS.2021.3053408.

EPS-115

CT-less PET by AI-derived synthetic CT trained in a federated learning setup

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Aim/Introduction: With the emergence of long axial field of view (LAFOV) PET/CT scanners, PET sensitivity has increased markedly allowing for reduced radiation dose. The associated attenuation correction (AC) CT scan then becomes the primary source of ionizing radiation. Deep learning synthetic CT (sCT) for AC using non AC emission data (NAC PET) has been demonstrated to achieve excellent results, and even addresses common artifacts due to motion [1]. Developing AI-models which are robust to demographic and site variations is becoming more challenging

with as data privacy regulations evolve. We propose a federated learning (FL) setup where local hardware is used for training and patient data storage, and the model is composed of data from multiple sites. ***Materials and Methods:*** Training: Paired NAC PET and CT images from 515 patients scanned on a LAFOV PET/CT at Rigshospitalet, Copenhagen (RH-cohort). PET (FDG 3MBq/kg) were reconstructed according to clinical protocol (4i5s). NAC PET for training: 4mm filtering, noPSF. PET images for evaluation: full PSF, 2mm filtering. Patients were scanned from vertex to mid-femur (106 cm). Furthermore 25 patients available at Siemens Healthineers (External-cohort) were used in this study. Data was uploaded to the federated learning platform with data storage and permission remaining site-controlled. A GAN-model was trained according to [1], 30 subjects were reserved for independent testing. First, training was performed on the RH cohort using the FL framework. We report mean relative error in selected organs between PET and sCT-AC PET. Secondly, we applied a two-site FL approach by using transfer-learning from the first run, alternating the training between the two sites/cohorts for 25 rounds with 10 epochs per round. To balance the datasets, only 25 subjects were used per location. ***Results:*** Quantitative analysis from the single site evaluation revealed mean relative error of liver, lung, kidney, heart, aorta, spleen, brain, bones of -2.8 ± 3%, 1.5 ± 6.3%, -1.8 ± 4.0, -1.6 ± 5.1%, -1.4 ± 3.5%, -3.5 ± 3.4%, -3.7 ± 3.2.7%, -2.9 ± 2.1% respectively. The two-site training demonstrated proof-of-concept for training an AI-model in a federated setup with local data.. ***Conclusion:*** We present a federated learning setup demonstrating implementation of a GAN-model. The model provides CT-less PET benefitting radiation sensitive cohorts using LAFOV PET scanning below 0.5 mSv. Furthermore, we demonstrated that a federated training setup is feasible with local handling of training and data storage. ***References:*** [1] Montgomery, M.E. , Andersen, F.L., Ladefoged, C.N. Diagnostics 2023. https://doi.org/10.3390/diagnostics13243661.

EPS-116

Evaluation of a deep learning method for registration of long axial field-of-view PET with CT images

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Aim/Introduction: Accurate PET-CT co-registration is crucial for accurate and precise attenuation correction in hybrid PET/CT scanners. Schaefferkoetter et al. developed a supervised convolutional neural network(CNN) utilizing elastic registration of anatomical data to mitigate motion artefacts and enhance image quality and quantification of attenuation corrected PET images[1]. However, the generalization ability of this CNN-based method requires validation across a diverse range of radiotracers and different scanner configurations, as the original training dataset was limited to four PET tracers on a single short axial field-of-view(SAFOV) scanner. Therefore, the aim of this study was to evaluate the performance of the CNN-based PET-CT co-registration method for additional PET tracers on a long axial field-of-view(LAFOV) PET/CT scanner. ***Materials and Methods:*** The CNN-based PET-CT co-registration framework employed a dual-network architecture consisting of a shared feature extraction CNN and a deformation vector field(DVF) prediction CNN. The performance of the method was evaluated using multiple datasets acquired with five different PET tracers on a LAFOV PET/CT scanner. PET images used as registration targets were not corrected for attenuation(NAC) and reconstructed by PSFTOF-OSEM, 4 iterations and 5 subsets, and without post-reconstruction filtering. To investigate the impact of the co-registration method on attenuation correction, two sets of attenuation-corrected images were reconstructed using the same reconstruction settings: one set utilized the co-registered CT obtained by applying the co-registration framework, and another used the original CT for attenuation correction(ACCT). ***Results:*** PET images reconstructed using the co-registered CT demonstrated a significant improvement in image quality by reducing the characteristic respiratory "banana artefact" at the liver dome compared with corresponding PET images reconstructed using the original ACCT. PET images with co-registered CT exhibited a more uniform tracer distribution within the whole liver, with a reduction in standard deviation ranging from 18.8% to 35.3% across different tracers. In addition, the co-registration method led to an increase in activity in the liver ranging from 1.9% to 3.7%. Finally, better alignment between tracer distribution and anatomical information was observed. ***Conclusion:*** The CNN-based PET-CT co-registration method appears to be generalizable to different tracers and scanners not included in the original training dataset, demonstrating great potential for improving attenuation correction accuracy and, especially, for reducing respiratory artefacts. However, occasional mismatches of bones were observed, indicating the need for additional registration strategies, such as rigid registration for bones. Nevertheless, the method could potentially be a valuable tool for quantitative PET imaging. ***References:*** [1] Schaefferkoetter, EJNMMI 50,8: 2292-2304 (2023).

EPS-117

^{225}Ac phantom characterization, in vivo mouse imaging, and quantitation on a commercial benchtop imaging system

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Aim/Introduction: Targeted alpha therapy (TAT) is an increasingly active area of research and development. Direct imaging of TAT compounds is advantageous for understanding biodistribution and dosimetry but is often challenging due to the complex decay schemes and low administered activities, typical of alpha emitters in TAT. We aimed to evaluate a commercial desktop imaging system equipped with a prototype high-energy, high-sensitivity collimator suitable for in vivo imaging of therapeutic amounts of 225Ac-labeled compounds. ***Materials and Methods:*** A benchtop preclinical imaging system was equipped with a Tungsten prototype high-energy, high-sensitivity collimator. Uniformity and linearity calibrations were performed to enable gamma-imaging of the 225Ac daughters, multiple characteristic x-rays, and a triple energy window (TEW) scatter correction for the 86 keV photopeak. A mouse phantom, consisting of bladder (11 kBq), left kidney (22 kBq), right kidney (37 kBq), and tumor (16 kBq) compartments, was used to assess acquisition and quantitation performance post-calibration. Jax Nu/J female mice were inoculated with 1 million AR42J cells. Mice were administered 185 kBq (5 uCi) of [225Ac]DOTATATE and sacrificed 1h and 4h post-injection (p.i.), respectively. Additional mice were imaged in vivo at 1, 24, 48, and 168h p.i. Whole-body planar image data were acquired for

30-60 minutes in all cases. ***Results:*** Image data were successfully acquired in both the mouse phantom and mice. Qualitative distribution of mouse phantom data was concordant with known activity distribution with all four phantom compartments clearly visualized. Correlation coefficients between estimated and known activities were 0.96, 0.90, and 0.86 for the 86, 218, and 440 keV photopeaks, respectively. Both ex vivo and in vivo mouse imaging show clearly differentiated uptake in kidneys and tumor across multiple time points post-administration, enabling generation of tissue time-activity curves suitable for analysis. ***Conclusion:*** This proof-of-concept study indicates that quantitative 225Ac imaging across multiple photopeaks with a commercial desktop planar imaging system is feasible in mice, using relevant administered activities and practical imaging times. Future work includes optimization of performance for high energy peaks, including TEW scatter correction windows, test-retest studies, and dynamic in vivo mice imaging to assess tissue biodistribution differences across photopeaks.

EPS-118

Comparison of Striatal Binding potentials between a 360°-CZT system and a conventional camera equipped with LEHRS collimators: an anthropomorphic phantom study

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Aim/Introduction: The 123I-FP-CIT dopamine transporter SPECT imaging is basically performed using a conventional gamma-camera equipped with LEHR collimators. Our objective is to evaluate with a phantom how to perform and optimise this cerebral examination with two recent technologies: LEHRS collimators (0.13 mm septal-thickness) using a conventional Anger-camera and a 360°-CZT camera (12 moving-detectors). ***Materials and Methods:*** A striatal anthropomorphic phantom was filled with 39 MBq of 123I to achieve the following Binding Potentials (BP) with wholebrain excluding striatum as reference: 6.3 for right and left caudate nuclei, 6.3 for the left putamen and 2.5 for the right-one. On 360°-CZT system, acquisitions were performed in non-focus (0F) brain-focus (BF) and striatum-focus (SF) modes in 30 minutes, the list-mode allowing to achieve acquisitions in various time-durations. On Anger-camera with LEHRS, acquisitions were successively performed in 22, 11 and 5 minutes. Iterative reconstructions were performed with different number of iterations, using an iterative resolution recovery algorithm (OSEM-RR) with no additional correction. For 360°-CZT system, we also used reconstructions recommended by the manufacturer. Reconstructed images were qualitatively validated by an experienced nuclear-physician. Quantification was done with a dedicated software based on CT segmentation of the phantom and correcting the partial volume effect. The mean square error (MSE) was calculated between expected and measured BP. ***Results:*** For the 360°-CZT system, image quality is visually acceptable whatever the conditions of acquisition and reconstruction. For LEHRS, image quality is considered not visually acceptable when acquired in 5 min, related to reconstruction parameters in 11 min and always interpretable for 22 min. For the 360°-CZT system, in 0F mode, the maximum MSE is 0.2 and decreases when the number of counts increases (<0.1). In BF mode, the MSE is below 0.1 whatever the acquisition-time. In SF mode, BP are highly increased the MSE is then between 0.3 up to 0.6. For LEHRS, even if MSE varies slightly within iterations and acquisition time, MSE is around 0.16 with a maximum value of 0.23. ***Conclusion:*** Some of our experimental conditions lead to high number of counts that are over the observed range in usual clinical conditions (SF-mode and all data in 22 min). Results in 5- and 11-minutes show that BP in brain compartments can be quantified with good accuracy for the BF mode (corresponding to the lowest MSE) and also in 0F mode and LEHRS. Attenuation correction will be shortly investigated to test its impact on quantification.

EPS-119

Bias and precisionof SPECT-based ^{177}Lu activity-concentration estimation using a ring-configured solid-state versus a dual-headed Anger system

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Aim/Introduction: The aim was to experimentally evaluate 177Lu activity-concentration estimation for a ring-configured CZT gamma-camera system and compare it with a conventional dual-headed Anger system for imaging at 113 keV and 208 keV with respect to bias and precision. ***Materials and Methods:*** Phantom experiments were performed on a dual-headed Anger system with 5/8" NaI(Tl) crystal (MEGP collimator) and a ring-configured CZT system. A NEMA PET body phantom with six spheres (1.2 mL, 2.6 mL, 5.6 mL, 11.5 mL, 26.5 mL, and 113 mL) and an anthropomorphic phantom with a liver insert and two spheres (10 mL and 25 mL) were filled with 177Lu. The NEMA phantom had a non-radioactive background, and the anthropomorphic phantom was imaged both with activity in the spheres and with activity in spheres and liver (ratio 15:1). SPECT projections at 113 keV and 208 keV were acquired for 1 h and divided into six 10-minute timeframes. Tomographic reconstruction was performed using OS-EM (Anger system: 1-40 iterations, 10 subsets, ring-configured system: 2-30 iterations) with compensation for attenuation, scatter (ESSE (Anger system) and window based (ring-configured system)), distance-dependent spatial resolution, and penetration (ring-configured system at 208 keV). Volumes-of-interest following the physical size of the spheres were defined and activity-concentration mean relative errors and coefficients-of-variation (CVs) over timeframes were computed for the different number of iterations. ***Results:*** The two systems showed similar mean relative errors and CVs for 208 keV. For the smallest and largest NEMA-sphere, at 20 iterations the mean relative errors/CVs were -66 %/21% and -19%/1% for the Anger system and -70%/17% and -27%/1% for the ring-configured CTZ-system. At 113 keV, corresponding results for Anger-system were -60%/15% and -20%/0.3% compared to -50%/12% and -8%/1% for the ring-configured system. For the anthropomorphic phantom with non-radioactive background at 208 keV, results for the sphere inserts were -34%/2% and 29%/1% (Anger) and -39%/3% and -32%/0.5% (ring-configured). At 113 keV, results were -34%/2% and -28%/1% (Anger) and -21%/2% and -12%/2% (ring-configured). For radioactive background at 208 keV, results were 38%/3% and -28%/1% (Anger) and -41%/2% and -33%/2% (ring-configured). At 113 keV results were -37%/2% and -28%/2% (Anger) and -24%/5% and -17%/2% (ring-configured). ***Conclusion:*** The ring-configured

CZT system is an alternative to the Anger system for estimation of 177Lu activity concentration. Precisions are similar for the two systems, whilst bias is better for the ring-configured system for imaging at 113 keV.

EPS-120

Kinetic analysis of [18F]MC225 data without arterial sampling

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Aim/Introduction: Arterial blood sampling is an invasive and time-intensive procedure. Although non-invasive quantification is available for tracers if a reference region exists, the requirement for arterial sampling remains if no such region is available1. Therefore, the purpose of this study was: (1) to validate the use of a long axial field-of-view (LAFOV) PET scanner to measure the arterial whole blood time-activity curve (BAC), and (2)to assess whether venous rather than arterial samples could be used to measure the plasma-to-whole blood ratio (PBR) and the plasma parent fraction (PPF). The study made use of data from [18F]MC225 PET acquisitions. ***Materials and Methods:*** Four healthy controls and two Parkinson's disease patients underwent 60-minute scans on a LAFOV PET scanner after administration of 162±58 MBq [18F]MC225. Manual blood samples were collected from the radial artery at 5, 10, 20, 30, 40, 50, and 60 minutes after the start of injection. Radioactivity concentration in whole blood samples was determined using a gamma counter. For BAC estimation, in the early time frames, a 14-20 mm circular region-of-interest (ROI) was placed around the aortic arch. Subsequently, a 1 cm^3 spherical volume-of-interest centred at the maximal pixel intensity (VOImax) within each ROI was generated. TACs for each VOImax were compared with the manual samples. To compare venous with arterial manual samples, six healthy controls from the previous [18F]MC225 study were used2. Arterial and venous samples were collected from the radial artery and the antecubital fossa vein, respectively, at 5, 10, 20, 40, and 60 minutes after injection. Radioactivity concentrations in whole blood and plasma were determined using a gamma counter. PPF was determined using thin-layer chromatography analysis. ***Results:*** Across different time points, a mean Spearman correlation coefficient of r=0.98±0.02 was observed between BAC values derived from aortic arch and whole blood concentrations from manual samples, showing higher values than reported in a previous study3. For the comparison between venous and arterial samples, strong Spearman correlations were observed for PBR (r=0.90, p=0.042) and PPF (r=1.00, p=0.0083), consistent with findings for other tracers4-6. ***Conclusion:*** This study shows that an accurate BAC can be obtained using a LAFOV PET and that, for [18F]MC225, arterial samples can be replaced by venous samples, making a [18F]MC225 study more patient-friendly and cost-effective. It should be noted that the use of venous samples should be validated for each tracer separately. ***References:*** 1Volpi, et al.(2023);2Mossel, et al.(2023);3Reed, et al.(2024);4Tomasi, et al.(2019);5Galovic, et al.(2021);6Ng, et al.(2013).

EPS-121

A Rapid Brain Perfusion Analysis Method with ^{18}F-FDG PET by Using Coincidence Event Detection

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Aim/Introduction: The significance of brain perfusion in ischemic stroke has been extensively investigated. Effective tissue reperfusion is a critical determinant for salvage of the ischemic penumbra and subsequent clinical improvement. Among them, time-based perfusion parameters offer advantages over CBF and CBV image in determining ischemic penumbra. However, previous studies predominantly focused on CT and MRI, neglecting the valuable information inherent in the process of brain perfusion with PET. Given the significant advantages of digital PET in sensitivity and count rate, alongside precise dynamic imaging of cerebral blood flow, this study explores a rapid analysis method of 18F-FDG PET brain perfusion using coincidence event detection to derive the brain perfusion parameters. ***Materials and Methods:*** In this study, 12 individuals without vascular injury underwent dynamic 18F-FDG PET scans, including 7 older adults (age > 50 years), and 5 younger adults (age < 50 years). The duration of perfusion data acquisition was 10 minutes, beginning prior to the 18F-FDG injection, with static images reconstructed 50 minutes post-injection. Perfusion time-count curve (TCC) was generated directly by coincidence events from head. Then PET brain perfusion parameters were extracted from TCC using MATLAB software. ***Results:*** PET static image revealed a markedly lower 18F-FDG-uptake in older adults compared to younger adults (SUVmax: 8.95versus 13.05, SUVmean: 3.29 versus 4.74). Following 18F-FDG injection, all PET brain perfusion curves (i.e., TTCs) exhibited three stages: a rapid rise before reaching a peak, a brief and slight decline post-peak, and followed by a gradual long-term increase. Specifically, two groups showed distinctive and characteristic time-count curves across three stages: The time to reach the perfusion peak following tracer injection decreased by 3.77+/-1.21 seconds for younger adults, and the average duration to reach the plateau stage was markedly longer for older adults (45.83+/-7.88 seconds) compared to younger adults (26.25+/-4.72 seconds), whereas the decline rate in older adults coincidence events post-peak (24.67+/-8.22%) was similar to younger adults (21.27+/-15.18%). ***Conclusion:*** PET coincidence event detection facilitates rapid quantitative assessment of brain perfusion without any addition of the standard protocol. Its values may be served as an alternative for brain blood flow analysis when iodinated contrast agents are unavailable. Overall, the dynamic time-count curve of PET brain perfusion exhibits the similarity with the CT perfusion time-intensity curve, enabling the extraction of some main brain perfusion parameters, and the potential extraction of cerebral hemodynamic parameters. This study underlines the additional value of dynamic 18F-FDG-PET coincidence event acquisition.

EPS-122

Digital Biopsy & Network Analysis of dynamic [^{68}Ga] FAPI data in pancreatic cancer patients

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Aim/Introduction: With static [68Ga]FAPI-PET/CT, distinguishing pathologies like pancreatic ductal adenocarcinomas (PDAC), inflammatory lesions of the pancreas (ILP), post-pancreatectomy reactive tissue (PRT) and recurrent-PDAC (RPDAC) is a major challenge due to their marked increase in signal. Dynamic imaging allows full [68Ga]FAPI kinetic profile analysis, highlighting differences between these pathologies. Analysis of such dynamic PET data is challenging. We propose the use of a voxel-level "digital biopsy" approach combined with network analysis and clustering to overcome this challenge. We hypothesise this approach will allow the identification of healthy, non-malignant pathological and malignant pathological kinetic signatures which could aid diagnosis in the future. ***Materials and Methods:*** 47 Patients with unclear pancreatic lesions (26 primary, 17 recurrent setting) underwent dynamic [68Ga]FAPI-PET/CT. Primary cases underwent surgical resection/biopsy after PET imaging. Possible recurrences were classified according to CT and clinical course (minimum 18 months). A digital biopsy consisting of 300 voxels was sampled in each volume of interest (VOI) before being blinded and imported into Graphia V.3.1. Muscle, fat, kidneys, liver and blood were sampled as controls. Voxel networks were created with multiple VOI from a single scan, or VOI combined from multiple scans, with a minimum Pearson correlation value of 0.7. k-NN edge reduction was also applied before Markov clustering. The datasets were then unblinded for interpretation. ***Results:*** A total of 48 individual-networks, and two combined-networks, were created. Within the individual datasets, voxels tended to arrange and cluster within the sampled VOI, with the exception of the left and right kidney which strongly co-clustered. Networks typically arranged into healthy control, elimination organ and pathological (malignant and non-malignant) regions. Pathologies tended to cluster with high purity (>95% from the same VOI), with multiple clusters per VOI indicating heterogeneity within the pathological classification. The combined PDAC (19 cases) and ILP (26 cases) network revealed a central core mainly consisting of PDAC clusters, which had more sustained [68Ga] FAPI signal towards the end of the scan relative to the ILP clusters which tended to be peripheral to this malignant core. A similar pattern was observed in the combined RPDAC (6 cases) and PRT (9 cases) network. Across both combined-networks, clusters almost exclusively clustered within their pathological cluster with minimal co-clustering. ***Conclusion:*** The unique kinetics of [68Ga] FAPI across the different regions, coupled with this sampling and analysis approach, allowed the separation and identification of healthy, non-malignant pathological and malignant pathological clusters and kinetic features, thus warranting further investigation.

EPS-123

Comparison Of Correlations Between ^{18}F And ^{68}Ga PET-CT PSMA Suspected Prostate Cancer Patients To Assess If Increased Bias Is Associated With Either Imaging Agent

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Aim/Introduction: [18F]F-PSMA-1007 and [68Ga]Ga-PSMA-1 are frequently used imaging agents in PET prostate cancer scanning that are sometimes interchanged when tracer supply is compromised. We investigate if greatly increased bias exists through analysing correlations between common parameters found in PET to establish if either radiopharmaceutical imaging agent leads to more reliable results. Results from such studies help establish a framework promoting the case for centrally commissioned funding and approval of a range of PET-CT PSMA imaging agents nationally. ***Materials and Methods:*** 61 68Ga and 72 18F different PSMA subjects were PET-CT scanned using clinical protocols. Each group consisted of 200 suspected lesions including metastatic sites of disease identified and reported by experienced radiologists. Spearmen ranks analysis was used to investigate the strength and direction (ρ) of correlations between height, weight, age, body mass index (bmi), body surface area (bsa), lean body mass (lbm), injected activity, uptake time, suspected lesion SUV with different normalisations, liver SUV with different normalisations, T/B, MTV and TLG for each radiopharmaceutical to investigate if either imaging agent was considerably more biased than the other. $P<0.05$ signified a statistically significant result. Data were analysed by medical physicists with >20 years PET experience each. ***Results:*** Extensive correlation results were visualised as heatmaps that exhibited multiple statistically significant differences for 68Ga and 18F PSMA parameters. In the case of 68Ga 89 correlations were negative, 0 had no correlation and 82 were positive (31 very strong) while 65 were highly significant ($P<0.0001$), 34 significant ($P<0.05$) and 72 not significant ($P\geq0.05$). For ^{18}F 97 correlations were negative, 0 had no correlation and 74 were positive (32 very strong) while 51 were highly significant ($P<0.0001$), 41 significant ($P<0.05$) and 79 not significant ($P\geq0.05$). For both radiopharmaceuticals highly significant strong positive correlations ($p<0.0001$) were seen especially between different lesion SUV normalisations and T/B, MTV, TLG. ***Conclusion:*** Results revealed a relatively similar trend for 68Ga and 18F PSMA with highly significant positive correlations in both especially for T/B, MTV and TLG with lesion SUV normalisations. This is reassuring and indicates analogous bias trends for either radiopharmaceutical so validating use clinically for detecting prostate cancer. Such results further support the case for full regulatory approval/commissioning of different imaging agents in prostate cancer imaging nationally.

EPS-124

Early Ultra-short [^{18F}]FDG Patlak Parametric Imaging May Reduce Patient Uptake Time and Increase Throughput

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Aim/Introduction: Parametric Patlak imaging (PPI), unlike static imaging, reveals tracer kinetics and distinguishes between specific and non-specific uptake. Using population-based input functions (PIF) together with dynamic imaging on novel long axial field-

of-view (LAFOV) PET/CT systems facilitates the use of shortened PPI in clinical routine. When applying the Patlak plot on [18F]FDG data, equilibrium between blood and reversible compartment is assumed at 30min post injection (p.i.). Still, patients are typically scanned around 60min p.i. This work investigates the feasibility of 10min PPI at 30min p.i., as well as using early kinetic information to predict static images at around 60min p.i. ***Materials and Methods:*** Twenty patients with suspected lung malignancy received 3 MBq/kg [18F]FDG and underwent 65min of dynamic scan on a LAFOV PET. Using the list mode data, Patlak Ki images from 30-40min p.i. (Ki30) and 55-65min p.i. (Ki55) were reconstructed, as well as a 10min standard static image at 55min p.i., as per local clinical reconstruction settings (CLIN). When applying the Patlak plot, the PIF was scaled to the image-derived input function. In addition, the PIF was used to calculate the reversed Patlak to predict SUV at 55-65min p.i. (SUV55). Ki and SUVmean of different tissues (lesion, brain, liver, spleen and muscle) were compared between images using R2 and Bland-Altman (BA) analysis. Both limited (high sensitivity, HS) and wide (ultra-high sensitivity, UHS) photon acceptance angle settings of the PET system were evaluated. ***Results:*** High correlation was found for both the Ki values between Ki30 and Ki55 (HS: 0.925<R2<0.995, UHS: 0.958<R2<0.999), as well as for the SUV values between CLIN and SUV55 (HS and UHS: 0.979<R2<0.999). BA analysis showed excellent agreement for both Ki (HS: -0.048<LOA<0.026, UHS: -0.068<LOA<0.041) and SUV in HS mode (-0.52<LOA<0.34). Higher, yet acceptable, differences in SUV were observed between CLIN and SUV55 in UHS (-2.104<LOA<1.078), mainly due to differences in lesion SUV. ***Conclusion:*** This work demonstrates the viability of 10min PPI at 30min p.i., resulting in about 30min shorter uptake times, possibly leading to increased patient comfort, higher throughput, and more cost-effective PET/CT scanning. Furthermore, using the PPI data, the calculated SUV at 60min p.i. can be obtained, which can aid in data harmonization with previous and ongoing studies and can still be used as a reference by clinicians for diagnostic purposes. Additionally, this method could be very beneficial in studies with other irreversible radiotracers, such as [18F]F-DOPA, with uptake times generally around 90 min.

810

Monday, October 21, 2024, 09:45 - 11:15
Hall G1

CTE 4 - Technologists + Oncology & Theranostics Committee - PET-CT Cancer staging Management

OP-384
^{18}F-FDG PET-CT: method of choice in cancer staging – an overview
V. Mautone;
Istituto Romagnolo per lo Studio dei Tumori "Dino Amadori" - IRST IRCCS, Diagnostic Nuclear Medicine, Meldola, ITALY.

OP-385
Immune PET-CT imaging in oncology
A. Santos;
Lisbon, PORTUGAL.

OP-386
68Ga-PentixaFor PET-CT: novel radiotracer for staging
R. Werner;
Goethe University Hospital Frankfurt, Department of Nuclear Medicine, Clinic for Radiology and Nuclear Medicine, Frankfurt, GERMANY.

811

Monday, October 21, 2024, 09:45 - 11:15
Hall Y1-Y3

Special Symposium 3: B&J: MSK in 2024: Follow the Guide(lines)!

OP-387
Joint EANM/ESNR/EUROSPINE guideline on bone SPECT/CT in suspected facet joint arthropathy and non-infectious post-operative spine conditions
T. Van *den Wyngaert;*
Edegem, BELGIUM.

OP-388
EANM ring geometry SPECT/CT position paper
R. Graham;
Royal United Hospital, Bath, UNITED KINGDOM.

OP-389
EANM/ESCEO/ECTS DXA guideline
M. Punda;
Zagreb, CROATIA.

901

Monday, October 21, 2024, 11:30 - 13:00
Hall 1

Plenary 3: Nuclear Medicine as Answer to all Clinical Questions

OP-390
How PSMA PET has changed our daily work
J. Walz;
Department of Urology, Institut Paoli-Calmettes Cancer Centre, Marseille, FRANCE.

OP-391
Nuclear Medicine to choose the right treatment for the right patient
M. Pavel;
Uniklinikum Erlangen, Erlangen, GERMANY.

OP-392
What has immunoPET to offer
E. Smits;
Antwerp University Hospital, Antwerp, BELGIUM.

OP-393a
How molecular imaging has changed patients' management in cardiology
S. Dorbala;
Brigham and Women's Hospital
Professor of Radiology, Harvard Medical School

OP-393b
PET is a clinical need in psychiatry
R. Lanzenberger;
Medical University of Vienna, Vienna, AUSTRIA.

OP-393c
The era of image-driven clinical management in rheumatological disorders is coming
V. Schäfer;
Centre for Rare Rheumatological Diseases, University Hospital Bonn, Bonn, GERMANY.

1001

Monday, October 21, 2024, 15:00 - 16:30
Hall 1

CME 7 - Neuroimaging Committee - CZT SPECT in Neurological Imaging: From Scintigraphy to Theranostics

OP-394
CZT SPECT in brain applications: the physicist point of view
L. Imbert;
CHRU Nancy Brabois, Nuclear Medicine Department, Nancy, FRANCE.

OP-395
CZT SPECT in brain perfusion imaging
D. Peretti;
Division of Nuclear Medicine and Molecular Imaging, Diagnostic Department, University Hospitals of Geneva, Geneva, SWITZERLAND.

OP-396
CZT SPECT in dopaminergic imaging
D. Cecchin;
Nuclear Medicine Unit, Department of Medicine - DIMED, Padua, ITALY.

OP-397
CZT SPECT in theranostics of brain tumours
C. Boursier;
Department of Nuclear Medicine, CHRU Nancy, Nancy, FRANCE.

1002

Monday, October 21, 2024, 15:00 - 16:30
Hall 4

Award Session: EANM Sanjiv Sam Gambhir Award - Compete and Win!

1003

Monday, October 21, 2024, 15:00 - 16:30
Hall X9-X12

LIPS Session 7 - Cardiovascular Committee - Motion Correction in Cardiac PET

OP-401
Data-driven motion correction for Rb-82
I. Armstrong;
Manchester University NHS FT , Manchester, UNITED KINGDOM.

OP-402
Impact from and correction of motion in 15O-water PET
J. Nordstrom;
Region Gävleborg, Uppsala, SWEDEN.

OP-403
Clinical impact of motion correction in dynamic PET imaging: working with moving targets
K. Wechaleka;
Royal Brompton Hospital, London, UNITED KINGDOM.

OP-404
Navigating Whole-body Motion: Insights from LaFoV PET Motion Correction
L. Sundar;
Medical University of Vienna, Vienna, AUSTRIA.

1004

Monday, October 21, 2024, 15:00 - 16:30
Hall X1-X4

M2M Track - Featured Session: Radiopharmaceutical Sciences + Translational Molecular Imaging & Therapy Committee: Tumour Response to Immunotherapy

OP-405
Tumour Response to Immunotherapy
N. Aide;
CHU de Caen, Caen, FRANCE.

OP-406
Noninvasive Granzyme B PET Imaging of meso-CAR T Intervention for Monitoring Early Tumor Responses to Immunotherapy
X. Lv[1,2], *J. Cao[3], X. Song[1,2], Y. Gai[1,2], D. Jiang[1,2], Y. Zhang[1,2], R. An[1,2], P. Lei[3], X. Lan[1,2];*
[1]Department of Nuclear Medicine, Union Hospital, Tongji Medical College, Huazhong University of Science and Technology, Wuhan, CHINA, [2]Hubei Province Key Laboratory of Molecular Imaging, Wuhan, CHINA, [3]Department of Immunology, School of Basic Medicine, Tongji Medical College, Huazhong University of Science and Technology, Wuhan, CHINA.

Aim/Introduction: The serine protease granzyme B and perforin, acting synergistically upon release, facilitate target cell apoptosis by cytotoxic lymphocytes, indicating granzyme B as a promising biomarker for evaluating the efficacy of immunotherapy. The substrate-based probe 68Ga-NOTA-GZP can specifically bind and longitudinally capture the dynamic changes of granzyme B levels within tumors, providing information about immune cell function and the immune activation status in the tumor. Utilizing the mesothelin-specific targeted nanobody MS3, identified from our preceding study, we have engineered a novel chimeric antigen receptor T cell (meso-CAR T). Moreover, we have delved into the

application of 68Ga-NOTA-GZP PET/CT imaging for evaluating the early tumor responses to CAR T-based cancer immunotherapy. ***Materials and Methods:*** T cells were genetically modified to express CAR with MS3 serving as the targeting recognition domain. As BxPC-3 tumors exhibit moderate to high mesothelin expression levels in immunohistochemical analysis and 68Ga-NOTA-MS3 PET imaging, they are potential candidates for meso-CAR T therapy. 10 days after tumor inoculation, approximately 5 × 106 CAR T or blank T cells were intravenously administered to BxPC-3 tumor-bearing mice on day zero. Granzyme B PET/CT imaging was performed on the day prior to T cells administration and subsequently on day 1, 3, 5, and 7. The mean percentage of injected dose per gram (%ID/g) for tumors were obtained by drawing regions of interest. ***Results:*** Baseline imaging with 68Ga-NOTA-GZP showed extremely low uptake in BxPC-3 tumors (0.17 ± 0.10 %ID/g), denoting minimal background adsorption, which is conducive to the highly sensitive detection of granzyme B within the tumor. After therapy administration, a progressive increase in tumor uptake was observed in CAR T and blank T groups through consecutive granzyme B PET imaging, as T cells accumulated, infiltrated, expanded and activated at tumor sites. Overall, the tumor uptake of 68Ga-NOTA-GZP in the CAR T group consistently exceeded that in the blank T group, despite no statistically significant. This can be attributed to the augmented tumor-targeting capacity of the CAR T cells. Semi-quantitative analysis presented that on day 7 post-treatment, the tumor uptake of 68Ga-NOTA-GZP in the CAR T group was significantly higher than the corresponding baseline levels (0.14±0.01 vs 0.61±0.20, P<0.05). ***Conclusion:*** Our findings preliminarily validate that granzyme B PET imaging can support early response assessment of CAR T therapy in a non-invasive, dynamic, and quantitative manner, holding the potential to guide and enhance the efficacy of CAR T therapy in solid tumors.

OP-407

Noninvasive longitudinal PET imaging of granzyme-B and caspase-3 for monitoring early treatment response to immunotherapy

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[1]Department of Nuclear Medicine, Union Hospital, Tongji Medical College, Huazhong University of Science and Technology, Wuhan, CHINA, [2]Hubei Key Laboratory of Molecular Imaging, Wuhan, CHINA, [3]Key Laboratory of Biological Targeted Therapy, the Ministry of Education, Wuhan, CHINA.

Aim/Introduction: Early predicting treatment response is important in assessing the course of immunotherapy to minimize deleterious side effects and timely adjust the treatment plan. This study aimed to provide a novel noninvasive method for monitoring early tumor response to immunotherapy using two positron emission tomography (PET) tracers targeting granzyme-B and caspase-3. ***Materials and Methods:*** CT26 murine colon cancer cells were implanted bilaterally on the right shoulder of Balb/c mice. Mouse models in the treatment group received anti-PD-1 on day 1, 4, 7 intraperitoneally. The control group was treated with an equal volume of PBS (vehicle). Tumor growth of the two groups was measured. Two substrate-based probes, [68Ga]Ga-NOTA-GZP targeting granzyme-B and [68Ga]Ga-NOTA-AC3 targeting caspase-3, are employed to compare their efficacy in monitoring the response to immune checkpoint inhibitor treatment in preclinical studies. Changes in granzyme-B activity and caspase-3 activity were assessed using the two PET tracers from baseline and continued every 3 days until day 9. ***Results:*** In the CT26 model immunotherapy group, immune system activation and subsequent tumor apoptosis are well induced, as demonstrated by the granzyme-B and cleaved caspase-3 levels. Tumor uptake of [68Ga]Ga-NOTA-GZP and expression of granzyme-B peaked on day 3 and remained high thereafter. Concurrently, tumor uptake of [68Ga]Ga-NOTA-AC3 and the expression of cleaved caspase-3 gradually increased and peaked at day 9 during the immunotherapy regimen. The signal from [68Ga]Ga-NOTA-GZP on day 3 throughout the regimen enabled early and effective monitoring of the response to immunotherapy in vivo. ***Conclusion:*** [68Ga]Ga-NOTA-GZP PET imaging facilitates early and non-invasive prediction of the early treatment response to immunotherapy. It provides a potential translational paradigm for early monitoring of immune checkpoint inhibitor treatment in a clinical setting.

OP-408

Discovery of [^{68}Ga]Ga-BCY10939, a bicyclic peptide PET ligand for in vivo imaging of tumor PD-L1 status

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Department of Nuclear Medicine, Xijing Hospital, Fourth Military Medical University, Xi'an, CHINA.

Aim/Introduction: In clinical practice, the clinical decision-making of immune checkpoint inhibitors has always relied on assessment of PD-L1 expression using immunohistochemical staining of biopsy tissues, which may not be optimal due to the heterogeneous and dynamic expression of PD-L1 protein. In contrast, positron emission tomography (PET) could noninvasively capture whole-body PD-L1 expression and dynamics, compensating the deficiency of immunohistochemistry. In this study, we described the discovery of [68Ga]Ga-BCY10939, a bicyclic peptide PET ligand for in vivo imaging of tumor PD-L1 status. ***Materials and Methods:*** The bicyclic peptide precursor NOTA-BCY10939 were custom synthesized and radiolabelled with 68GaCl3 to obtain the PET radiotracer [68Ga]Ga-BCY10939. The radiochemical yield and purity, molar activity, partition coefficient as well as in vitro stability of [68Ga]Ga-BCY10939 were characterized. The binding model between [68Ga]Ga-BCY10939 and PD-L1 protein was determined by molecular docking. The cell uptake and binding assays, PET imaging, biodistribution and pharmacokinetics of [68Ga]Ga-BCY10939 were performed in vitro and in vivo using U87 MG, U87MG/PD-L1-/- and their tumor xenograft models. ***Results:*** [68Ga]Ga-BCY10939 was produced with high radiochemical yield, radiochemical purity and molar activity. The hydrophilicity of [68Ga]Ga-BCY10939 was determined with a partition coefficient (Log P) of -1.43 ± 0.25. The stability was verified in saline and serum within 4 h. In silico approach revealed the optimized binding conformation of [natGa]Ga-BCY10939 towards PD-L1 with a binding energy of -9.087 kcal/mol. In vitro assays demonstrated the nanomolar affinity and specificity of [68Ga]Ga-BCY10939. Tumor uptake of [68Ga]Ga-BCY10939 with high contrast was observed by PET imaging in U87MG xenograft models and the in vivo specificity was proved using U87MG/PD-L1-/- tumor xenograft models and blocking study with excess of non-radioactive BCY10939. The biodistribution of [68Ga]Ga-BCY10939 was consistent with the PET results. [68Ga]Ga-BCY10939 displayed the renal excretion and a rapid clearance from blood and other non-specific organs, contributing to high contrast imaging in the clinical time frame. ***Conclusion:*** [68Ga]Ga-BCY10939 is a promising bicyclic peptide-based PET ligand for in vivo imaging of tumor PD-L1 status. Further clinical translation of [68Ga]Ga-BCY10939 in patients is warranted.

OP-409

Granzyme B PET/CT Imaging Evaluates Early Response to Immunotherapy in Gastric Cancer

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Aim/Introduction: As few patients could benefit from immune checkpoint inhibitors (ICIs), accurately predicting and monitoring early therapeutic responses to ICIs is essential for precision therapy. Here, we developed a positron emission tomography/computed tomography (PET/ CT) probe targeting granzyme B, [68Ga]Ga-NOTA-GSI, and aimed to investigate whether it could provide a noninvasive and effective method to predict the early response to immunotherapy. ***Materials and Methods:*** A total of 72 patients were performed the interim [68Ga]Ga-DOTA-GSI PET/CT scan. And finally, 40 patients were included for further analysis. The SUVmax of tumor, metastatic lymph nodes (LNs), and normal tissues (liver and blood pool) were measured, and their ratios were denoted as TLRtumor, TBRtumor, TLRLN, and TBRLN, respectively. Two-sample t tests and Wilcoxon rank-sum tests were used to compare the PET/CT parameters between responders and non-responders. Moreover, receiver-operating characteristic (ROC) curve analysis was used to investigate the predictive performance of [68Ga] Ga-DOTA-GSI PET/CT in evaluating the treatment response. Two-tailed $P < 0.05$ was considered statistically significant. ***Results:*** We found that SUVmax-t, TLRtumor, TBRtumor, SUVmax-LN, and TBRLN were higher in responders than in non-responders (2.49 ± 0.58 vs. 1.55 ± 0.48, $p = 0.000$, 2.24 ± 0.48 vs. 1.74 ± 0.67, $p=0.007$, 1.38 ± 0.43 vs. 0.90 ± 0.23, $p = 0.000$, 2.24 ± 0.99 vs. 1.42 ± 0.55, $p = 0.003$, 1.28 ± 0.68 vs. 0.83 ± 0.32, $p =0.012$), respectively. According to ROC curve analysis, the cutoffs for SUVmax-t, TLRtumor, TBRtumor, SUVmax-LN, TLRLN, and TBRLN were 2.05, 2.25, 0.885, 1.65, 0.765, and 1.52, respectively. SUVmax-t and TBRtumor showed satisfying accuracy in distinguishing non-responders and responders. Additionally, multivariate logistic regression indicated that TBRtumor was an independent predictor of treatment response ($p = 0.03$). ***Conclusion:*** Our results indicated that [68Ga] Ga-DOTA-GSI PET/CT is a promising useful tool to predict the early response to combined immunotherapy in patients with GC.

OP-410

Development of a Bispecific Antibody ^{124}I-NB12 for Imaging PD-L1/2 Expression in Tumors

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Aim/Introduction: NB12 is a bispecific antibody that consists of two anti-programmed cell death-ligand 1 (PD-L1) nanobodies and two anti-programmed cell death-ligand 2 (PD-L2) nanobodies. As two ligands of programmed cell death protein 1 (PD-1), PD-L1 and PD-L2 are closely related to the efficacy of ICI therapy (ICI), and therefore this bispecific antibody could be suitable for screening potential beneficiaries. The aim of this study is to design a novel tracer 124I-NB12 targeting PD-L1/2 and perform preclinical evaluation to dynamically monitor PD-L1/2 expression. ***Materials and Methods:*** The bispecific antibody targeting PD-L1 and PD-L2 (NB12) was labeled with the radionuclide 124I at room temperature. An in vitro binding assay was performed to assess the affinity 124I-NB12 to PD-L1 and PD-L2, respectively. In vitro stability in 5% human serum albumin (HSA) and PBS was analyzed using Radio-thin layer chromatography (Radio-TLC).. Cell uptake, pharmacokinetic, and biodistribution experiments were used to evaluate the biological properties. Micro-PET/CT imaging with 124I-NB12 was conducted at different time points. Immunohistochemical and HE staining studies were carried out using tumour tissues from tumour-bearing mice. ***Results:*** The MALDI-TOF-MS results showed that the average molecular weight of NB12 was 108.376 kDa. The radiochemical yield of 124I-NB12 was 84.62±3.90% and the radiochemical purity (RCP) was more than 99%. The tracer incubated in 0.01 M PBS and 5% HSA maintained high stability (RCP>95%). Radio-ELISA showed that 124I-NB12 had a high affinity for the PD-L1 ($Kd = 19.82$ nM, $R2 = 0.95$) and PD-L2 protein ($Kd = 2.52$ nM, $R2 = 0.87$). Cellular uptake experiments confirmed that the uptake of 124I-NB12 in A549-PDL1/2 cells was higher than that in A549 cells at each time point. The half-lives of the distribution phase and elimination phase were 0.26 h and 4.08 h. Micro-PET/CT showed significant uptake in the tumor region of A549-PDL1/2 tumor-bearing mice 24h postinjection of 124I-NB12 compared with A549 group (SUVmax=2.26 ± 0.08, 2.90 ± 0.11 and 0.38 ± 0.07, respectively). HE staining confirmed that the subcutaneous xenograft tumor model A549-PDL1/2 was successfully constructed, and immunohistochemistry showed that A549-PDL1/2 was highly expressed in A549-PDL1/2 mice. ***Conclusion:*** We have constructed 124I-NB12 targeting PD-L1 and PD-L2. On the basis of high yield, radiochemical purity and stability, biological evaluation showed its specificity and affinity for PD-L1/2, and micro-PET/CT imaging confirmed the feasibility of visualizing tumor PD-L1/2 in vivo. It will be a promising method to dynamically monitor PD-L1/2 expression and screen potential beneficiaries of ICI therapy.

OP-411

Development of A New ^{68}Ga-labeled Peptides for PD-L1 Targeted PET Imaging

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Aim/Introduction: The immune checkpoint protein programmed death-ligand 1 (PD-L1, CD274) serves as a crucial therapeutic target. However, the heterogeneity in PD-L1 expression poses challenges to the accuracy of immunohistochemistry (IHC) results. In order to precisely monitor PD-L1 expression levels throughout the body, we developed novel 68Ga-labeled peptides. These peptides enable specific and selective in vivo imaging of PD-L1, offering a promising avenue for enhanced diagnostic and therapeutic strategies. ***Materials and Methods:*** 68Ga-DOTA-CCC was synthesized and its radiochemical purity was evaluated by Radio-iTLC and Radio-HPLC. Its stability, octanol/water partition coefficient (log P), and biological half-life were also evaluated PET imaging was performed on B16F10, NCL-H292, or A549 tumor-bearing mice. dynamic monitoring of PD-L1 exposure in NCL-H292 tumor-bearing mice for five days after the injection of different doses of atezolizumab. ***Results:*** 68Ga-DOTA-CCC showed favorable radiolabeling efficiency, and the stability of 68Ga-DOTA-CCC in saline and serum remained above 95% in 3 h. The logP of 68Ga-DOTA-CCC was -1.95 ± 0.32 ($n = 5$), which suggests the probe was hydrophilic, and the half life of the probe was 17.5 ± 5.5 min ($n = 5$). PET imaging showed the tumor uptake of B16F10 was 3.20 ± 0.17 %ID/gmax, and NCI-H292 was 1.47 ± 0.06 %ID/gmax ($n = 3$) at 30 min post injection, this was consistent with WB. We will subsequently refine the imaging of the A549 tumor model with low PD-L1 expression. Tumor uptake of 68Ga-DOTA-CCC was significantly reduced at 24 h after injection of atezolizumab and then gradually recovered. ***Conclusion:*** 68Ga-DOTA-CCC was successfully synthesized with high radiochemical purity.

Tumor uptake was related to PD-L1 expression that suggested the specificity of the probe. Dynamic monitoring experiments of PD-L1 exposure demonstrate the potential of probes to advise for antibody therapy in clinic.

OP-412

^{18}F-CFA/FAC-PET Reveals Immune Cell Activation in the Tumor-Draining Lymph Nodes Following Treatment with Immune Checkpoint Inhibitors

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Aim/Introduction: The advent of immunotherapy underscores the need for advanced non-invasive whole-body imaging techniques to facilitate patient stratification and enhance therapy monitoring. Being substrates of the deoxyribonucleoside salvage pathway, the murine radiotracer 1-(2′-Deoxy-2′-18F-fluoro-β-D-arabinofuranosyl)-cytosine (18F-FAC) [1] and the human analog 2-chloro-2′-deoxy-2′-18F-fluoro-9-β-d-arabinofuranosyl-adenine (18F-CFA) [2] allow for the in vivo visualization of immune cell activation within lymphatic organs. ***Materials and Methods:*** 18F-CFA-PET/CT was conducted on two metastatic melanoma patients before and after the onset of immune checkpoint inhibitor therapy (CIT). In a preclinical setting, CIT-sensitive (MC38 and CT26 colon adenocarcinomas) or CIT-resistant (B16F10 melanomas and 4T1 breast cancers) tumor bearing mice underwent a baseline and - after one week of CIT (anti-PD-L1 mAb) - a follow-up 18F-FAC-PET/MRI. Control mice received sham-treatment (isotype mAbs). Ex vivo biodistribution, flow cytometry analyses, immunohistochemistry and in vitro 18F-FAC cell uptake experiments (T cells, macrophages, tumor cell lines) completed our studies. ***Results:*** Melanoma patients revealed CIT-induced enhancement of 18F-CFA uptake in in tumor-draining lymph nodes (TDLNs). In line with this, CIT-induced immune cell activation yielded a significantly increased 18F-FAC uptake in TDLNs of experimental mice when compared to contralateral control lymph nodes (cLNs) and to the TDLNs of sham-treated tumor-bearing mice. Furthermore, enhanced 18F-FAC uptake was observed in primary and secondary lymphoid organs, small intestine, and tumors. Cross-sections of the TDLNs were larger compared to their cLNs, regardless of whether the mice underwent anti-PD-L1 or isotype mAb treatment. Flow cytometry analysis revealed a lower abundance of CD3+ T cells in the TDLNs but not in the cLNs of tumor bearing mice independent of treatment indicating that not the T cell population might be responsible for the enhanced 18F-FAC-uptake within the TDLNs. We determined in the TDLNs of both CIT-resistant tumor models a generally higher relative number of CD11b+ cells when compared to the CIT-sensitive tumor models. In vitro experiments showed significantly elevated 18F-FAC uptake by activated mouse T cells and macrophages, whereas naïve T cells and macrophages showed almost no 18F-FAC-uptake. In addition, all four tumor cell lines exhibited a significant 18F-FAC-uptake. ***Conclusion:*** 18F-FAC- and 18F-CFA-PET enable the identification of CIT-induced immune cell activation in TDNLs, supporting further the essential role of the TDLN in promoting anti-cancer immune response. ***References:*** [1] Radu, C.G. et al. Nat. Med. 14, 783-788 (2008). [2] Shu, C.J. et al. J. Nucl. Med. 51, 1092-1098 (2010).

OP-413

Development and Evaluation of ^{124}I-E6scFv-Fc for Monitoring PD-L2 Expression in Tumors

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Aim/Introduction: Programmed cell death-Ligand 2 (PD-L2), a ligand programmed cell death protein 1 (PD-1), is an immune checkpoint molecule closely related to the efficacy of immune checkpoint inhibitor therapy (ICI). The aim of this study is to design a novel tracer 124I-E6scFv-Fc targeting PD-L2 and perform preclinical evaluation to dynamically monitor PD-L2 expression and screen potential beneficiaries of ICI therapy. ***Materials and Methods:*** A human single-chain fragment variable (scFv) was generated by phage display, using the extracellular domain of recombinant human PD-L2. The E6scFv was reformatted into a bivalent E6scFv-Fc, based on human IgG1-fragment crystallizable (Fc). The E6scFv-Fc was radiolabeledwith 124I by N-Bromosuccinimide (NBS) in PB-buffer at pH 7 (37°C, 60s). The affinity of the 124I-E6scFv-Fc was evaluated using PD-L2 protein by Radio-ELISA. Cellular uptake assays were performed using the transduced PD-L2 expressing lung cancer cell line A549 (A549-PD-L2) and wild-type A549 cells as negative control. Micro-PET/CT imaging was conducted with 124I-E6scFv-Fc and static images were recorded with an acquisition time of 15 min. Immunohistochemical and HE staining studies were carried out using the tumor tissue of tumor-bearing mice. ***Results:*** The radiochemical yields of 124I-E6scFv-Fc were 84.02±4.89% and the radiochemical purity (RCP) of the tracer was more than 99%. Radio-ELISA showed that 124I-E6scFv-Fc had a high affinity for the PD-L2 protein (Kd = 11.17 nM, R2 = 0.92). Cellular uptake experiments confirmed that the uptake of 124I-E6scFv-Fc in A549-PDL2 group was higher than that in A549 group and A549-PDL2-block group at each time point. The half-lives of the distribution phase and elimination phase were 0.18 h and 9.01 h. Micro-PET/CT showed significant uptake in the tumor region of A549-PDL2 tumor-bearing mice (SUVmax = 3.53 ± 0.12 at 40h) compared with other groups. The biodistribution of the at 24h postinjection showed higher tumor uptake in A549-PDL2 mice (20.34±1.09 %ID/g for 124I-E6scFv-Fc in A549-PDL2 mice vs 3.25±0.24 %ID/g for 124I-E6scFv-Fc in A549 mice vs 3.20±0.51 %ID/g for 124I-CKscFv-Fc in A549-PDL2 mice). The dosimetry estimation by using olinda software showed that the effective dose was 7.99E-02 mSv/MBq. Immunohistochemistry showed that A549-PDL2 was highly expressed in A549-PDL2 mice. ***Conclusion:*** 124I-E6scFv-Fc enables easy radiosynthesis and shows excellent in vitro and in vivo PD-L2 targeting characteristics. The high tumor uptake at early imaging time points demonstrate the feasibility of 124I-E6scFv-Fc for imaging of PD-L2 expression in tumors and is encouraging for further clinical applications of screening potential beneficiaries of ICI therapy.

1005

Monday, October 21, 2024, 15:00 - 16:30
Hall Y4-Y9

Cutting Edge Science Track - TROP Session: Physics Committee: AI: Modelling, Generative and Large Language Models

OP-414

Quantum convolutional neural networks for minimizing training and model complexity - a dual-center prostate cancer study

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Aim/Introduction: State-of-the-art classic convolutional neural networks (CNN) may have millions of parameters to train; thus, they generalize poorly if trained on small medical data. Quantum computing can encode N voxel values to log2(N) number of qubits, resulting in a simplified search space for artificial intelligence tasks. This allows simplified training and minimizes barren plateaus as well as model complexity [1]. In this work, we aimed to compare the predictive performance of quantum CNNs (qCNN) and state-of-the-art classic CNNs in small medical imaging data. ***Materials and Methods:*** This study relied on 53 [68Ga]Ga-PSMA-11 (PSMA) PET/CT and 30 PSMA PET/MRI prostate cases to form a mixed training set (n=83) from one imaging site. For independent testing 84 PSMA PET/MRI prostate cases collected from an external imaging site were used. The PET/CT cases underwent image-guided biopsy, while all PET/MRI cases had whole-mount histopathology evaluations at both sites. Each case was classified as ISUP ≤ 2 vs. ISUP ≥ 3 to result in a binary label for prediction. Prostate detection with pre-trained deep learning (DL) models in CT and MRI scans was performed. Each PSMA PET was resampled to 2mm isotropic voxel resolution, followed by masking out a 32x32x32 cuboid VOI area around the prostate as defined by the DL detection models. The PSMA cuboid VOI voxels of each case were encoded to log2(32x32x32) = 15 qubits. A qCNN model having 2 convolutional and 5 fully connected layers utilizing the training set was built in the Pennylane quantum simulator. For comparison, a 3D CNN was built as well. Performance evaluation of the qCNN and the CNN models was done on the independent test set with confusion matrix analytics. ***Results:*** The test balanced accuracy was 84% for qCNN, and 41% for the classic CNN. The number of parameters to train was 435 in qCNN and ~11million in the classic CNN. ***Conclusion:*** We demonstrated quantum advantage in qCNNs while relying on a dual-center imaging dataset. Quantum CNNs have the potential to democratize NNs on small data due to their simple model and training schemes while relying on the advantage of classic-quantum encoding. ***References:*** [1] Caro, et al. (2022). DOI: 10.1038/s41467-022-32550-3.

OP-415

In the search of optimal hyperparameter and network configurations of the novel DEBI-NN neural network for increased generalizability in small medical datasets

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Aim/Introduction: The recently proposed distance-encoding biomorphic-informational neural network (DEBI-NN) has demonstrated to significantly reduce the number of trainable parameters, while preserving predictive performance, compared to traditional neural networks (NN) [1] in various clinical datasets. However, due to the novelty of DEBI-NNs, the optimal choice of hyperparameters and their generalization abilities are unknown. This study aimed to evaluate DEBI-NNs in two small multi-centric medical datasets in an independent train-test setting, over which training highly generalizable deep NNs would not be feasible. ***Materials and Methods:*** The train and independent test sets were taken from the diffuse large b-cell lymphoma (DLBCL) [2] and the HECKTOR [3] ^{18}F-FDG PET/CT datasets to predict 2-year survival and HPV status, respectively. DLBCL had 40-44, while HECKTOR had 340-223 train-test cases. Both datasets contained IBSI-compliant radiomic and clinical-demographics features per patient. Five different network architecture configurations and 20 different hyperparameter configurations were used, resulting in 100 different DEBI-NN configurations overall. The train-test cases were evaluated 10-times in a test-retest scenario (1000 runs overall per cohort) to investigate the effect of any random selection events during training. Test predictive performance was estimated with averaging balanced accuracy (BACC) and 95% confidence interval (CI) values over the test-retest evaluations per configuration. ***Results:*** In DLBCL, networks with 1-2 hidden layers were sufficient to model the data (highest BACC: 79%). In HECKTOR, 3 hidden layers resulted in better overall performance (highest BACC: 72%). The highest-performing DEBI-NN models in both cohorts were with shift-scale optimization and without group norm, weight standardization and spatial dropout. These models yielded 68-73% BACC, 4.17-6.45 CI (DLBCL) and 67-69% BACC, 3.41-7.75 CI (HECKTOR). In contrast, poorly-performing models had 49-66% BACC, 3.75-7.81 CI (DLBCL) and 62-66% BACC, 4.03-7.04 CI (HECKTOR). ***Conclusion:*** DEBI-NNs with minimal to no regularization techniques can result in highly generalizable NN configurations even if the training set is disproportionally small compared to what is generally required for training conventional NNs. This has been hypothesized in [1], but this work provides a rigorous analysis and supporting evidence. This novel network architecture can pave the way to successfully model small, albeit representative nuclear medicine imaging datasets with deep NNs while maintaining minimal training complexity. ***References:*** [1] Papp, L., et al. (2023). DOI: 10.1016/j.neunet.2023.08.026[2] Ritter, Zs., et al. (2022). DOI: 10.3389/fonc.2022.820136[3] Andreaczyk V., et al. (2022), ArXiv : 2201.04138.

OP-416

Generative artificial intelligence improves performance of medical classifiers in low data regimes

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Aim/Introduction: A paradigm shift in medical imaging research has been introduced by the rise of machine learning. Deep neural networks have shown promising results in the detection of diseases and for prediction of patient outcome. This advancement, however, is limited by the availability of large datasets, as substantial volumes of data are required to train effectively. We hypothesize that recent advances in Generative AI can help to alleviate this need by enlarging small medical datasets with

synthetic examples enabling medical image research at a larger scale. ***Materials and Methods:*** A generative adversarial network was trained on bone scintigraphy scans from the Vienna General Hospital to generate synthetic images of patients representing two clinical conditions: (1) cardiac uptake indicative of cardiac amyloidosis and (2) tracer uptake indicative of bone metastases. Two scenarios were created to evaluate the clinical value of the generated synthetic cases. First, we benchmarked the synthetic dataset against real patient data. Second, we investigated the added value of complementing small single-center datasets by adding synthetic data to the training in a downstream classification task. ***Results:*** Overall, 11.997 patients with 12.761 scans from three medical centers were included. A convolutional neural network trained on real patient data revealed an average AUC=1.000 (95% CI=0.999-1.000) across external validation for the detection of cardiac uptake indicative of cardiac amyloidosis. The same model, trained with purely synthetic cases only, performed on par with an average AUC=0.998 (0.996-1.000). For the detection of tracer uptake indicative of bone metastases, an AUC=0.920 (0.906-0.933) and 0.891 (0.875-0.906) was achieved for real and synthetic data models, respectively. Enlarging small single-center datasets with synthetic examples (real/synthetic-data-ratio 1:50) improved the model performance by +10% and +9% AUC in the prediction of the two respective clinical endpoints. ***Conclusion:*** Generative AI enables synthetic image generation representative of realistic clinical characteristics such as prespecified disease entities. These images can be used to create medical classifiers with the same degree of accuracy as real patient data. Complementing small medical datasets by adding synthetic cases to the training, improved model performance significantly. Our findings point to the potential of synthetic data to overcome challenges in data sharing and might be beneficial in addressing fairness in medical classifiers through the adjustment of underrepresented subgroups in the training dataset. The detection of rare diseases by imaging is particularly challenging, and augmenting the training set with synthetic examples may increase detection rates and improve clinical care.

OP-417

Towards increased prognostic value of FDG PET/CT in non-malignant diseases via healthy digital twins

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Aim/Introduction: The distribution of fluorodeoxyglucose (FDG) uptake in certain tissues/organs and organs holds promise as a prognostic marker for non-malignant diseases such as diabetes. One challenge is that the prognostic information is often concealed by physiological patient-specific factors such as patient age, weight, and sex, which can greatly influence FDG uptake patterns. While these factors may average out in population-based comparisons, they must be accounted for when prognosing individual patients. Addressing this, we propose a Synthetic Baseline PET (sbPET) model aimed at decoupling physiological from non-physiological FDG uptake. The sbPET image represents a healthy FDG distribution tailored to the patient's characteristics. Abnormal uptake patterns can thus be revealed by comparing the sbPET and the true PET images. We demonstrate the efficacy of the sbPET model in explaining the uptake variance observed in brown adipose tissue (BAT). ***Materials and Methods:*** 3190 Long Axis Field of View (LAFOV) FDG PET/CT studies acquired during clinical routine at Rigshospitalet were used to train a 3D generative AI-model to synthesize a personalized sbPET images conditioned on the accompanying CTs as well as the patient age, sex, weight, FDG dose, and uptake time. Using BAT masks obtained from a separate segmentation model (nnUnet, trained on 150 manually CT-delineated subjects), the average BAT SUV was calculated for 98 independent test patients, yielding a vector of average PET uptakes, yPET. Likewise, ysbPET, was calculated by averaging the BAT SUV in the generated sbPET images. As a baseline, we employed a 3rd order polynomial regression model to predict the BAT SUV based on the aforementioned patient-specific features excluding the CT. The performance of both models was quantified by the explained BAT variance (1- Var[yPET -ysbPET]/ Var[yPET]). ***Results:*** The sbPET and regression models achieved explained variances of 48% and 20%, respectively, indicating that nearly half of the variance in BAT uptake, can be explained by simple patient specific features and anatomical information using a AI-based synthetic baseline PET. ***Conclusion:*** The gap in baseline and sbPET performance emphasizes the value of the CT providing anatomical information and alludes to a complex nonlinear relationship between patient features and FDG uptake. By removing the healthy physiological component in the BAT, one could imagine that uptake patterns of certain diseases would become more distinguishable. Future work could focus on subject with disease labels that could be acquired form electronic patient records or even genetic profiling.

OP-418

Synthetic Data to Simplify Development of Machine Learning Models in Medical Imaging

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Aim/Introduction: Artificial Intelligence (AI) offers promising opportunities for innovating the field of medical imaging, yet its practical implementation remains limited. Two important reasons for this are strict legislation and the unavailability of data, partly due to patient privacy. Synthetic data (SD) could offer a solution to the latter. Synthetic data is a machine-learning (ML) technique that learns the distributions and correlations of a real dataset and generates a synthetic dataset with the same characteristics, without containing real data. Synthetic data could facilitate multi-centre collaborations enabling the training of ML-models with data that are now limited. Our aim was to investigate the effects of replacing real data with synthetic data on ML-model performance using SD-generators for the prediction of metastases on 18F-PSMA-1007 PET/CT using a tabular dataset. ***Materials and Methods:*** We included a cohort of 131 consecutive patients who underwent 18F-PSMA-1007 PET/CT that yielded 289 bone hotspots and 272 lymph node hotspots in whom follow-up from multidisciplinary meetings were available. Several ML-model classifiers were trained to classify hotspots as metastases or aspecific. The ML-models were trained either on real data or synthetic data from three SD-generators (CTGAN, CopulaGAN, TVAE). Four algorithms were used for the classifiers (Random Forest, K-Nearest Neighbor, XGBoost and Logistic Regression). ML-model performance was assessed using five metrics (F1-score, Accuracy, ROC-AUC, Sensitivity and Specificity). The metrics were

determined by comparing the classifiers prediction of a hotspot to the real outcome. ***Results:*** The ML-models trained on synthetic data showed an average F1-score of 0.87 for all generator-model combinations compared to 0.90 for ML-models trained on real data. TVAE showed the highest average score, then CTGAN, followed by CopulaGAN. The generator-model combination with the highest F1-score was TVAE/Random Forest with 0.93. The lowest was 0.75 for CTGAN/XGBoost. For the real data, this range was 0.83 for K-Nearest Neighbor to 0.94 for Random Forest. Although synthetic data performed comparable to real data for most metrics, the specificity showed a large variation ranging from 0.48 to 0.98. ***Conclusion:*** Overall, ML-models trained on synthetic data showed a marginal decrease in performance of predicting metastases on 18F-PSMA-1007 PET/CT, as compared to real data. Although specificity of ML-models trained on synthetic data showed large variation, the performance for the other metrics was comparable to that of real data. Hence, synthetic data could be a viable option for simplifying development of ML-models in medical imaging.

OP-419

Enhancing Medical Imaging Reporting: a Multimodal Language Model for Automated Bone Scintigraphy Report Generation

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Aim/Introduction: The rise of large language models enabled computers to hold informative and integrated conversations, presenting far-reaching implications across various domains, including medicine. More recently, language models have progressed to encompass image processing alongside text, known as multimodal language models. We aim to fine-tune and assess a multimodal language model's capability to generate semantic textual reports, focusing specifically on bone scintigraphy within the nuclear medicine domain. ***Materials and Methods:*** We curated a dataset from our own institution consisting of 28571 distinct bone scintigraphy from 9092 patients, with each study containing anterior/posterior planar views and a text report. Our workflow had two stages: A preliminary lesion localizer using the vision transformer (ViT) architecture, and a report generation backbone using Large Language and Vision Assistant (LLaVA). For the purposes of fine-tuning, pseudo-labels were generated from text reports through a large language model. This pseudo-label was used to fine-tune both the first-stage lesion localizer and the second-stage report generation. We evaluated the quality of generated report on image findings using Bilingual Evaluation Understudy (BLEU), Recall-Oriented Understudy for Gisting Evaluation (ROUGE), and Metric for Evaluation of Translation with Explicit Ordering (METEOR) metrics. The generated impression and ground truth impression are both scored by an independent LLM (Google Gemini) to determine the presence of metastasis based on the text; the performance of the system is then evaluated against the score generated from ground truth. ***Results:*** The dataset was split by patient with 80% to training and evaluated on the remaining 20%. Fine-tuning of LLaVA was performed on an A100 with 80G of VRAM for 2 epochs. Our fine-tuned model was able to automatically generate the finding and impression sections of a bone scintigraphy study based on only images. The 1-gram BLEU score, 2-gram BLEU score, ROUGE, and METEOR score of generated image findings were 0.46, 0.33, 0.55, and 0.53, respectively. On the task of determining whether a metastasis is present, we report a F1 score of 0.64, sensitivity of 0.67, and specificity of 0.57. ***Conclusion:*** We demonstrate the feasibility of a two-stage workflow incorporating a multi-modal fine-tuned large language model to generate textual reports for bone scintigraphy. This is an essential first step towards incorporating textual clinical information in addition to images. Our work demonstrates the potential of multi-modal language models in assisting nuclear medicine workflows; however, further research to improve performance and vigilant validation are prudent before its adoption in the clinic.

OP-420

Label extraction from PET/CT reports using Large Language Models

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Aim/Introduction: PET/CT clinical reports are typically written in free-text format. Consequently, while they contain a wealth of valuable and reliable information, it is challenging to store and structure this information in a way that it can be searched, modeled and analyzed in a consistent and efficient manner. This study aims to assess the feasibility of extracting structured data from textual reports by employing the latest Large Language Models (LLMs). ***Materials and Methods:*** We reviewed PET/CT reports from 31 patients with confirmed lung cancer. A human reader synthesized these reports into a structured format, categorizing each anatomical location (AL) as either "Presence" or "Absence" of a lesion. We then prompted publicly available LLMs to structure given reports, using Few-Shot (FS) learning [1] with up to 4 shots (reports and expected output fed to the model as examples), to assess the impact on performance. The evaluation was conducted on 27 held-out reports, using the F1-score metric. The dataset's AL distribution included an average of 23.4 ALs for "Absence" (80 unique ALs) with the 5 most frequent being: [bladder: 31, spleen: 31, liver: 29, kidneys: 24, aorta: 22] and 6.9 ALs for "Presence" (143 unique ALs) with the 5 most frequent being: [right-upper-lobe: 4, right-lung-parenchyma: 4, right-lower-lobe: 3, right-middle-lobe: 3, left-upper-lobe: 3]. We evaluated six LLMs: GPT-4-Turbo, Llama3-70B, Llama3-8B, Mistral-7B, Mixtral-8x22B, Mixtral-8x7B. ***Results:*** The results for the "Absence" class showed that Llama3-70B performed best, with an average F1-score of 93.02% when prompted with 4-shots. All models demonstrated a significant increase in performance from 0-shots (i.e., no examples provided) to 1-shot, with an average F1-score increase of 30.12% (from 35.20% to 65.32%). The performance plateaued with 2 or more shots, averaging 80.24% across all models. For the "Presence" class, Mistral-7B had the highest average F1-score of 69.00% with 3 shots. A similar trend was observed with an increase from 0 to 1-shot, with the average F1-score increase of 20.53% (from 35.77% to 56.30%). The performance was also stable with 2 or more shots, with an average F1-score of 57.25% across all models. ***Conclusion:*** The study indicates that LLMs are capable of structuring PET/CT clinical report data effectively, with few-shot learning being a critical factor for achieving high accuracy. Future research should explore additional LLMs for optimal performance and the refinement of the shots used to enhance model performance. ***References:*** [1] Brown T B et al 2020 Language models are few-shot learners (arXiv:2005.14165).

OP-421

Semantic Neuro-Symbolic AI: Pairing Large Language Models with Expert System Oversight for accountable and compliant automated Clinical Studies

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Aim/Introduction: Use of publicly available large language models (LLMs) in healthcare is hindered by compliance, regulatory, and data privacy concerns. Furthermore, low-factuality outputs from these statistical AIs can have adverse clinical implications. Conversely, symbolic AIs, such as expert systems (ESs), adhere strictly to predefined ontologies, but struggle with uncertainties and unstructured data. Our novel approach therefore employs an LLM for solving complex problems and a rule-based ES for managing inputs and validating outputs. We validated this concept, by creating an AI system capable of autonomously compiling unstructured clinical trial data within the boundaries of a human-designed ontology. ***Materials and Methods:*** We integrated GPT-4, our natural language ES, and various application modules into one system. Semantic interoperability between its elements was enabled by our proprietary multi-paradigm software platform. The thereof resulting neuro-symbolic AI combines scalability of neural networks with traceable logic of symbolic systems and real-world data access. We tasked the LLM to structure clinical data from 206 anonymized 68Ga-PSMA PET/CT diagnostic reports, extracting 25 study relevant variables. The ES verified study compliance before passing data to the LLM and checked returning answers for plausibility, reprompting the LLM if needed. We tested the combined system's ability to extract meta-information through three main tasks: Identifying pathological reports, extracting the nearest PSA-value to the PET exam, and recognizing reports from primary tumor staging (PTS) exams to include only follow-up exams in the study. We compared the outputs of LLM-only and LLM-ES collaborative trials against a physician-generated gold standard. ***Results:*** The LLM demonstrated high sensitivity (0.99) but low specificity (0.41) in identifying pathological reports without ES support, with precision at 0.91. When identifying PTS reports, the LLM alone achieved a sensitivity of 0.5, specificity of 0.99, and precision of 0.83. The LLM identified five physician errors in PSA values but committed three errors itself. Although the ontology was incomplete at submission, preliminary results indicate that ES support could eliminate PTS classification errors and significantly enhance the accuracy of pathological report identification. The ES successfully intercepted two datasets that were not properly anonymized. ***Conclusion:*** Our results demonstrate that LLMs, when paired with ES oversight, can effectively undertake tasks typically performed by clinical study personnel, potentially transforming the management of large clinical trials. Given its ability to impart semantic interoperability and handle heterogeneous data types, our system is well-equipped to digitalize a broad range of clinical workflows, while safeguarding data flow and medical confidentiality.

OP-422

Optimizing Contextual Augmentation for Generative AI Performance in Medical Chatbot Responses

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Aim/Introduction: Chatbots, such as ChatGPT, are currently gaining interest in many fields, including healthcare. Integrating them into medical practice can lead to improved patient engagement, better patient-physician communication, and more efficient dissemination of healthcare information. However, Large Language Models (LLMs), the AI models that power chatbots, often face challenges in specialized domains such as nuclear medicine. This study examines how augmentation techniques like Retrieval Augmented Generation (RAG) can improve the performance of medical chatbots specialized in theranostics and nuclear medicine topics. ***Materials and Methods:*** In our study, we evaluate four LLMs (OpenAI's GPT-4, Cohere's Command R+, Google's Gemini 1.0, and Antrophic's Claude 3 Opus) on 35 clinician-oriented questions translated into English and German. To assess the impact of contextual augmentation, we generate different answer types: 1) no context, where the LLM relies solely on its pre-trained knowledge, and 2) with context, where the LLM can access 198 pre-selected research papers on theranostics and nuclear medicine through RAG techniques. We conduct a user study to evaluate the appropriateness of the answers, complemented by an LLM evaluator, which uses metrics such as clarity, completeness, conciseness, average sentence length, language robustness, and word count to calculate an overall evaluation score. ***Results:*** Initial evaluations of the LLM evaluator indicate that utilizing RAG techniques enhances the efficiency of LLMs when compared to relying solely on pre-trained knowledge (see Table 1). Gemini 1.0 demonstrated the most substantial improvement, followed by Claude 3 Opus and GPT-4. It is worth noting that the performance of Command R+, a model optimized for RAG pipelines, experienced a slight dip when providing context information. ***Conclusion:*** These preliminary results highlight the potential of RAG techniques in enhancing medical chatbot performance. The study reveals differences in performance based on the different LLMs and augmentation methods used. These findings can guide the development of more effective chatbots tailored to the specific needs of theranostics and nuclear medicine, ultimately improving healthcare delivery and patient outcomes. Ongoing work focuses on implementing advanced RAG techniques with additional pre- and postprocessing steps specific to each LLM and evaluating the user study as an additional assessment method.

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Monday, October 21, 2024, 15:00 - 16:30
Hall Z

Clinical Oncology Track - TROP Session: Oncology & Theranostics Committee: Prostate: Biochemical Recurrance and Re-staging

OP-423

PSMA-PET and PROMISE re-define stage and risk in prostate cancer patients

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Aim/Introduction: Introduction of Prostate Specific Membrane Antigen Positron-Emission-Tomography (PSMA-PET) for prostate cancer staging in 2012 led to stage-shift in nearly all disease stages. However, the prognostic value of PSMA-PET findings remains less clear. Thus, we compare the prognostic value of PSMA-PET assessed in accordance with PROMISE criteria including tumor volume head-to-head to clinical risk scores in a large prostate cancer dataset with overall survival follow-up. ***Materials and Methods:*** Our retrospective analysis includes all prostate cancer patients, who underwent PSMA-PET between October 2014 and December 2021 at the Essen University Hospital. PSMA-PET stage including the molecular imaging TNM system (miTNM), tumor volume, mean standardized uptake value (SUVmean) and overall survival follow-up were collected. We split the dataset into development and validation cohorts (2:1) and created two nomograms based on Cox regression models with LASSO penalty using the development cohort. Performance of the visual and the quantitative nomograms in the validation cohort were measured using C-indices. ROC-curves and C-indices were examined for head-to-head comparison to clinical risk scores separately for each staging group. ***Results:*** Our cohort includes 1,612 prostate cancer patients across all disease stages with 544 (33.7%) recorded deaths. Predictors based on PROMISE criteria included into the quantitative PSMA-PET nomogram were lymph nodes (miN2, Hazard Ratio [HR]=2.71;95%CI 2.18-3.37), distant metastases (miM1a, HR=3.85;3.15-4.72; miM1b pattern, HRuni=2.13;1.47-3.09 or HRoligo=2.89;1.86-4.49 or HRdiss or dmi=11.73;9.31-14.78; miM1c, HR=5.36;4.06-7.08), tumor volume (per liter, HR=3.64;3.25-4.07) and tumor SUVmean (per unit, HR=1.04;1.03-1.05). The visual nomogram includes distant metastases and total tumor lesion count (Reference: 0-5 lesions, HR6-20=5.00;3.80-6.59 or HR>20=15.80;12.41-20.12). Overall C-indices were 0.80 and 0.78 for the quantitative and visual nomogram, respectively. The quantitative PSMA-PET nomogram was superior to STARCAP at initial staging (n=139; AUC: 0.73 vs. 0.54; p=0.02), to EAU risk score at biochemical recurrence (n=412; AUC: 0.69 vs. 0.52; p<0.001), and to NCCN subgroups at any disease stage (n=1534; AUC: 0.81 vs. 0.74; p<0.001). The visual PSMA-PET nomogram was superior to EAU risk score (n=414; AUC: 0.64 vs. 0.52; p<0.001) and NCCN subgroups (n=1544; AUC: 0.79 vs. 0.73 p<0.001). ***Conclusion:*** Both PSMA-PET nomograms based on standardized PROMISE criteria were prognostic and accurate in early and late stages of prostate cancer with higher predictability compared to clinical risk tools. Multi-center validation with long-term follow-up in the PROMISE registry is ongoing.

OP-424

CD13 as a Potential Membrane Marker in PSMA-Negative Prostate Cancer: A Complementary or Superior Alternative to PSMA

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Aim/Introduction: Our aimed to discover new marker by analysing the proteomics of PSMA-negative PCa tissue and develope targeted radiolabeled probe to assess its potential for PCa theranostics. ***Materials and Methods:*** In order to identify new membrane protein targets, we analyzed foci and adjacent tissues from 8 PSMA-negative PCa patients and 11 benign prostatic hyperplasia (BPH) tissues using proteomics. Subsequently, a large-scale immunohistochemistry study was conducted on 141 PCa and 100 BPH tissues to validate the differential expression of the novel target. An 18F-labeled peptide PET probe targeting the marker was developed, with its characteristics and uptake in RWPE-1 and PC-3 (PSMA-negative) cells assessed. Biodistribution and micro-PET imaging were conducted in PC-3 xenograft nude mice. Whole-body PET/CT scans were performed on PCa patients to evaluate diagnostic efficacy. Additionally, the toxicity and therapeutic effects of the targeted radionuclide in PC-3 xenograft models were investigated in Vivo. ***Results:*** In PSMA-negative PCa tissues, proteomic quantification analysis revealed 35 significantly elevated proteins, with CD13 emerging as the most promising among them. Immunohistochemistry results demonstrated CD13 positivity rate of 92.9% in PSMA-negative PCa tissues (13/14), 82.7% in PSMA-positive PCa tissues (105/127), 91.7% in ductal adenocarcinoma (11/12), 70% in intraductal carcinoma of the prostate (14/20), and 20% in post-endocrine therapy PCa (8/40). Subsequently, in vitro studies confirmed the affinity and specificity of $^{[18F]}$F-CD13-L, as demonstrated by cellular uptake tests showing binding to PC-3 but not RWPE-1 cells. Micro-PET studies showed exhibited localized uptake of $^{[18F]}$F-CD13-L in PC-3 tumor xenografts, with a tumor-to-background ratio of 8.30±0.28. Biodistribution analysis revealed rapid circulation clearance, with a half-life of 11.1 minutes, and significant renal excretion. The first human trial of this imaging probe demonstrated results consistent with preclinical studies. In PSMA PET negative PCa lesions, the SUVmax of $^{[18F]}$AlF-CD13-L1 PET was found to be 4.3 (1.5-5.8), with a median tumor-to-muscle ratio of 4.6 (1.4-6.1). Survival curve analysis illustrated that treatment with 7.4 MBq of [177Lu] Lu-CD13-L1 substantially extended the survival of tumor-bearing mice compared to the controls (p=0.0027), with median survival periods of 69 days and 33 days, respectively. ***Conclusion:*** CD13 may serve as a potentially valuable marker, even in PSMA-negative PCa. Our CD13-targeting probe has undergone initial validation for detecting PCa in cell, animal, and first-in-human PET/CT imaging trials. Moreover, CD13-targeted radionuclide therapy has demonstrated safety and efficacy against PC-3 xenografts. Further research is necessary to verify the theranostic potential of the CD13 target and its probe in PCa.

OP-425

Feasibility and Diagnostic Performance of PSMA-PET-Guided Prostate Biopsy in PI-RADS Scores 2-3: Preliminary Results from a Prospective Single-Center Study

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Aim/Introduction: Prostate biopsy utilizes multiparametric MRI (mpMRI) guidance. However, MRI may fail to identify clinically significant prostate cancer(csPCa) in a substantial number of cases. This study aimed to determine the feasibility and the diagnostic performance of trans-perineal prostate biopsy guided by PSMA-PET/CT-US fusion in patients with PI-RADS score 2-3 on mpMRI. ***Materials and Methods:*** Prospective single-center study enrolling patients with serum PSA≥4ng/ml, PSA density (dPSA)≥0,1 and mpMRI PI-RADS 2-3.68Ga-PSMA-11 PET-CT images were acquired both 60-and-90-minutes post-injection. Prostate contours on CT and PSMA-positive lesions(ROIs) were manually delineated. Trans-perineal prostate biopsy was performed via real-time PET/CT-US fusion(Esaote-Urofusion). Biopsy cores were obtained from PSMA-positive regions of interest(at least 3 cores) and systematically. Intra-prostatic PSMA activity was assessed using the PRIMARY score. A PRIMARY score≥3 was considered PSMA-positive and contoured. ***Results:*** 22 patients have been included (mean age 65years). At the time of PSMA-PET-CT the median PSA was 14ng/mL and median dPSA was 0,24. On mpMRI, 19/22(86%) patients had PI-RADS 2 lesions while 3/22(14%) had PI-RADS 3. The median time between the PSMA-PET-CT scan and the biopsy was 27 days (IQR 1-70). 12/22 (55%) patients had a PRIMARYscore≥ 3 and underwent trans-perineal PET-fusion biopsies plus systematic biopsies, while 10/22 (45%) were PRIMARY 1-2 and underwent only systematic biopsies. PRIMARYscores were: score 1-2 in 10/22 patients (none positive for csPCa); score 3 in 5/22 (40% csPCa), score 4 in 4/22 (75% csPCa) and score 5 in 3/22 (100% csPCa). 8/22 (36%) patients had csPCa at PET-fusion biopsies. Median SUVmax of the lesions (PRIMARY score ≥ 3) was 7,9(IQR 3 - 42,5) 60' post-injection and 8,2(IQR 4-45,9) 90' post-injection. Overall, combining PET-guided and systematic biopsies we had 12/22 PCa detected by biospy: 8/22 (36%) patients had a csPCa (3 ISUP 2, 3 ISUP 3, 1 ISUP 4, 1 ISUP 5), while 4 /22 was ISUP 1 (18%). PET-fusion only biopsy sensitivity, PPV and accuracy for csPCa were 85%(95%CI 65-96%), 37%(95%CI 33-41%) and 34%(95%CI 23-47%), respectively. Combining systematic with PET-fusion biopsy, sensitivity, specificity, NPV, PPV and accuracy for csPCa were 85%(95%CI 65-96%), 86%(95%CI 81-90%), 98%(95%CI 96-100%), 37%(95%CI 29-45%) and 86%(95%CI 81-89%), respectively. ***Conclusion:*** Transperineal PSMA-PET-guided biopsy is feasible. Our preliminary results suggest that adding PSMA-PET-guidance to systematic biopsies in patients with suspicious of PCa and PI-RADS 2-3 on mpMRI increased csPCa detection. The PRIMARY score correlates with csPCa. Further studies are warranted to elucidate the role of PET-guided biopsies in patients with PI-RADS 2-3 lesions.

OP-426

Clinical impact of changes in tumor uptake on PSMA-PET/CT during 177Lu-PSMA radioligand therapy in metastatic castration-resistant prostate cancer

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Aim/Introduction: To investigate the prognostic value of changes in tumor uptake on PSMA-PET/CT during 177Lu-PSMA radioligand therapy in metastatic castration-resistant prostate cancer ***Materials and Methods:*** This multicenter retrospective study at three academic centers included adults who received 177Lu-PSMA-617 or 177Lu-PSMA-I&T between December 2014 and July 2019. PSMA PET/CT images performed at baseline and after 2 cycles (12 weeks) were evaluated by two nuclear medicine specialists for changes in tumor SUVmax at a region-based level. Whole-body tumor SUVmax, SUVmean, and total tumor volume were calculated using qPSMA software. Changes in tumor SUVmax (whole-body and region-based; ΔSUVmax), whole-body SUVmean (ΔSUVmean), total tumor volume (ΔTTV) and occurrence of new lesions were determined. Region-based analysis was stratified as bone, lymph node and visceral disease. Primary outcomes were the associations of ΔSUVmax, ΔSUVmean, ΔTTV, and occurrence of new lesions with PSA progression-free survival (PSA-PFS) and overall survival (OS) by Cox regression analyses. ***Results:*** A total of 124 adults (median age, 73 years [IQR, 67-76 years]) were included. 114/124 (92%), 101/124 (81%), 32/124 (26%) patients had bone, lymph node, and visceral disease at baseline. In patient-based analysis, median (IQR) ΔSUVmax, ΔSUVmean were -33.5% (-13.3 to -52.0%) and -24.3% (-8.6 to -35.2%), respectively. In region-based analysis, median ΔSUVmax for bone, lymph node and visceral disease were -24% (-7% to -51%), -35% (-17 to -63%), -24% (-6% to -55%). ΔTTV and occurrence of new lesions were significantly associated with PSA-PFS (P<0.001) and OS (P<0.001). In patient-based analysis, ΔSUVmax and ΔSUVmean ,were not associated with outcome. In region-based analysis, only ΔSUVmax in visceral lesion was significantly associated with PSA-PFS (p = 0.007) but not with OS. ***Conclusion:*** Changes in tumor uptake on interim PSMA-PET imaging during 177Lu-PSMA radioligand therapy were not associated with survival outcome. In contrast, change in total tumor volume and occurrence of new lesions provide significant prognostic value and should be considered when evaluating treatment response.

OP-427

Non-invasive stratification of men with clinically suspected prostate cancer but negative-/equivocal-magnetic resonance imaging: a biparametric PSMA PET/CT-based model

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Aim/Introduction: Multiparametric magnetic resonance imaging (mpMRI) combined with prostate-specific membrane antigen positron emission tomography (PSMA-PET) has been demonstrated as a highly sensitive diagnostic approach to detect clinically significant prostate cancer (csPCa). Therefore, additional

PSMA-PET scan will enable some MRI-negative/-equivocal men to safely avoid prostate biopsy while ensuring csPCa detection. We aimed to develop a diagnostic model to further improve the diagnostic accuracy of csPCa in such cases. ***Materials and Methods:*** The study included 151 clinically suspected and MRI-negative/-equivocal men (112 from a prospective database, ClinicalTrials.gov identifier NCT05073653), who underwent ultrasound/mpMRI/PET fusion-guided biopsies, into retrospective analysis. PRIMARY-scores on 68Ga-PSMA-617 PET/CT scans were prospectively evaluated and visual assessments based on imaging reports were retrospectively recorded. A diagnostic model was developed using PRIMARY-score, SUVmax and serum free prostate-specific antigen (PSA)/PSA (fPSA/tPSA). The discriminative performance and clinical utility were compared with other methods. The 5-fold cross-validation with 1000 iterations was used for internal validation. ***Results:*** In this cohort of MRI-negative/-equivocal men, for diagnosis of csPCa, area-under-the-curve (AUC) for PRIMARY-score (3-5 vs 2-1), SUVmax (cut off, 6.5) and PSMA PET/CT reports was limited to 0.796 (95% CI, 0.738-0.853), 0.807 (95% CI, 0.740-0.873) and 0.806 (95% CI, 0.742-0.870), respectively, owing to benign prostate diseases (BPD)-related expressions of PSMA, shown as both false-positive rates of 75.0% (15/20) and 46.2% (18/39) for PRIMARY 3 and 4, respectively, and a wide range of overlap of SUVmax between non-csPCa and csPCa. The diagnostic model comprising PRIMARY-score, SUVmax and fPSA/tPSA exhibited a significantly highest AUC of 0.906 (95% CI, 0.851-0.961) compared to visual assessments or single-parameter-based PSMA approach (P≤0.001) and extremely significantly higher than conventional strategies based on PSAD and/or PI-RADS (P<0.001). The internal validation showed that the average 5-fold cross-validated AUC with 1000 iterations was 0.878 (95% CI, 0.876-0.879). The model with a threshold of 21.6% could have prevented 78% of unnecessary biopsies while merely missing 7.8% of csPCa cases in this cohort. ***Conclusion:*** A novel diagnostic model based on PRIMARY-score, SUVmax on 68Ga-PSMA-617 PET/CT and fPSA/tPSA was developed and validated. The model assists clinical decision-making by providing a diagnostic tool with higher accuracy that maximizes PSMA information use and potentially reduces considerable unnecessary biopsy procedures in MRI-negative/-equivocal cases. This approach also facilitates personalized decision-making, especially in challenging cases where additional PSMA-PET scans are considered for men with inconclusive MRI findings.

OP-428

COBRA: Assessment of safety and efficacy of ^{64}Cu-SAR-bisPSMA in patients with biochemical recurrence of prostate cancer following definitive prostate cancer therapy

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Aim/Introduction: Prostate-specific membrane antigen (PSMA) is a transcellular antigen used as an imaging target in prostate cancer (PC). 64Cu-SAR-bisPSMA may offer several advantages over the currently approved PSMA PET agents due to the bivalent structure of SAR-bisPSMA and longer half-life of 64Cu (t1/2=12.7h), compared to monovalent agents utilizing 18F and 68Ga (t1/2<2h). Clinical evidence showed 2-3x higher tumour uptake and detection of additional lesions using 64Cu-SAR-bisPSMA compared to approved PSMA PET agents. ***Materials and Methods:*** COBRA is a Phase I/II study assessing the safety/efficacy of 64Cu-SAR-bisPSMA (200 MBq) in PC patients with biochemical recurrence (BCR) and negative/equivocal standard of care (SOC) imaging (NCT05249127). Patients underwent PET/CT on Day 0 and Day 1 (1-4h and 24±6h post-dose, respectively). Efficacy endpoints included detection rate (DR), correct detection rate (CDR), maximum standardised uptake value (SUVmax), tumour-to-background ratio (TBR) and lesion size. Results were expressed as the ranges among readers. PET results were assessed against a Reference Standard (histopathology, SOC imaging and/or prostate specific antigen levels) that was determined by an independent, blinded, central expert panel. ***Results:*** Fifty-two patients were enrolled/imaged (42 evaluable for efficacy endpoints). One adverse event was related to 64Cu-SAR-bisPSMA (Grade 2 worsening of type II diabetes, resolved). The Day 0 DR was 44-58% (95% CI:30-71.8), increasing on Day 1 to 58-80% (95% CI:43.2-90). CDR on Day 0 was 21.4-28.6% (95% CI:0.3-44.6), increasing to 28.6-38.1% (95% CI:15.7-54.4) on Day 1. CDR results were substantially impacted by the number of lesions that were detected but were unable to be biopsied in conjunction with the low sensitivity of the SOC scans. The number of lesions identified increased from Day 0, 53-80 to Day 1, 82-153. Mean SUVmax and TBR increased 87% and 4.8x, respectively, on next-day imaging (Day 0 and Day 1, respectively: SUVmax 13.9-14.0 and 22.2-33.4; TBR 23.2-25.4 and 118.1-181.7). 64Cu-SAR-bisPSMA was able to identify lesions of <5mm in diameter (2mm range). ***Conclusion:*** The COBRA study demonstrates that 64Cu-SAR-bisPSMA is safe and effective in detecting lesions in patients with BCR. In patients with a negative/equivocal entry SOC scan, 64Cu-SAR-bisPSMA identified lesions on same-day imaging (53-80 lesions), with a higher proportion of positive scans and more lesions detected on the following day (82-153 lesions). Notably, lesions as small as 2mm were detected. These findings are significant as disease localisation and detection of additional lesions can inform optimal treatment pathways in patients with BCR.

OP-429

PSMA PET/CT improves overall survival in men with biochemical recurrent prostate cancer who are treated with salvage radiotherapy; A national cohort study

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Aim/Introduction: Salvage radiotherapy (sRT) is recommended for potential curative treatment in patients with biochemical recurrence (BCR) after radical prostatectomy (RP). PSMA PET/CT is diagnostically superior to other PET tracers in BCR at low PSA

values, where it can be used in patient selection for sRT. The aim was to evaluate if the use of pre-sRT PSMA PET/CT improves overall survival in patients with BCR following RP undergoing sRT. This was done in a national cohort with free (tax-paid) and equal access to PSMA PET/CT. ***Materials and Methods:*** A Danish nationwide cohort study, using real-world data from the national registries. Using the unique identification number of every Danish citizen and health-care registries, we identified all patients who underwent sRT due to BCR after RP since 2015. Patients were excluded if PSA >1.0 ng/mL at the time of sRT. The cohort was stratified into two groups: 1) patients undergoing PSMA PET/CT before sRT or 2) patients with no PSMA PET/CT before sRT. We applied the Kaplan-Meier method to estimate overall survival for both groups of patients. ***Results:*** We identified 808 patients receiving sRT between January 1, 2015, and July 1, 2023, of whom 300 (37.2%) underwent PSMA PET/CT before sRT, and 508 (62.8%) did not. Preoperative risk class was assessed according to the European Association of Urology (EAU) risk classification. There were no differences among the two groups regarding EAU risk class, age, comorbidities, time since RP, R0/R1 status at RP and N0/N1 status at RP. Median follow-up after sRT was shorter in the PSMA PET/CT group, 28.9 months [IQR: 13.9, 46.9] versus 66.1 months [IQR: 38.1, 82.3] for non-PSMA patients. In the PSMA PET/CT group the 1- and 4-year year overall survival rates were 100% (95% CI: 100-100) and 99.1% (95% CI: 97.4-100), respectively compared to 98.8% (95% CI 97.8-99.8), and 94.7% (95% CI 92.6-96.9) in the non-PSMA group. ***Conclusion:*** The patient group selected to sRT after undergoing PSMA PET/CT had higher survival indicating that PSMA PET/CT is useful in the selection process for sRT. Overall, the four-year survival rate among all patients undergoing sRT was above 94%.

OP-430

Imaging shapes the long-term oncological outcome of oligorecurrent prostate cancer patients submitted to metastasis-directed therapy (the PRECISE-MDT study)

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Aim/Introduction: Clinical trials showed metastasis-directed therapy (MDT) as an effective treatment for oligorecurrent prostate cancer (PCa). However, there is an ongoing debate regarding the impact of using different imaging techniques interchangeably for defining lesions and guiding MDT within clinical trials. Thus, we aimed to assess the impact of different imaging tools in guiding MDT and their effects on oncological outcomes in oligorecurrent PCa patients. ***Materials and Methods:*** We retrospectively analysed hormone-sensitive or castration-resistant oligorecurrent PCa patients who underwent $^{[18F]}$F-Fluorocholine, [68Ga]Ga-PSMA-11 or $^{[18F]}$F-PSMA-1007 PET/CT-guided MDT across eight Italian tertiary-level cancer centers between July 2012 and May 2023. Inclusion criteria were: (i) histologically confirmed PCa, (ii) ≤5 nodal, bone or visceral metastases at choline or PSMA PET/CT, (iii) MDT through stereotactic body radiation therapy with or without systemic therapy, and (iv) ≥6 months clinical follow-up. To compare treatment groups, we calculated a propensity score using multivariable logistic models, including PET tracers used as independent variables, and well-known prognostic factors as dependent variables: International Society of Urological Pathology grade at baseline, and, at the time of MDT, castration-resistant status, PSA level, concurrent systemic treatment, and number of metastases. Propensity-matched cohorts on a one-to-one basis with a 0.01 calibration were then created. Through Cox-regression and Kaplan-Meier analyses, imaging guiding MDT was assessed as Progression-Free Survival (PFS), time to systemic treatment change due to polymetastatic conversion (PFS2), and Overall Survival (OS) predictor. The Inverse Probability of Treatment Weighting (IPTW) approach was employed as a sensitivity analysis. ***Results:*** Out of 402 patients, 232 (57.7%) and 170 (42.3%) were submitted to MDT guided by $^{[18F]}$F-Fluorocholine and PSMA PET/CT, respectively. Matched and unmatched variables across the two groups were superimposable. After propensity score matching, PSMA PET/CT was associated with significantly longer PFS (HR=0.49, 95%CI=0.36-0.67; p<0.0001), PFS2 (HR=0.42, 95%CI=0.28-0.63; p<0.0001) and OS (HR=0.39, 95%CI=0.15-0.99; p<0.05) compared to choline PET/CT-guided MDT. We then matched patients submitted to [68Ga]Ga-PSMA-11 vs. $^{[18F]}$F-PSMA-1007 PET/CT, showing that MDT based on the former provides higher PFS and PFS2 compared to the latter (HR=0.51, 95%CI=0.26-1.00 and HR=0.24, 95%CI=0.09-0.60, respectively; p<0.05 and p<0.005, respectively). In the whole sample of unmatched patients, IPTW-based sensitivity analyses confirmed all these findings. ***Conclusion:*** Diverse PET/CT methods influence the long-term oncological outcome in a real-world, multi-institutional, propensity score-matched sample of patients with oligometastatic PCa undergoing MDT. Additional studies with prospective and randomised designs are necessary to provide more evidence for the practical implementation of the obtained findings.

OP-431

Long-Term Outcomes of PSMA PET/CT-Guided Radiotherapy in Biochemical Recurrence Patients Post-Radical Prostatectomy: a 5-Year Follow-Up Analysis.

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Aim/Introduction: PSMA PET/CT imaging is increasingly used to guide salvage radiotherapy (sRT), the main potentially curative option for biochemical recurrence (BCR) after radical prostatectomy (RP) in clinically localized prostate cancer (PCa). Our purpose is to evaluate the role of PSMA PET/CT guided salvage radiotherapy (sRT) in improving long-term biochemical recurrence free-survival in these patients. ***Materials and Methods:*** we retrospectively screened 240 patients, with 100 meeting inclusion criteria: PSMA PET/CT performed for biochemical persistence (PERS) or BCR after

RP; ≥4 years of follow-up; PSMA PET/CT-guided sRT; availability of PSA values and clinical data. All PSMA PET/CT scans were performed using [68Ga]Ga-PSMA-11. The study endpoint was biochemical recurrence free survival (PSA ≤ 0.2 ng/ml) after PSMA PET/CT guided sRT. ***Results:*** Sixty-tree/100 patients underwent PSMA PET/CT for BCR and thirty-seven for PERS. Fifteen patients had PSA pre-RT<0.5 while seventy-five had PSA pre-RT≥0.5. sRT was performed according to EAU guidelines. PSMA PET/CT was positive in 52/100 cases. BCR patients were more often PET-negative or, if positive, exhibited a higher frequency of local recurrence (21%BCR vs 8%PERS); with 65%receiving RT as the only treatment. PERS patients were more often PSMA PET/CT positive with nodal involvement (54%PERS vs 21%BCR; p <0,001). Patients with PERS received RT and androgen deprivation treatment (ADT) in 21/37 cases (57%). The hazard ratio (HR) of RT-treatment failure between patients with PSA pre-RT≥0.5 and patients with PSA pre-RT<0.5 was statistically significant (2.2; p<0.039). Answering to our main aim, the overall median time of follow-up was 59mo (IQR 50-67mo) and the median PSA at last follow-up was 0,01ng/ml (0,01 -0,03ng/ml). We assessed a RT-treatment failure in 36/100 patients (36%) with a median time from RT of 33mo (18-47mo) without statistically significant differences between BCR and PERS (38%BCR vs 32%PERS); all of them underwent a second PSMA PET/CT. Among all patients who had RT-treatment failure, 23/36 (64%) were PET positive and 14/36 (39%) received a new PSMA PET/CT-based RT. All patients were alive at the last analysis. ***Conclusion:*** PSMA PET/CT-guided radiotherapy demonstrates significant long-term efficacy in patients experiencing biochemical recurrence or persistence post-RP, eliciting a substantial PSA response over time and serving as a valuable tool in treatment management.

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Monday, October 21, 2024, 15:00 - 16:30
Hall Y10-Y12

TROP Session: Thyroid Committee: Current and Future Perspectives in the Treatment of Thyroid Cancers

OP-432

Impact of radioactive iodine treatment on long-term overall- and relative-survival in patients with differentiated thyroid cancer: A SEER based cohort study

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Aim/Introduction: In patients with differentiated thyroid cancer (DTC, i.e. papillary- and follicular thyroid cancer (PTC, FTC)) the American Thyroid Association (ATA) established a risk stratification system based on i.a. TNM and histology, which is currently adopted in the planned German S3 guideline. Only in high-risk patients ATA generally recommends radioiodine therapy (RAI). However, adjuvant RAI remains a matter of controversial debate. A single prospective study showed that treatment avoiding RAI was non-inferior for selected low risk patients, yet follow-up time was short (three years). We present long-term data based on the large Surveillance, Epidemiology, and End Results Program database (SEER). ***Materials and Methods:*** We retrospectively compared long term overall survival (OS) and survival relative to the proportion of expected survivors in a comparable set of cancer free individuals (RS) in patients treated with and without RAI using SEER. The years 2000 to 2020 were analyzed (n=187915 patients). Patient were subdivided based on histology (PTC, aggressive PTC, FTC including minimal invasive FTC and angioinvasive FTC). These cohorts were stratified into very low risk [pT1a, N0], low risk [(pT1b, pT2), N0, M0], intermediate risk [(pT3, N0, M0) or (pT1-3, N1, M0)] and high risk [(pT3, pT4, N1 or any M1]]. OS and RS were determined for each subgroup. Statistics included a 1:1 z-test. ***Results:*** OS and RS were improved or tended to be improved in the majority of subgroups undergoing RAI. Preliminary results show that even in low risk subgroups ten-year survival may relevantly be increased after RAI: In minimally invasive FTC, OS was increased by 5.5% and RS by 1.9%. For intermediate risk, even in less aggressive classical PTC, OS was increased by 3.1% and RS by 1.7% after RAI. In high-risk patients, RS was improved by 32.4 % and OS by 25.2% for FTCs after RAI. Notably, without RAI, RS was decreased to ~20%. For high-risk classical PTC OS was improved by 12.9% and RS by 12.7% after RAI. RAI did not impair OS and RS in any subgroup after ten years. ***Conclusion:*** In patients with DTC, subgroup analysis defining cohorts of low, intermediate and high-risk of recurrence according to the planned German S3 guideline undergoing surgery and RAI have a benefit in OS compared to patients with surgery alone, especially in the presence of lymph node and distant metastases. Benefit of RAI was most pronounced in cohorts of high risk of recurrence.

OP-433

Effects of radioiodine treatment on fertility indicators in men with differentiated thyroid cancer: A cohort study

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Aim/Introduction: Following thyroidectomy, radioiodine therapy is the standard management of differentiated thyroid cancer. The effects of such treatment on testicular function remained a concern for cases and clinicians. We aimed to observe changes in fertility indicators in men treated with ablation. ***Materials and Methods:*** In this prospective cohort study, 18 men with differentiated thyroid cancer from June to December 2020 underwent thyroidectomy plus radioiodine therapy. Participants were grouped based on iodine dose (8 men with 30 mCi vs. 10 men with ≥ 150 mCi). Baseline values (VB) of the follicular stimulating hormone, luteinizing hormone, testosterone, and sperm analyses were measured 3 wk before iodine ablation and repeated 3 (V3) and 12 (V12) months later. They were analyzed once as a whole and once based on their groups via ANOVA and Friedman's tests where appropriate. ***Results:*** The mean age of participants was 35.61 ± 9.74 yr. Follicular stimulating hormone levels showed a significant trend among all participants (VB : 12.51 ± 1.72, V3 : 13.54 ± 1.41, and V12: 13.10 ± 1.67 IU/mL; p < 0.001). Luteinizing hormone showed a similar pattern (VB : 4.98 ± 1.27, V3 : 5.65 ± 1.29, and V12: 5.21 ± 0.95 IU/mL; p < 0.001). Testosterone levels did not differ significantly from baseline. Sperm count decreased at the first checkpoint and returned to normal after 12 months (VB : 38.22 ± 19.40, V3 : 32.05 ± 17.96, and V12: 36.66 ± 18.81 million/mL; p < 0.001). Sperm motility and morphology did

not change significantly. ***Conclusion:*** Our research showed that even less than 5 GBq irradiation could induce a transient testicular dysfunction in the first 3 months of therapy, but it was mostly reversible after 12 months.

OP-434

INSPIRE - A multi-centre clinical trial to investigate the radiation dosimetry of radioiodine therapy for thyroid cancer

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Aim/Introduction: The aim of this study is to investigate the range of absorbed doses delivered to thyroid remnants, whole-body and salivary glands in patients undergoing radioiodine treatment for low, intermediate or high risk thyroid cancer and to determine the feasibility of conducting clinical dosimetry-based trials in a multi-centre setting. ***Materials and Methods:*** A prospective observational dosimetry study, INSPIRE (NCT04391244), has been set up with a recruitment target of 150 patients across 10 UK sites. Sites were prepared for quantitative imaging following procedures developed for previous UK and European multicentre clinical trials (1,2). Data acquisition protocols were designed to have sufficient flexibility with imaging timepoints to allow for local logistics and constraints. Imaging and patient-specific data are acquired and uploaded to a core dosimetry hub for centralised processing. ***Results:*** To date 49 patients have been recruited (median age: 47, range 18-84, M:F 17:34, 37 papillary, 15 follicular carcinoma). Initial results indicate a wide range of radiation doses delivered to thyroid remnants (median: 9.1 Gy, range 1 - 691 Gy), whole-body (mean: 0.13 Gy, range 0.03 - 0.33 Gy) and salivary glands (median: 0.3 Gy, range 0.1 - 1.7 Gy) that have shown transient toxicity in some patients. ***Conclusion:*** INSPIRE builds on previous clinical studies (SELIMETRY and MEDIRAD) to demonstrate that investigator-led multicentre dosimetry trials are feasible, permitting clinical questions to be addressed. Standardised imaging and centralised data processing for patient dosimetry supports widespread multicentre participation. Further work will investigate associations between delivered radiation doses and clinical outcome. It is envisaged that the results of this study will inform a subsequent interventional trial, particularly focussed on personalised dosimetry-based treatments. ***References:*** 1. Taprogge J. 7:1125-1130. J Nucl Med 2. Taprogge J. 50:3225-3234. Eur J Nucl Med Mol Imaging.

OP-435

Radioactive iodine therapy, response-related factors and survival analysis in lung metastatic differentiated thyroid cancer.

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Aim/Introduction: The aim of our study is to analyze the clinicopathological characteristics and survival-related factors in adults with lung metastatic differentiated tyroid cancer (DTC) who received Radioactive Iodine Therapy (RAI). ***Materials and Methods:*** The study included patients diagnosed with DTC who underwent bilateral total thyroidectomy (BTT) between 1986 and 2017, were found to have lung metastases (LM) at diagnosis or during follow-up, and received RAI at least once (1-7). The patients' pathology results, type of iodine uptake in LM, cumulative doses, RAI response classification, progression-free survival (PFS), and overall survival (OS) were recorded. ***Results:*** 112 patients [mean age at diagnosis 46.8 ± 14.4 (19-81) years] were included in the study. The clinicopathological/demographic characteristics of patients are shown in Table 1. 92 patients (82%) had a cumulative dose of >500 mCi with no complications related to RAI. LM were detected by iodine uptake at diagnosis in 81 (72%) patients and during follow-up in 6 (6%); iodine-negative LM 25 (22%) patients were detected by FDG PET/CT at diagnosis or during follow-up. After RAI, 55 (49%) patients were iodine responsive [32 complete, 18 biochemical incomplete response (disease-free follow-up), 5 anatomical and biochemical partial response], while 57 (%51) were iodine non-responsive (41 iodine positive, 16 iodine negative refractory). The median PFS was 112.0±85.5 months (95% CI 9-418) and OS 10.3±6.7 years (95% CI 2-33). PFS was significantly higher in patients of female gender and <45 years (p=0.02, p<0.001 respectively). Papillary type was associated with longer PFS 228.7±23.3 months (95% CI 182.9-274.4) and OS 22.5±1.8 years (95% CI 19.0-26.1). Additionally, diffuse iodine uptake was associated with longer PFS [294±40 months (95% CI 214-373)], compared to iodine negativity [98±14 months (95% CI 70-125)] and macronodular type [155±18 months (95% CI 120-190)] (p<0.001). Patients with LM at diagnosis had a significantly longer PFS [215±22 months (95% CI 170-259)] compared with concomitant bone metastases at diagnosis [44±10 months (95% CI 23-65)] (p<0.001). Despite the PFS of patients with LM detected during follow-up [120±17 months (95% CI 85-154)] was clinically lower than those with at diagnosis [193±20 months (95% CI 153-234)], it was not statistically significant (p=0.19). ***Conclusion:*** Long-term follow-up in adults with LM DTC revealed that male gender, ≥45 years, poorly differentiated/folicular/oncocytic type, iodine-negative or macronodular pattern, iodine refractoriness, and concomitant bone metastases at diagnosis were associated with shorter PFS, while age ≥45 years, poorly differentiated/folicular/oncocytic type and iodine refractoriness were associated with shorter OS.

OP-436

Short-term re-differentiation in patients with radioiodine refractory metastatic differentiated thyroid carcinoma

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Aim/Introduction: Differentiated thyroid carcinomas exhibit a favorable prognosis attributed to their typically slow tumor growth, good resectability and possibility of radioactive iodine treatment (RAIT). However, 60-70% of patients with metastatic disease are already radioiodine refractory (RAIR) at diagnosis or become RAIR during the course of the disease, resulting in a significant reduction in overall survival. In these patients, attempts to restore iodine uptake in thyroid carcinoma lesions by inhibition of the MAP kinase pathway with appropriate kinase inhibitors (KI) have been reported. ***Materials and Methods:*** Eight patients with histopathologically confirmed, progressive metastatic differentiated thyroid carcinoma, previously diagnosed as RAIR, underwent re-differentiation therapy. The patients received either a combination of trametinib and dabrafenib (in the presence of a BRAF mutation) or trametinib alone (in all other MAPK pathway mutations or in cases without driver mutations). Success of re-differentiation therapy was assessed after 10 and 20 days of kinase

inhibitor treatment using 123I-scintigraphy. In case of sufficient restoration of iodine uptake, high dose RAIT was performed. Pre-interventional glycolytic activity derived from $^{[18F]}$-2-fluoro-2-deoxy-D-glucose (FDG) - positron emission tomography/computed tomography (PET/CT), the histological tumor subtype and mutation status were correlated with re-differentiation success. Response to RAIT was evaluated using RECIST 1.1 and thyroglobulin marker assessment. ***Results:*** Re-differentiation after only 10 days of daily KI intake was achieved in 2/8 patients (25%), both of whom had BRAF-wild type in the genetic analysis. One of the two patients had an additional NRAS p.Q61K mutation. No sufficient re-differentiation occurred in 4 of the remaining patients who underwent continued KI treatment for another 10 days. Two patients refused further KI treatment after the first iodine re-staging due to adverse effects (pleural effusion and peripheral edema). No significant difference in glycolytic activity could be detected between the patients with and without successful redifferentiation. Following RAIT with 9.9GBq or 11.7GBq of 131I, both patients achieved a stable disease at radiologic assessment and a significant decrease in thyroglobulin levels with 90% and 50%, respectively. ***Conclusion:*** Short-term re-differentiation in metastatic RAIR thyroid carcinoma after only 10 days of daily KI intake is feasible, reducing side effects and overall costs. Additional treatment for another 10 days did not enhance tumor NIS expression. Further prospective trials in larger patient cohorts are warranted.

OP-437

Use of bRAF/Mek Inhibitors to Enhance the Efficacy of Repeated Adjuvant RAI Therapy in Recurrent bRAFV600E-positive Papillary Thyroid Cancers s/p Re-operation

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Aim/Introduction: The loco-regional recurrence or persistence of intermediate- to high-risk papillary thyroid cancers (PTCs) post thyroidectomy is usually treated with re-do surgical intervention. After reoperation, some patients might receive empirical use of radioiodine (RAI) therapy especially when there is no evidence of structural disease but still detectable serum thyroglobulin (Tg) and anti-Tg antibodies (ATA). However post-therapy scans (RxWBS) usually demonstrate little RAI-avid lesion and thus the usefulness of empirical RAI therapy become controversial. In our study we proposed to use anti-bRAF treatment before repeated empirical RAI therapy after reoperation for recurrent PTCs harboring bRAFV600E mutation. We intend to investigate whether combined use of anti-bRAF and RAI treatments might assist to visualize those occult lesions. ***Materials and Methods:*** We recruited 14 bRAFV600E-positive PTC patients (female=10, age: 21-67 year old) who had received reoperation for cervical recurrence, referred for RAI therapies due to serum Tg- or ATA-positive but without structural disease shown by FDG PET/CT or CT. Pretreatment with bRAF and MEK inhibitors for 12~16 weeks followed by RAI therapy was done and RxWBS were examined for any I-131 avid lesions. The change of serum tumor markers was followed for > 1 year and compared with RxWBS. ***Results:*** 10/14 patients showed RAI avid lesions on RxWBS, including neck lesions only (n=6), neck plus lung metastases (n=2), lung metastases only (n=1) and mediastinal metastasis (n=1). Interestingly, two extra-cervical metastases were noticed in absence of neck lesions. As compared with the change of serum tumor marker, there appears to be greater decrease of Tg or ATA level in patients with positive I-131 avid lesions. ***Conclusion:*** For bRAFV600E-positive PTCs, with bRAF/MEK inhibitor treatment, RAI-avid lesions seem to be more prone to be visualized on RxWBS. Significantly decreased serum Tg/ATA as correlated with the presence of I-131 avid lesion after RAI therapy indicates the efficacy of repeated adjuvant RAI therapy following reoperation therapy. Also accidental notation of extra-cervical RAI-avid lesions gives the impact to change the therapeutic approach. Our preliminary results suggest the possible use of anti-bRAF pretreatment to augment empirical RAI therapy in such settings.

OP-438

Regaining radioiodine avidity following PRRT in four radioiodine-refractory thyroid cancer patients: a revolutionary re-differentiation strategy?

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Aim/Introduction: About 10% of DTCs are metastatic, of which two-thirds lose their radioiodine (RAI) uptake and finally become RAI-refractory (RAIR-DTC), heralding a worse prognosis (1, 2). Multiple re-differentiation strategies have been proposed, including tyrosine kinase inhibitors (TKI) and retinoic acid administration (3). A proportion of RAIR-DTCs also fall into the thyroglobulin (Tg)-elevated negative iodine scan (TENIS) category. These patients are candidates for a variety of imaging modalities (4). We report 4 cases of TENIS syndrome, suprisingly regaining its RAI uptake following PRRT. ***Materials and Methods:*** four women with a history of follicular in one case and papillary thyroid carcinoma in three cases who were referred to our nuclear medicine department following a total thyroidectomy, were under active follow-up after first radio iodine therapy. During follow-up, they developed TENIS syndrome, short interval doubling seum Tg levels with negative therapeutic WBIS. Ga68-DOTAtate and Tc99m-octerotate scans showed tracer avidity in the metastatic locations. ***Results:*** After being discussed in the tumor board meeting, they were deemed eligible for PRRT, and two cycles of 177Lu-DOTA-TATE were administered(200 mCi each). Post-treatment PRRT SPECT/CT scans depicted increased radiotracer uptake in the metastatic areas (figure 3). Following PRRT, clinical symptoms improved, and serum suppressed-Tg level were reduced . On this account, we decided to withhold additional cycles requesting a diagnostic WBIS. Surprisingly, the WBIS showed significant iodine avidity in all metastatic foci. The patients received 200 mCi 131I, and the post-treatment whole-body scan confirmed the regaining RAI uptake in all of the metastatic foci found in the SSTR PET/CT study . The interval between this WBIS and the previous negative study were between 40-70 months. Despite doing a thorough literature search, we could not find any hypothetical mechanism for re-differentiation following PRRT. Indeed, data in this research domain is still limited, as fewer than 200 cases of RAIR-DTC have been treated with PRRT in the literature. Regaining radioiodine uptake in theses cases were really happened because of PRRT-induced irradiation to the tumoral cells and this needs to be elucidated in future studies ***Conclusion:*** We report four cases of RAIR-DTC that showed re-differentiation and gained RAI uptake capacity after PRRT. This hypothesis may be a ray of hope. It may propose PRRT as a possible re-differentiation strategy in patients with RAIR-DTC who have lost their RAI avidity if repeated and confirmed by future studies.

OP-439

Redifferentiation of radioiodine-refractory differentiated thyroid cancer to warrant I-131 therapy using lenvatinib: results of the RESET trial

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Aim/Introduction: In patients with radioiodine-refractory differentiated thyroid cancer (RAI-R DTC), I-131 therapy is deemed ineffective. In a part of these patients, the disease is characterized by a loss of radioiodine uptake and accumulation. Prior studies show that short-term treatment using (selective) tyrosine kinase inhibitor (TKIs) can reinduce radioiodine uptake and warrant I-131 therapy. This study (NTC04858867) investigated the potential of standard-of-care multitargeted-TKI lenvatinib to reinduce radioiodine uptake and subsequent eligibility for I-131 therapy in RAI-R DTC patients. ***Materials and Methods:*** 9 RAI-R DTC patients starting lenvatinib treatment were included and underwent rhTSH-stimulated I-124 dosimetric procedures at baseline, week 6 (N=7) and week 12 (N=8).[1] At all timepoints, the maximum tolerable activity (MTA)[2] and fraction of patients eligible for I-131 therapy was assessed. Patients were considered eligible if at least one target lesion showed an expected mean absorbed dose >20 Gy when administering 7.4 GBq (or MTA if ≤7.4 GBq) I-131. In total, 23 target lesions were selected for dosimetry. Lesions were segmented on I-124 PET/CT, volumes estimated using low-dose CTs and recovery correction was applied to the measured mean activity concentration at each timepoint. Tumor dosimetry was performed following the MIRD methodology using a mono-exponential fit and S-values from IDAC-Dose2.1. MTA, mean absorbed lesion dose per administered I-131 activity (LDpA), residence time and uptake 24 hours post-administration in target lesions were assessed and compared between time points. ***Results:*** In all patients, a morphological therapy response due to lenvatinib was observed at week 6 and 12. By our definition, none of the patients were found eligible for I-131 therapy at any timepoint. Median LDpA was 0.08 (IQR: 0.04-0.17), 0.18 (IQR: 0.08-0.36) and 0.17 (IQR: 0.09-0.37) Gy/GBq at baseline, week 6 and 12, respectively. No significant increase in mean LDpA was observed at both timepoints on-lenvatinib (p=0.3 and p=0.06, respectively). LDpA showed an increase in 12/17 (71%) lesions at week 6 and 15/20 (75%) lesions at week 12 compared to baseline. MTA, 24h-lesion uptake and residence time were comparable between time points (p>0.2). ***Conclusion:*** Redifferentiation of RAI-R DTC to reinduce radioiodine uptake to a level that warrants I-131 therapy cannot be established by short-term lenvatinib treatment. Based on a predefined futility stopping criterion, the study was preliminary terminated after 9 patients completed all dosimetric procedures. Multitargeted-TKIs may not be as potent as selective-TKIs in reinducing clinically meaningful radioiodine retention. ***References:*** [1] Dotinga et al. Diagnostics (2023) [2] Lassmann et al. EJNMMI (2008).

OP-440

Results of the phase I "Lumed " study: Dose escalation of ^{177}Lu-PP-F11N in patients with medullary thyroid carcinoma.

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Aim/Introduction: Targeting the cholecystokinin 2 receptor (CCK2R) with radiolabeled compounds for therapy of malignancies such as medullary thyroid carcinoma (MTC) is an attractive approach. Recently, we demonstrated that the administration of the CCK2R agonist [177Lu-DOTA-(DGlu)6-Ala-Tyr-Gly-Trp-Nle-Asp-PheNH2] (177Lu-PP-F11N) in patients is safe and enables visualization and dosimetry of metastasized disease in MTC patients. This subsequent prospective phase 1 single-center dose escalation study (ClinicalTrials.gov: NCT02088645) aims to the determination of the maximum tolerated dose of 177Lu-PP-F11N. We present the recent data of two dose levels in patients. ***Materials and Methods:*** Main inclusion criteria were histologically confirmed MTC with or without thyroidectomy and elevated levels of calcitonin (> 100 pg/mL) and/or a calcitonin doubling time of less than 24 months. Depending on the escalation cohort, patients received up to 4 infusions of 177Lu-PP-F11N in an interval of 8-10 weeks. Planar whole-body scintigraphy and quantitative SPECT/CT acquisitions of neck/thorax/abdomen/pelvis were acquired at several time points for tumor and organ dosimetry. For measurement of in-vivo stability, blood samples were taken. Adverse events were recorded and graded according to Common Terminology Criteria for Adverse Events (CTCAE) version 4.03. ***Results:*** In total, 9 patients were recruited for this study and received infusions of 177Lu-PP-F11N between October 2018 and March 2024. Six patients received all planned activity doses according to the dose escalation protocol. Of these, 3 patients received each 3 infusions of 6.0-6.6 GBq (median: 6.3) within the first, and further 3 patients each 4 infusions of 7.8-8.5 (median: 8.2) GBq 177Lu-PP-F11N within the second escalation cohort. Follow-up was performed for (current status, depending on the date of patient recruitment) from 2 months up to 5 years after the last infusion. In all of these 6 patients, no dose limiting toxicity occurred. Patients only suffered temporary adverse reactions related to the pharmacological effects of the substance not higher than CTCAE grade 2. Of the remaining 3 patients, 2 cancelled study participation after the first infusion due to visually low tracer accumulation of metastases in the posttreatment scan and one patient after the second infusion due to noncompliance with the imaging procedures. ***Conclusion:*** In the two escalation cohorts with 3 x 6 GBq and 4 x 8 GBq 177Lu-PP-F11N, no patient suffered any dose limiting toxicity. Therefore, activity doses of at least 4 x 8 GBq 177Lu-PP-F11N can be considered as a safe activity dose in future therapy trials or in clinical application. ***References:*** J Nucl Med. 2020 Apr;61(4):520-526.

1008

Monday, October 21, 2024, 15:00 - 16:30
Hall G2

Joint Symposium 4 - Translational Molecular Imaging & Therapy Committee / ENETS - What Role can Nuclear Medicine play in Neuroendocrine Tumor Surgery?

OP-441
The cornerstones of molecular imaging and theranostics in neuroendocrine neoplasms
V. Ambrosini;
IRCCS Azienda Ospedaliero-Universitaria di Bologna, Nuclear Medicine, Bologna, ITALY.

OP-442
Surgical management of NETs: where we are and where we would like to go
A. Frilling;
Department of Surgery and Cancer, Imperial College London, Hammersmith Campus, London, UNITED KINGDOM.

OP-443
What is and what will be the role of Nuclear Medicine in neuroendocrine tumor surgery
J. Orozco Cortes;
Hospital Universitario Dr. Peset, Valencia, SPAIN.

OP-444
The future of radioguided surgery in neuroendocrine tumors: new devices, new isotopes
P. Fragoso Costa;
Department of Nuclear Medicine, West German Cancer Center (WTZ), University Hospital Essen, University of Duisburg-Essen, Essen, GERMANY.

1009

Monday, October 21, 2024, 15:00 - 16:30
Hall F

e-Poster Presentations Session 7: Dosimetry Committee: Evolving Dosimetry Strategies

EPS-127
European SIRT dosimetry challenge for yttrium-90 resin microspheres: insights into clinical practice
J. Badel*[1]*, *L. Sancho-Rodriguez[2], O. Grosser[3], J. Orcajo Rincon[4], S. Chauvie[5], R. Sciuto[6], M. Bray-Parry[7], S. Gnesin[8], C. Deroose[9], W. Noordzij[10], L. Strigari[11], L. de Wit[12], F. Grillet[13], S. Parisse-Di Martino[13];*
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Aim/Introduction: This study aims to provide an overview of SIRT dosimetry planning practices with Yttrium-90 (Y-90) resin μspheres in Europe. The project attempts to answer the following question: are dosimetric practices comparable and consistent across Europe? In particular, does the dose prescribed delivered to the tumor depend on center-specific practice? ***Materials and Methods:*** A phantom case and two anonymized clinical cases were provided to participants. The phantom case was composed of 99mTc-SPECT/CT images of an anthropomorphic phantom with an inserted sphere to mimic tumor in liver. The dosimetric challenge was to calculate the activity of Y-90 to deliver 120 Gy into the sphere. The two anonymized clinical cases consisted of a radiation segmentectomy for the treatment of mCRC (case A) and a case of SIRT retreatment of HCC (case B). Patient characteristic, tumor description, clinical data, diagnostic images and 99mTc-MAA SPECT/CT were provided to participants. The dosimetric challenge was to perform the dosimetry planning workflow, from segmentation of volumes of interest to absorbed dose calculations according to the individual clinical practice of the participating centers. Data collected included lung-shunt-fraction (LSF), volumes data (type, segmentation method, volume value, DICOM RTSTRUCT), dosimetric data (calculation method, absorbed doses, DICOM RTDOSE) and calculated Y-90 activity for treatment. Additionally centers reported their methodology by a standardized online questionnaire. Inter-center variability in segmented structures, absorbed doses, LSF, and Y-90 activity was analyzed using the quartile coefficient of dispersion. ***Results:*** In total, 55 Europeans centers participated. Forty-eight percent use voxel-based dosimetric method, with 72.9% of those using a commercial software. In the interim analysis of clinical case A, the quartile coefficients of dispersion (QCD) of calculated yttrium-90 activity and LSF value are 29.5% and 82.9%, respectively. The QCD of absorbed doses for liver, tumor, perfused volume and normal liver are 31.9%, 35.8%, 22.1% and 38.5%, respectively. Results for the phantom case and clinical case B are currently underway. ***Conclusion:*** The interim findings offer valuable insights into the variability in dosimetry planning associated with Y-90 resin μspheres across Europe. This study holds the potential to provide a comprehensive overview in used dosimetric workup procedures, laying the groundwork for the formulation of recommendations and towards the standardization of practices.

EPS-128
In-situ ^{90}Y Microdosimetry and Biological Effects at Microscopic Level after Transarterial Radioembolization
A. Kirov, *L. Carter, O. Talarico, A. Teplov, E. Vakiani, D. Lafontaine, H. Kunin, E. Chan, M. Nehmeh, M. P. Dimopoulos, V. S. Sotirchos, C. Samson, E. Petre, P. Zanzonico, A. Kesner, Y. Yagi, J. L. Humm, C. S. Sofocleous;*
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Aim/Introduction: To investigate microscopic level correlations between tissue absorbed dose and microsphere distribution with resulting pathologic changes determined by immunohistochemistry (IHC) on the same tissue sample obtained through PET/CT-guided biopsies. ***Materials and Methods:*** The distribution of microspheres was investigated in N = 27 18G

core needle biopsy specimens obtained from the tumor and surrounding liver parenchyma (margins) at day 0 (T0) and 3 ± 1 weeks (T3) post-radioembolization from 7 patients consented to an IRB-approved prospective research protocol and treated by transarterial radioembolization (TARE) using glass and resin 90Y-loaded microspheres. High-resolution micro-CT (voxel dimensions of several microns) and autoradiography were used to determine the number and location of microspheres in each specimen. The absorbed dose distribution within each specimen was determined using a hybrid image-based approach that separated the dose contributions into two components: the internal dose from microspheres within the specimen and the external dose from microspheres in the surrounding tissue. For the internal dose, Monte Carlo particle transport simulations were employed, utilizing the 90Y activity distribution derived from microCT and autoradiographic images of each specimen. The external dose was estimated by multiplying the macroscopic dose, as obtained from 90Y-PET images, by a scaling factor that accounted for the spill-in effect of dose from a uniform-activity background into the specimen volume. The high-resolution dose maps obtained by summing the internal and external dose components are registered with IHC micrographs with submillimeter precision. The correlations of the biological effects (double strand DNA breaks (DSB), cellular viability, apoptosis, necrosis, proliferation and immune infiltration/inflammation) with local dose in the specimens are currently being investigated. ***Results:*** For specimens containing high activity, the mean dose to the specimen exceeds substantially the mean dose derived from the PET images. The initial dose rate and the total treatment dose may exceed 10 Gy/h and 1000 Gy respectively at distances of up to few hundred microns from clusters of glass microspheres. Preliminary results from two specimens showed increased inflammatory infiltration and activation of DSB at T0 in the immediate vicinity of resin microspheres. The dependence of the biological effects on local dose at the two time points will be presented for the current cohort. ***Conclusion:*** Investigating dose response effects in the submillimeter vicinity of the microspheres may help advance our understanding of the processes underlying response to TARE by revealing effects not observable at the whole specimen level or with standard response assessment criteria.

EPS-129

Dosiomics and Dose Volume Histogram Analysis for Early Prediction of Tumor Response in ^{90}Y-SIRT

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Aim/Introduction: The aim of this work was to develop an AI model based on extracted dose volume histogram (DVH) and dosiomic features for early prediction of tumor response in patients undergoing personalized 90Y-SIRT. ***Materials and Methods:*** This retrospective study involved 25 liver cancer patients treated with 90Y-glass microspheres through personalized planning. Treatment response was assessed at three months using m-RECIST criteria, classifying patients into Responders (R) and non-responders (NR) groups. Dosimetry calculations were conducted using 99mTc-MAA SPECT/CT. Voxel-wise dosimetry was performed using the MIRD local energy deposition method. Additionally, biological effective dose (BED) maps were calculated for lesions, normal perfused liver (NPL), and whole normal liver (WNL). 126 dose-volume constraint (DVC) parameters were extracted from physical and BED-related DVHs. Dosiomic features, including first-order, shape, and texture, were extracted from dose maps for all structures. Three strategies, including Dose, BED, and BED+Dose, were adopted for both DVH and dosiomics analysis. The Kruskal feature selection method was used, combined with the Logistic Regression machine learning algorithm for model development. Three-fold nested cross-validation and bootstrapping methods were adopted to avoid overfitting. Model performance was evaluated using area under the ROC curve (AUC), Accuracy (ACC), Sensitivity (SEN), and Specificity (SPE) metrics. ***Results:*** Fourteen cases were NRs, whereas eleven cases were categorized as Rs, with only one case of complete response (mean absorbed dose = 233.45 and mean BED = 378.08 Gy from 90Y). No statistically significant differences existed between mean absorbed doses in NR and R groups (p-value > 0.05). Multiple features were involved in response prediction. Most-frequently selected DVCs were V400(%)-tumor, V20(%)- NPL and V20(%)-BED-WNL, tumor-dose homogeneity index(D5%/D95%), tumor to normal ratio, WNL-Volume, D50-NPL and minimum-dose-NPL. Corresponding dosiomic features were shape-maximum 2D and 3D diameter-WNL and different tumor-GLCM features. The achieved AUCs were 0.52, 0.71, 0.59, 0.78, 0.85, and 0.75 for DVH-BED, DVH-BED-Dose, DVH-Dose, Dosiomics-BED, Dosiomics-Dose, and Dosiomics-BED-Dose, respectively. Corresponding values for ACC were 0.52, 0.72, 0.60, 0.79, 0.84, and 0.76, SEN were 0.50, 0.78, 0.64, 0.92, 0.71, and 0.78, and values for SPE were 0.54, 0.63, 0.54, 0.63, 1, and 0.72, respectively. ***Conclusion:*** This study is a step towards precise and informed 90Y-SIRT therapy. Our findings indicate that dosiomic models outperformed conventional DVH-based models. Moreover, incorporating BED dosimetry features into the DVH approach resulted in improved model performance comparable with dosiomic models. Notably, factors other than mean absorbed dose were more significant in tumor response prediction.

EPS-130

Dosimetric study of Liver and Metastases in Treatments with [^{166}]Ho-PLLA: Dead Time Effects and Prediction Power

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Aim/Introduction: [166]Ho-PLLA microspheres has been recently introduced into clinical practice for radioembolization in the treatment of liver tumors and metastases. The use of the same microspheres both in pre-therapy simulation (SA) and in therapeutic administration (TA), and the possibility of acquiring SPECT/CT images (81 keV peak), should lead to improved predictive power of absorbed dose estimation (AD) from SA to TA (ADSA and ADTA, respectively). However, TA can exceed 10 GBq, so SPECT/CT image acquisitions (generally performed 2 days after TA) are affected by dead time effects (DTe). The aim of this study is to evaluate the predictive power of SA on TA in terms of mean AD and AD distribution, assessing the impact of DTe. ***Materials and Methods:*** A recovery coefficient curve for DTe was obtained by acquiring SPECT/CT images of a phantom over one week, with

activity ranging from 1.9 GBq to 83 MBq. Fifteen patients with various liver diseases and a single lesion were retrospectively analyzed in this study. ADSA and ADTA were calculated using the local energy deposition method. ADTA was then evaluated using three methods: M1, where no correction for DT was applied, M2, where the entire AD distribution was corrected for DTe, and M3, where only the AD within the tumor contour was corrected. Percentage differences (ΔD%) and linear correlations between the calculated mean ADSA and ADTA were performed, for the three methods. Finally, registering ADSA and ADTA distributions, a gamma index analysis was performed, with Dose Difference equal to 10% and Distance to Agreement equal to 10 mm as pass rate criteria. ***Results:*** DTe result negligible for activities below 250 MBq. The mean AD presents a strong linear correlation in both liver and tumor, using the three different methods. ΔD% values ranged, for the liver contour, between (median[min;max]) -8.6[-21.0;0.6]% (M1), 21.5[3.3;48.2]% (M2) and 8.2[-9.0;24.8]% (M3), and between -20.1[-41.8;-8.8]% (M1) and 0[-19.6;18.5]% (M2) for the tumor ROI. The best result of the gamma analysis was obtained with M3, achieving a pass rate range 92[71;100]% for the whole liver and 87[69;98]% for the tumor contour. ***Conclusion:*** Considering that SPECT/CT images are generally acquired when the therapeutic activity is above 250 MBq, dead time correction is necessary for an accurate estimation of ADTA. The best results from M3 also demonstrate that the correction should be localized to the areas with the highest uptake, achieving high predictive power both in terms of mean and distribution of AD.

EPS-131

Is the 30Gy lung absorbed dose limit still appropriate in Y90 resin microsphere radioembolization with 3D Voxel-Based dosimetry?

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Aim/Introduction: To assess the actual absorbed dose by lungs (ADL) in the Y90-PET-voxel-based analysis that is related to the eventual occurrence of radiation pneumonitis. Moreover, to compare ADL and lung shunt fractions (LSF) from planar MAA imaging and MAA-SPECT-CT-voxel-based analysis with the final values derived from Y90-PET. ***Materials and Methods:*** Patients who underwent Y90-resin-microspheres radioembolization (RE) between 2018-2023 were retrospectively analysed. Inclusion criteria comprised same MAA and Y90 injection site/s and >3 month-follow-up period. Commercially available software was used to calculate LSF with MAA-SPECT-CT and Y90-PET and to prevent liver counts from overlapping with lung counts, a boolean operation excluding manual delineation of a 1%-threshold of maximal activity in the liver from automatic lung volume segmentation was employed. Additionally, ADL mean and other parameters related to voxel-based dosimetry [V70V30,D40···] were obtained. ADLmean from planar images were calculated using partition model formula. To evaluate the agreement between planar and MAA-SPECT-CT values with the actual ones in Y90-PET, Lin coefficient correlation (CCC) was utilized. The potential correlation between dosimetry parameters and the presence of pneumonitis was also studied. ***Results:*** Sixty-six patients were included: 48 men; 64±8.5 years; 81% primary liver tumors; RE procedures: 6% bilobar, 53% lobar/lobar-extended, 38% segmental or selective. Median admininistered activity 1GBq (CI:1-2). Median LSF for planar, MAA-SPECT-CT and Y90-PET were 5% (95% confidence interval [CI]:4-7), 2% (CI:1-3) and 1% (CI:1-2), respectively. Median ADLmean were: 4Gy(CI:2-6) for planar, 1.2Gy (CI:0.6-2.4) for MAA-SPECT-CT and 1.3Gy (CI:0.77-2.2) for Y90-PET. A poor correlation between planar and Y90-PET was observed for LSF and ADLmean: CCC=0.23 (CI:0.11-0.33) and 0.37 (CI:0.2-0.52) respectively, being moderate between MAA-SPECT-CT and Y90-PET for LSF (CCC=0.46; CI:0.25-0.62) and ADLmean (CCC=0.5; CI:0.33-0.65). An strong correlation for V70 (volume of lung receiving more than 70 Gy) between MAA-SPECT-CT and Y90-PET was obtained(CCC=0.85; CI:0.76-0.91). One patient developed radiation pneumonitis (ADLmean of 25Gy in Y90-PET, 15Gy in planar and 11Gy in MAA-SPECT-CT; V70 of 3% in both MAA-SPECT-CT and Y90-PET). Median [maximum and minimum values] ADLmean for the remaining patients were 3.5 Gy [0-15) for planar, 1.2 Gy [0.3-8.4] for MAA-SPECT-CT and 1.3Gy [0.37-20.5] for Y90-PET, with V70 of 0%[0-0.8]in MAA-SPECT-CT and 0%[0-1.5] in Y90-PET. ***Conclusion:*** This series challenges the conventional 30Gy limit for ADLmean in planar images, showing that with voxel-based dosimetry, radiation pneumonitis can occur with values of 25 Gy in Y90-PET and 11 Gy in MAA-SPECT. Additionally, parameters from MAA-SPECT-CT-voxel-based dosimetry (V70 >3%), can potentially help to reduce pneumonitis risk.

EPS-132

Radiobiologic considerations in ^{90}Y resin microspheres radioembolization of Hepatocellular Carcinoma: Tumor response prediction with PET/CT and Cone Beam CT-based mean absorbed dose and equivalent uniform dose

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Aim/Introduction: The aim of the study was to implement radiobiologic models for tumor control probability (TCP) in patients treated with 90Y-resin microsphere using mean absorbed dose (Dmean) and Equivalent Uniform Dose (EUD) metrics derived from post-embolization 90Y PET/CT. ***Materials and Methods:*** 24 patients with hepatocellular carcinoma (HCC) who underwent transarterial radioembolization (TARE) from 2020 to 2024 were retrospectively considered in the study. Tumor volumes (TVs) delineated on the early arterial phase Cone-Beam CT (CBCT) were rigidly coregistered and manually adjusted in the post-TARE 90Y PET/CT. Tumor Dmean was calculated using 90Y PET/CT for all patients with voxel dosimetry-based model. The tumor response evaluation was performed on follow up (FU) contrast enhanced CT at 3 months post-TARE according to modified Response Evaluation Criteria in Solid Tumors (mRECIST) and divided in two groups: partial/complete response versus no response/stable disease. To take into account the biological effects and the dose non-uniformity, the EUD on 90Y PET/CT was calculated as EUD=-(1/α) ln(∑iexp(-αDi)/nvoxel). The radiosensitivity α (Gy-1) was established by simplified linear quadratic model for tumor control via least mean square minimization method. A logistic regression model based on 90Y PET/CT dose distribution was performed to predict the TCP using tumor Dmean, EUD, mRECIST. The area under the curve (AUC) of the receiver-operating characteristic (ROC) curves of the Dmean and the EUD were used to assess the dose values able to determine the tumor treatment response with 85.7% specificity. ***Results:*** A total of 32 lesions were assessed; partial/complete response was seen in 75% (24/32) of lesions.

The overall median Dmean and EUD were 282 Gy and 187.43 Gy respectively.Best-fit value of α parameter was: 0.015 Gy-1.Ninety % TCP corresponded to 315 Gy for Dmean and 200 Gy according to EUD metric.The Dmean and EUD values able to determine the tumor response were 280 Gy and 166 Gy respectively (AUC of 0.9). ***Conclusion:*** TCP model showed a strong association between Dmean, EUD metrics and the response probability. However, EUD should be preferred since it allows to consider the heterogeneity of the dose distribution.

EPS-133

A Recovery Coefficient Model for Resolution Characterization, Harmonization, and Shape-Specific Partial Volume Correction

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Aim/Introduction: Recovery coefficient (RC) based partial volume correction (PVC) is one of the simpler methods used to correct for partial volume losses impacting uptake measurements. However, while RC-PVC is routinely performed, the process is not well standardized and is often sub-optimally implemented. As part of the MIRDsoft community dosimetry tools project, we have developed an empirical RC model with potential applications to resolution characterization, SUV harmonization, and shape-specific PVC. In this work we validate our empirical model with experimental phantom data and demonstrate its utility for PVC. ***Materials and Methods:*** Recovery coefficients for spheres and prolate/oblate spheroids were simulated in python and an empirical model was developed to describe the partial volume losses of these shapes. Our model, "MIRD Resolution Equivalent Recovery Coefficient" (MIRD-RERC), facilitates the conversion between RCs and spatial resolution estimates. The model is a function of volume, sphericity, and spatial resolution, as well as 3 empirical fit parameters. For validation, RCs were measured from IEC phantom experiments containing 99mTc and 177Lu; the RCs were used to generate a conventional two-parameter logistic function RC-curve such as that described in the EANM dosimetry committee guidance document on uncertainty analysis [3], and an RC-curve generated with the MIRD-RERC model. The two models were then used to perform PVC on 3D-printed spheroid phantom data, consisting of 3 large spheres, 9 prolate, and 9 oblate spheroids. The PVC data was compared to the reference values. ***Results:*** The model demonstrates agreement with both experimental and simulated RCs for the various objects and is consistent with previous findings [1,2]. The PVC results, shown in Table 1, demonstrates that in our comparison the MIRD-RERC model outperforms the conventional RC-curve approach. ***Conclusion:*** We have developed a MIRD-model for recovery coefficients of differently shaped objects. The MIRD-RERC methodology is undergoing further validation and may facilitate new approaches to resolution characterization, algorithm optimization & harmonization, and shape-specific PVC. Furthermore, this model will form the basis of MIRDpvc, a MIRDsoft effort currently in development which aims to incorporate these advancements in RC-based PVC methodology accessible and easy to implement in the wider community. ***References:*** [1] Mínguez Gabiña P, et al. DOI:10.1088/1361-6560/acd982. [2] de Nijs, Robin. DOI:10.1016/j.ejmp.2023.103174. [3] Gear, J.I. et al. DOI:10.1007/s00259-018-4136-7.

EPS-134

Bone Marrow Dosimetry Exploratory Analysis from the Phase 3 SIERRA Trial of ^{131}I-apamistamab Prior to HCT in Relapsed/Refractory Acute Myeloid Leukemia

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Aim/Introduction: 131I-apamistamab, an anti-CD45 radioimmunoconjugate, delivers targeted radiation to hematopoietic cells allowing for induction and conditioning. The safety and efficacy of this targeted radiation therapy has been demonstrated in the SIERRA randomized controlled Phase 3 study prior to allogeneic hematopoietic cell transplant (HCT). The main target organ of this treatment is the bone marrow, to achieve successful myeloablation leading to induction and conditioning prior to transplant. ***Materials and Methods:*** Patients 55 years or older with active relapsed/refractory AML were randomized (1:1) to receive 131I-apamistamab with fludarabine and total body irradiation (2 Gy) followed by HCT or conventional care (CC), with the potential to proceed to HCT if achieving CR. Patients not achieving CR on the CC arm were eligible to cross over to 131I-apamistamab. Organ-specific absorbed dose estimates were calculated for each patient and the prescribed activity of 131I-apamistamab was determined individually by limiting the absorbed dose to liver to 24 Gy. Bone marrow dosimetry was performed using the sacral scintigraphy method1 and associations of various patient demographics and estimated dose to marrow are presented in this analysis. ***Results:*** 153 patients were enrolled in SIERRA, 76 in the 131I-apamistamab arm and 77 in the conventional care arm. The primary endpoint of 6-month durable complete remission (dCR) was met with 22% in the 131I-apamistamab arm vs. 0% for CC ($p<0.0001$). 131I-apamistamab followed by HCT was well tolerated with lower rates of sepsis compared to CC (6.1% vs. 28.6%), and respectively 43.9% vs. 50% febrile neutropenia and 15.2% vs. 21.4% mucositis. The median estimated dose to bone marrow was 16.0 Gy (range: 4.6 - 44.6 Gy), Table 1 shows the bone marrow dose estimates stratified by several patient factors. No significant differences were found in dose to marrow by age ($p=0.30$), sex ($p=0.31$), BMI ($p=0.46$) or performance status ($p=0.09$), indicating that myeloablative bone marrow doses were achievable irrespective of patient characteristics. ***Conclusion:*** 131I-apamistamab based induction and conditioning followed by HCT resulted in statistically significant improvement in primary endpoint dCR at 6 months as a result of targeted radiation delivery with excellent safety. High doses of targeted radiation to the diseased marrow, greater than what would be achievable using total body irradiation, were safely delivered irrespective of age, performance status, sex and BMI. ***References:*** 1. Siegel et al. 1989. Sacral scintigraphy for bone marrow dosimetry in radioimmunotherapy. IJRAI. Nuclear Medicine and Biology, 16, 553-559.

EPS-135

GPU-Accelerated Monte Carlo Enables Generation of Patient-Specific Recovery Coefficients for Accurate Partial Volume Correction and Radiopharmaceutical Dosimetry

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Aim/Introduction: The limited spatial resolution of SPECT imaging can lead to inaccurate measurements of radiopharmaceutical (RPT) treatment delivered to patients. Current methods rely on generic recovery coefficients (RCs) based on simplified phantoms, which can be inaccurate due to variations in patient anatomy and activity distribution. ***Materials and Methods:*** SPECT/CT (D0, D1, D2, D7) from patients (n=5) treated with 177Lu-DOTATATE were used as input data for this study. Using an inhouse automatic segmentation algorithm, VOIs were created at each time point for each kidney and five bone marrow regions within the lumbar spine. Patient-specific RCs were calculated using Monte Carlo simulation (1000 photons per voxel) of the SPECT scanner and VOIs. Three scenarios were investigated which used the same VOIs but varied the activity within and around the VOIs:1) Uniform activity within VOIs and no activity outside of VOIs, 2) true 177Lu-DOTATATE activity distribution inside of VOIs, no activity outside of VOIs, and 3) true 177Lu-DOTATATE activity distribution inside and outside of VOIs. The calculated RCs for each VOI (5 patients x 4 time points = 20 data points) were compared for each scenario. A similar investigation was repeated assuming 225Ac-DOTATATE. The effect of varying the collimator (e.g., HEGP, MEGP, MELP, LEHR) was also investigated. ***Results:*** Results showed that the most realistic scenario (activity inside and outside ROIs) produced the most consistent RCs, regardless of ROI size. Bone marrow ROIs showed the most significant variation across scenarios. The type of collimator used in the SPECT scanner also affected the RCs. For 177Lu the mean RCs for L1 were 0.760, 0.527, and 0.979 for scenarios 1-3, respectively; and, for 225Ac, the mean RCs for L1 were 0.641, 0.361, and 0.966 for scenarios 1-3, respectively. For 177Lu of scenario 1 and 2, the largest RC was for the right kidney whose mean was 0.853 ± 0.016 and 0.887 ± 0.015, respectively. For scenario 3, the largest RC was L3 whose mean was 1.002 ± 0.089. The LEHR and MEGP had the largest RCs for 177Lu (0.8268 ± 0.03923) and 225Ac (0.7723 ± 0.01953), respectively, while the HEGP (0.7629 ± 0.05637) and LEHR (0.6614 ± 0.09046) had the smallest RCs for 177Lu and 225Ac, respectively. ***Conclusion:*** This research demonstrates a promising new approach for generating patient-specific RCs, potentially improving the accuracy of RPT dosimetry in SPECT imaging. Future work will compare this method to traditional phantom-based methods for even greater accuracy.

EPS-136

Development of a skin dosimetry model for assessing normal tissue dosimetry following CD44v6 therapy: a comparison between ^{177}Lu and ^{161}Tb

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Aim/Introduction: The cell surface antigen CD44v6 is a promising targeting agent for several cancers, demonstrating favorable in vivo attributes in terms of affinity and biodistribution. Normal tissue typically has limited expression of CD44v6; however, it is abundantly present in skin keratinocytes. When coupled with a radionuclide, this increases the potential for skin toxicity, emphasizing the need for a dedicated skin dosimetry model. In this study, we compared the energy deposition of 177Lu or 161Tb in various skin structures under different radionuclide distributions. ***Materials and Methods:*** Sequential H&E-stained histological sections of normal skin biopsies were segmented using MATLAB. The dermis region was subdivided into blood vessels, sebaceous glands, sweat glands, hair follicles, and remaining tissue. The epidermis, primarily composed of keratinocytes without a direct blood supply, was divided into the upper epidermis and the basal layer. This thin layer, which forms the boundary between the dermis and epidermis, harbors several skin stem cell populations and is likely of particular importance for skin toxicity assessment. To quantify radiation exiting the skin, the air outside of the epidermis was also included. Simulations in the voxelized skin model were performed using event-by-event tracking in the Monte Carlo program PENELOPE. ***Results:*** The complete model size was 0.2x0.3x0.2 cm with 3.6 µm voxel sides. Ten million decays of either 177-Lu or 161-Tb were simulated in the following source regions: blood, the basal layer, and the upper epidermis. When activity was distributed in the basal layer and upper epidermis, the self-dose from 161-Tb was 59 and 15 keV/decay, respectively, compared to 28 and 13 keV/decay for 177-Lu. For the blood activity distribution in the dermis region, the regional variations were particularly large for 161-Tb, averaging 101 keV/decay in self-dose and 3.9 keV/decay to the basal layer. For 177-Lu, the corresponding measures were 79 and 3.4 keV/decay. ***Conclusion:*** Our results demonstrate increased energy deposition to all skin regions for 161-Tb compared to 177-Lu across all distributions of activity. When activity was solely distributed in the stem cell populations of the basal layer, a two-fold higher energy deposition was observed for 161-Tb.

EPS-137

Post-Therapeutic Dosimetric Evaluation of ^{166}Ho Hepatic Radioembolization: Software Impact on Tumor and Liver Doses

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Aim/Introduction: Transarterial radioembolization with 166Ho-microspheres (166Ho-TARE) is a promising therapy for primary and secondary liver malignancies, sparking interest in precise dosimetric evaluations using quantitative Single Photon Emission Computed Tomography (SPECT/CT)1. This study aimed to estimate post-treatment liver and tumor absorbed doses using two state-of-the-art software platforms. ***Materials and Methods:*** Patients selected for 166Ho-TARE underwent a scout procedure and SPECT/CT images to assess tumor dose coverage and microsphere extrahepatic leakages. Treatment was given two weeks later, followed by a post-treatment SPECT/CT. Whole liver and tumor mean doses were estimated using Hermia Voxel dosimetry™ 1.1 and Q-Suite™ 2.1, and dose coverage was evaluated at three points using (D50, D70 e D85) dose-volume histograms. Results were compared using Bland-Altman analysis

and Wilcoxon tests. ***Results:*** The study included 15 patients with an average age of 60 years, predominantly female (77%), and mostly diagnosed with hepatocellular carcinoma (77%). Hermia Voxel dosimetry showed mean liver and tumor doses of (12±4) Gy and (58±23) Gy, respectively, while Q-Suite reported (44±9) Gy and (209±83) Gy. D50, D70 and D85 values were (55±21) Gy, (41±19) Gy and (29±16) Gy for Voxel dosimetry and (201±78) Gy, (149±67) Gy and (108±59) Gy for Q-Suite, respectively. Significant differences were observed in mean doses (p=0.002 for liver, p<0.001 for tumor), with wide limits of agreement in Bland-Altman analysis. To address these differences, a patient/activity-specific CF was applied, rather than a general CF obtained with low activity, to correct the Voxel dosimetry dose maps. This CF was determined based on the gamma camera's response curve, assuming a direct correlation between camera's sensitivity and CF. The revised mean doses were (42±6) Gy for liver and (196±17) Gy for tumor, aligning closely with Q-Suite results (p=0.69 for liver, p=0.64 for tumor). ***Conclusion:*** Voxel dosimetry initially underestimated doses compared to Q-Suite, likely due to the short time interval between therapy administration and imaging. However, with a new patient-specific CF, the corrected dose maps showed valid results, aligning with Q-Suite outcomes. The CF plays a key role in generating the activity map for accurate dose distribution in 166Ho-TARE using these software, highlighting the importance of proper calibration and timing. ***References:*** 1. Sjögreen-Gleisner K, Flux G, Bacher K et al. EFOMP policy statement NO. 19: Dosimetry in nuclear medicine therapy - Molecular radiotherapy. Phys Med. 2023 Dec;116(103166). doi: 10.1016/j.ejmp.2023.103166.

EPS-138

Impact of Tissue Density on Dosimetric Accuracy in ^{166}Ho-TARE: A Comparative Analysis Using Local Energy Deposition, Voxel S-Values, and Monte Carlo Simulations

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Aim/Introduction: Radioembolization therapy with 166Ho microspheres needs accurate dosimetric assessments to ensure therapeutic efficacy and minimize potential toxicity. The complexities of absorbed dose (AD) distribution within and around heterogeneous tissues, particularly the liver and lungs, challenge traditional dosimetric methods that rely on homogeneous water-equivalent assumptions. This can lead to significant inaccuracies in AD estimation, potentially affecting clinical outcomes. This study aims to compare the dosimetric differences between the Local Energy Deposition (LED) and Voxel S-Values (VSV) with Monte Carlo (MC) simulations. ***Materials and Methods:*** A retrospective cohort of 10 patients with primary (hepatocellular carcinoma, colorectal carcinoma) and secondary (metastatic) liver malignancies treated with 166Ho microspheres was analyzed. Dosimetric calculations were conducted using data from patient SPECT/CT scans acquired after injecting 166Ho microspheres. A dedicated software was used for LED and VSV AD calculations, while another dedicated one, implementing GPU-accelerated MC algorithm, provided MC absorbed dose values. AD estimations obtained from the LED and VSV methods were compared against those provided by MC simulations (considered as reference values), focusing on the liver and lungs. Absolute and relative AD differences were assessed. ***Results:*** Mean AD percentage differences between LED and MC in the liver region ranged from 0.3% to 4.7% (absolute AD differences from 0.1 Gy to 1.7 Gy). In the lungs, these differences ranged from -97.1% to -100% (absolute AD differences from 3.4 Gy to 10.5 Gy), and with density correction applied, they ranged from -91.8% to -99.9% (absolute AD differences from 3.3 Gy to 10.5 Gy). Mean AD percentage differences between VSV and MC in the liver region ranged from 5.3% to 9.6% (absolute AD differences from 0.9 Gy to 3.4 Gy). In the lungs, these ranged from -73.4% to -77.9% (absolute AD differences from 2.5 Gy to 8.2 Gy), and with density correction applied, they ranged from -25.4% to -37.9% (absolute AD differences from 0.9 Gy to 4 Gy). ***Conclusion:*** Both LED and VSV approaches, compared with MC simulations, showed significant AD underestimations, particularly in regions with air-equivalent densities. These preliminary results highlight the sensitivity and potential inaccuracies in dosimetric calculations when non-MC methods are employed in regions with variable densities. Further research is recommended to explore improvements in dosimetric methods and their impact on clinical efficacy and safety.

EPS-139

Streamlining Parameter Dimensionality in a PBPK Model for [^{177}Lu]Lu-PSMA I&T Radioligand Therapy using Bayesian Parameter Estimation

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Aim/Introduction: Physiologically based pharmacokinetic (PBPK) models mathematically describe the absorption, distribution, metabolisation and excretion of chemical substances in humans and animals. Compartments within the models represent organs or tissues connected via blood flow. A system of differential equations enables calculating the concentration of substance in each compartment, relying on knowledge of parameter values. Precise parameter estimation can be challenging due to an often-large number of unknown parameters and high computational costs. One method to reduce parameter dimensionality is Bayesian parameter estimation, explored in this work using a whole-body PBPK Model for [177Lu]Lu-PSMA I&T radioligand therapy (RLT). ***Materials and Methods:*** Data from 13 patients who underwent one diagnostic PET scan and one cycle of [177Lu]Lu-PSMA I&T RLT were used to fit 17 parameters of a recently-developed whole-body PBPK model through minimisation of an objective function implementing Bayesian information. To determine which parameters could be fixed, 9 iterations were performed where the Bayesian mean and standard deviation for each patient were updated with the population average of the estimated parameter from the previous iteration. A parameter could be fixed when the average Bayesian relative standard deviation is less than 0.001%. The Time-Activity Curves (TACs) and the Time-Integrated Activity Coefficients (TIACs) of the total body, kidneys, liver, salivary glands and tumour lesions were compared when fitting 17 and 9 parameters. ***Results:*** In 13 patients, after 9 iterations, the Bayes parameters converged, and 8 out of 17 parameters had a standard deviation of less than 0.001%. The modelled TACs for all investigated organs and tumours appeared almost identical when fitting 17 parameters after 9 iterations and 9 parameters after

fixing 8, with the difference in the TIACs being less than 0.01%. Due to their importance in treatment safety and efficacy, the TIACs of the kidneys and tumour lesions are considered. While fitting 17 parameters after the first iteration, these are 0.086±0.019 min and 1.267±0.758 minl-1, respectively. The corresponding TIACs after the 9th iteration and after fitting 9 parameters are identical with results 0.087±0.019 min and 1.257±0.783 minl-1, respectively. The total body and the parotid glands demonstrate the largest differences in the TIACs between the 1st and 9th iteration. ***Conclusion:*** Bayesian parameter estimation has effectively determined the number of adjustable parameters that could be fit in a population, resulting in almost identical TAC results. This reduces user dependence when using a PBPK model for [177Lu] Lu-PSMA I&T RLT without compromising the results.

EPS-140

Plausibility of ^{225}Ac-DOTATATE dosimetry estimation based on the biodistribution of ^{177}Lu-DOTATATE

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Aim/Introduction: Actinium-225 (225Ac) has increasingly been used in targeted alpha therapy, however, its dosimetry estimation poses several challenges. In this work, we investigate the accuracy of human dosimetry estimation for 225Ac-DOTATATE based on the biodistribution (BioD) of 177Lu-DOTATATE collected in NETTER-1 trial [1]. We then compare the results of model extrapolation to the observed dosimetry data for 225Ac-DOTATATE obtained in Part-1 of the ACTION-1 trial [2]. ***Materials and Methods:*** We first reproduced the 177Lu-DOTATATE absorbed doses for each organ and tumor for the 20 patients in the NETTER-1 dosimetry sub-study [1]. We then calculated the number of disintegrations for 225Ac-DOTATATE assuming a similar decay-corrected BioD to 177Lu-DOTATATE. Finally, we calculated the absorbed doses for 225Ac-DOTATATE in OLINDA/EXM v2.2.3, assuming all daughter radioisotopes of 225Ac decay in the same organ/tissue as the 225Ac-parent. We used a relative biological effectiveness (RBE) of 5 for all alpha-emissions similar to ACTION-1 trial [2]. ***Results:*** Estimated (mean ± SD) organ absorbed doses for 225Ac-DOTATATE for the 20 patients from the NETTER-1 trial for spleen, kidneys, liver, and red marrow are 0.97±1.01, 0.69±0.31, 0.28±0.20 and 0.058±0.055 SvRBE5/MBq, respectively. In comparison, in Part 1 of the ACTION-1 trial, mean weighted absorbed doses for 225Ac-DOTATATE for spleen, kidneys, liver, and red marrow in Cycle 1 were 0.88, 0.52, 0.45, and 0.029 SvRBE5/MBq, respectively [2], demonstrating a 10.2%, 32.7%, and 100.0% overprediction for spleen, kidney, and red marrow, respectively, and a 37.8% underprediction for liver. Tumor absorbed doses for 225Ac-DOTATATE are estimated to be 9.7±13.4 SvRBE5/MBq for the 20 patients from NETTER-1, whereas mean tumor absorbed dose was 3.3 (range 1.0-8.8) SvRBE5/MBq in ACTION-1 trial [2]. The discrepancy in red marrow and tumor absorbed doses might be explained by the differences between NETTER-1 and ACTION-1 trials in red marrow dosimetry estimation methods and in pre-treatment with 177Lu-labelled somatostatin analogues, respectively. ***Conclusion:*** Estimating 225Ac dosimetry based on BioD of 177Lu-labelled compounds is a plausible approach, which may be used as a first approximation in cases where no clinical data is yet available. For 225Ac-DOTATATE, other than in red marrow, the estimated absorbed doses in organs compared well to the observed dosimetry in ACTION-1 trial [2]. ***References:*** [1] Strosberg J, et al. Lancet Oncol. 2021, 22(12):1752-1763. [2] Sgouros G, et al., J Nucl Med. 2023, 64:P129.

EPS-141

Reproducibility of SPECT-based MTV for patients treated with Lu-177-PSMA

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Aim/Introduction: Recent studies showed that Metabolic Tumor Volume (MTV) from Lu-177-SPECT-imaging can serve as a prognostic marker to determine whether Lu-177-PSMA therapy should be continued. [1,2] These studies use a semi-automatic delineation method with an empirical SUV-threshold of 3. However, this approach has not been validated nor evaluated in terms of reproducibility. This study compares the reproducibility of MTV using a threshold-based semi-automatic approach with values obtained with a gradient-based manual approach. ***Materials and Methods:*** Patients with variable tumour load underwent a full cycle of Lu-177-PSMA therapy consisting of four administrations. Each patient underwent a quantitative Lu-177-SPECT/CT-scan 12 hours after each administration, and one intermediate F18-PSMA PET/CT-scan three weeks after the second administration. First, tumoral lesions on the PET/CT were manually selected and segmented by two expert physicians using a gradient-based contouring approach in addition to a semi-automatic approach with a fixed SUV-threshold of 2, 3 and 4. Next, lesions on SPECT/CT were segmented by each expert, again first manually using a gradient-based contouring approach, in addition to a semi-automatic approach with fixed SUV-threshold of 0.5, 1, 2, 3 and 4. Time per segmentation was recorded while the reproducibility of the different methods amongst the two expert readers was evaluated using the relative percentage difference. ***Results:*** The time for manual segmentations by the readers ranged from under two minutes up to 18 minutes for a patient with high tumour burden. Meanwhile, all semi-automatic segmentations took less than 2 minutes, independent of the tumour burden. For each expert reader, MTV values using semi-automatic segmentations with an SUV-threshold of 2 were closest to the MTV-values from manual segmentations. For the MTV from manual segmentations, the relative difference between expert readers ranged from 5.2% up to 60% while for the MTV of semi-automatic segmentations with an SUV-threshold of 2, the relative difference between expert readers was lower than 2.6%. ***Conclusion:*** An SUV-threshold of 2 instead of 3 better aligned SPECT-based MTV using a semi-automatic threshold-based approach with a manual gradient-based approach. In addition, the semi-automatic threshold-based highly increased MTV reproducibility amongst expert readers compared to manual contouring. ***References:*** [1] John, N.: (177)Lu-PSMA SPECT quantitation at 6 weeks predicts short Progression-Free survival for patients undergoing (177)Lu-PSMA-I&T therapy. J Nucl Med 64(3), 410-415 (2022)[2] Neubauer, M.C.: Early response monitoring during [177Lu]Lu-PSMA I&T therapy with quantitated SPECT/CT predicts overall survival of mCRPC patients: subgroup analysis of a swiss-wide prospective registry study. EJNMI 51(4), 1185-1193 (2024)

EPS-142

Effect of Absorbed Dose on Toxicity and Tumor Response in Patients With Gastroenteropancreatico Neuroendocrine Tumors Treated with Lu-177-DOTATATE in Combination with Olaparib: Preliminary Results

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Aim/Introduction: Gastroenteropancreatic neuroendocrine tumors (GEP-NETs) are somatostatin receptor (SSTR) expressing tumors treated with Lu-177-DOTATATE. Olaparib is a poly-ADP-ribose polymerase inhibitor that blocks single-stranded DNA repair which may synergize with Lu-177-DOTATATE for both efficacy and toxicity. We present in-progress dosimetry results of a phase 1/2 trial testing this combination in metastatic GEP-NET. ***Materials and Methods:*** Three quantitative SPECT/CT scans (4, 24, 48 hours post-infusion) are performed in NCT04086485, a 3+3 dose escalation phase 1/2 study evaluating Lu-177-DOTATATE + olaparib. Lu-177-DOTATATE is given at fixed 200 mCi x 4 cycles while olaparib is escalated from 50mg to 100mg, 200mg, and 300mg bid. Dosimetry was performed using MIM's SurePlan MRT workflow. Regions of interest (ROIs) are drawn around all major organs and select tumors by an experienced Nuclear Medicine physician using MIM's automatic segmentation and PET Edge tool. Integrated time activity curves were obtained using both MIM's fitting functions and trapezoidal integration. The latter data and the voxel S-value convolution method in SurePlan was used to calculate absorbed doses. CT scans obtained at baseline, post 2-cycles, and post 4-cycles were used for RECIST tumor measurements. ***Results:*** By April 2024, 11 patients were treated (6 patients with 4 cycles, 3 with 3 cycles, and 2 with 1 cycle). Absorbed doses calculated with trapezoidal integration yielded results that were on average 34% higher than best fit method. For the 6 patients who completed therapy, 62 tumors lesions were contoured, of which 23 were official RECIST measurable lesions. For these 62 tumors, absorbed dose over all 4 cycles averaged 51.86 Gy (range: 0.77 to 248.85 Gy) per lesion. Per cycle average dose decreased over time (Cycles 1-4: 15.91, 13.57, 12.36, 11.29 Gy, respectively). No correlation was found between total absorbed dose or olaparib dose with change in RECIST diameter at studied re-staging time points. For toxicity, 3/9 (33%) evaluable patients had grade 1 creatinine elevation with average absorbed doses of 13.35 Gy (left) and 11.91 Gy (right) to kidneys, compared to 12.79 Gy and 11.02 Gy in the other 6 patients. One patient (11%) had grade 1 transaminase elevation with 5.85 Gy to the liver, compared to 25.14 Gy (range: 5.85 to 53.13 Gy) in others. ***Conclusion:*** Preliminary data suggests that absorbed doses calculated via 3 time-point dosimetry do not correlate with tumor response or organ toxicity after 2 or 4 cycles in patients treated with Lu-177-DOTATATE and olaparib.

EPS-143

Investigation of [^{177}Lu]Lu-PSMA-617 therapy minimum cycle interval with [^{68}Ga]Ga-PSMA-11 PET/CT

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Aim/Introduction: [177Lu]Lu-PSMA therapy is typically performed with up to four infusions of 7.4 GBq 6 weeks apart. However, short intervals may help to avoid tumour resistance, which has been associated with poor patient response at late therapy cycles. The tumour uptake is limited to the number of receptors on the cell surfaces. Once saturated, the remaining free drug in the blood pool irradiates the non-tumoral tissue, reducing the therapeutic index. Therefore, the occupancy of receptors by radiopharmaceutical and how long it takes for the receptors to be free again (recovery time) constitute essential information to help define a minimum interval cycle. Here, we use a physiologically-based pharmacokinetic (PBPK) model with pre- and peri-therapy PET/CT images to investigate receptor occupancy and recovery time. ***Materials and Methods:*** Three patients were imaged with approximately 190 MBq of [68Ga]Ga-PSMA-11 one month before the therapy (baseline) and between 30 min and 120 min after the first cycle of 177Lu-PSMA-617 therapy. Pre and post-infusion images were acquired one hour after 68Ga-PSMA-11 injection. A PSMA whole-body PBPK model was developed in SimBiology (MATLAB) to simulate [68Ga]Ga-PSMA-11 biokinetics in patients before and after the therapy infusion. The model was adjusted for each patient based on age, weight, organ masses, injected and measured activities, kidney and tumour receptor densities, and blood flow to tumour. The PBPK model was used to calculate the receptor occupancy and the time needed for 90% of receptors to be free again. ***Results:*** After the therapeutic infusion, 68Ga-PSMA-11 uptake for tumours was 34%, 72%, and 49% lower than the baseline for patients 1, 2, and 3, respectively, suggesting PSMA receptor saturation. Likewise, kidney uptake was 77%, 68%, and 74% lower. Tumour receptor occupancy in simulations reached 75%, 81%, and 71%, and it took 1.8, 4.2, and 1.2 days to recover for patients 1, 2, and 3. Similarly, on kidneys, 51%, 92%, and 73% of receptors were occupied, and it took 1.3, 5.9, and 1.2 days to recover. ***Conclusion:*** Reducing the interval between therapy cycles depends on the time needed for targeted cells to recover the initial number of free receptors. A subsequent infusion might be ineffective if administered before this time. A minimal cycle interval of 1.8, 4.2, and 1.2 days for the patients would allow for reaching the maximum tumour uptake with the current injected substance amount. In addition, the large interpatient variation reinforces the need for dosimetry for optimal individualised therapy.

EPS-144

Impact of total-body PET/CT Scan Duration and Reconstruction Parameters on Absorbed Doses in Y-90 Radioembolisation Patients derived from Dose Maps generated with a Monte-Carlo simulated Dose Kernel

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Aim/Introduction: The high sensitivity of total-body PET/CT scanners can compensate the low branching ratio of Y-90, enabling precise voxel-based dosimetry for Y-90 liver radioembolisation. Building on our previous work on optimization of Y-90 imaging [1], we implemented an advanced dosimetric approach and evaluated the impact of image reconstruction

parameters and scan duration on absorbed doses (AD) in radioembolisation patients. ***Materials and Methods:*** Evaluation was performed for 7 patients (2 CRC, 3 NET, 1 ICC, 1 breast cancer) with 11 radioembolisations who underwent a 30min total-body PET/CT scan up to 48h post radioembolisation with Y-90 microspheres. PET images were reconstructed using OP-OSEM with 2 iterations and 5 subsets (2i5s)/3i5s/4i5s, 0-mm/2-mm/4-mm post-reconstruction Gaussian filters and rebinned list-mode data of 20min. Subsequently, 3D AD maps were generated by convolution of the PET activity images with a dose kernel (ICRP soft tissue) obtained from Monte-Carlo simulations using GATE. Delineation of tumor and non-tumorous compartment (NTC) was performed to determine AD values Dmean and Dmax and compared with the reference reconstruction (30 min, 2i5s, 4-mm filter [1]) and pretherapeutic therapy planning. ***Results:*** Increasing the number of iterations to 4i5s resulted in an increase in Dmean by 2.0%±1.0/0.6±1.1% and Dmax by 9.6±4.4%/9.2±5.3% for tumor/NTC, respectively. Reducing the filter size to 0-mm resulted in an increase in Dmean by 1.2±0.7%/0.3±0.7% and Dmax by 9.0±4.4%/4.5±2.9% for tumor/NTC, respectively. Shortening the acquisition time to 20 min did not impact Dmean with an average change of 0.7±0.6%/1.0±1.5% (tumor/NTC) and maximum change of 4.0% (25 Gy to 26 Gy). Dmax increased by 3.0±3.7%/3.6±4.1% (tumor/NTC), with maximum change of 10.6% (123 Gy to 136 Gy, tumor) and 12.4% (145 Gy to 163 Gy, NTC). In comparison to pretherapeutic planning, determined Dmean values ranged from a close match 0.3%/6.5% to variations up to 50.0%/56.1% for tumor/NTC, respectively. ***Conclusion:*** The impact of reconstruction parameters on Dmean for tumor and liver was negligible and consistent down to 20min scan duration. However, Dmax is susceptible to reduction of filter size with an average increase of 9%/4.5% (tumor/NTC) and increase of iterations with an average increase of 9.6%/9.2%. The discrepancy observed in absorbed dose between pretherapeutic planning and therapy for some patients is likely to be related to differences in catheter position and therapy administration. As next step, we aim to validate the accuracy of the 3D AD maps obtained with the dose kernel with patient-individual Monte Carlo simulation. ***References:*** [1]Linder et al, Diagnostics 2023, doi:10.3390/diagnostics13223418

EPS-145

Influence of patient motion on image-based dosimetry for ^{177}Lu-PSMA therapy

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Aim/Introduction: 177Lu-PSMA patients often have progressive bone metastases that cause pain and make it difficult to lie still during post-therapeutic SPECT scans. Thus, they may perform sudden movements that distort quantification and dosimetry. The aim of this study was to investigate the effect of small patient movements on the lesions' and kidneys' activity quantification and time-integrated activity (TIA). ***Materials and Methods:*** SPECT/CT projections of a realistic patient phantom including 2 kidneys (k) and 20 lesions (l) with 25ml were simulated using Simind. In addition to a baseline position, shifted positions of the phantom were simulated with shifts of ±(5, 10 and 20)mm in the transverse plane. These projections were stacked and reconstructed to create motion affected tomographic image data. It was assumed that the patient stays in the translated position until the next movement. To compare the effects of short (5s) and long (15s) scan times per projection the following motion patterns were examined: uniform patterns, with movements occurring every 1 or 4min and patterns with linearly increasing occurrence of movement over time (max. 2 movements/min). For both scan times and all motion patterns, 20 SPECT scans with randomly selected movements were generated. Activity deviations from the baseline (without motion and 15s per projection) were determined and used for generating time-activity-curves (24, 48, 72, 168h p.i.) where each data point was assigned with a deviation corresponding to the results of the motion simulation. The corresponding TIA errors were estimated. ***Results:*** For the linearly increasing motion scenarios, 15s and 5s scan times showed similar results with mean activity deviations of -31±10% (l), -17±6% (k) and -29±19% (l), -19±13% (k). The corresponding TIA errors were -30±7% (l), -17±3% (k) for 15s and -27±15% (l), -17±8% (k) for 5s. For the 1min uniform patterns, the deviations are smaller for the shorter scan time per projection of 5s with -30±18% (l), -17±10% (k) than for 15s with -38±8% (l), -21±6% (k). The same holds for the 4min uniform patterns with deviations of -10±10% (l), 7±8% (k) for 5s and -34±17% (l), -20±11% (k) for 15s. These deviations result in TIA deviations of -10±7 (l), -7±5% (k) for 5s and -32±15% (l), -19±7% (k) for 15s. ***Conclusion:*** This preliminary study shows that small and only few motions during 177Lu-PSMA SPECT/CT scans can lead to significant errors in measured activities, TIAs and hence dosimetry. These results motivate optimization of current 177Lu-PSMA SPECT/CT dosimetry protocols.

EPS-146

Evaluation of automated γ-H2AX+53BP1 foci detection in ex vivo irradiated PBMCs

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Aim/Introduction: This study aimed to establish and test the automated co-localized γ-H2AX+53BP1 DNA double-strand-break foci detection software "AutoFoci"[1] after low dose internal ex vivo irradiation of peripheral blood mononuclear cells (PBMCs) and to compare the results to our gold-standard "manual counting". ***Materials and Methods:*** Blood samples from 3 healthy volunteers were irradiated internally with 50mGy of [177Lu]LuCl2. Time points 0h, 3h, 6h and 24h after irradiation were used to analyse focus induction and DNA repair after automated scanning of extended focus images using Metafer 4. Automated foci analysis was performed using the following software adjustments: First, the ImageJ plugin "Cellect" was used to create single cell images. The maximum cell area of Cellect was adapted to 650µm2 to adjust to PBMCs and to adjust the pixel size to our settings(0.29µm). A manual check of the generated images was performed to discard artefacts. Secondly, AutoFoci was used with its published parameters to determine the number of co-localized γ-H2AX+53BP1 foci per cell. The results of the automated count were compared to the foci per cell values obtained by manual counting 100 cells of each sample by an experienced observer. ***Results:*** In average 471 cells per sample were detected and analysed with Autofoci. The radiation induced foci (RIF) values were calculated to compare the different volunteers with each other. For the different time points, the mean AutoFoci RIF values are: (1.01, range:0.551-1.296, t=0h), (0.43, range:0.067-0.883, t=3h), (0.65, range:0.231-1.292, t=6h), (0.12, range:-0.086-0.379, t=24h post irradiation). The manually counted mean RIF values are: (0.84, range:0.78-0.92, t=0h), (0.4, range:0.38-0.44, t=3h), (0.34,

range:0.28-0.45, t=6h), (0.07, range:-0.03-0.2, t=24h). The values show that the results of the automatic counting are subject to a high degree of scatter relative to the manually obtained values. Nevertheless, it is possible to distinguish between irradiated and non-irradiated samples. To evaluate the results of AutoFoci, the correlations to the gold-standard were determined. The first test person showed a very good correlation of R=0.96. For the second, 0.37 because of outliers at 3h and 24h. The third showed a correlation of 0.79 despite an outlier at 6h. Pooling all data of the volunteers revealed a correlation of 0.68. ***Conclusion:*** A first application of AutoFoci analysis provides meaningful results in the low dose range. More datasets have to be analysed and the software needs further adaptation to our experimental setup to achieve a better correlation and a lower degree of scatter. ***References:*** [1]Lengert et al., SciRep2018

EPS-147

Reconstruction of Time-Activity Curves in MRT Therapy Using Bayesian Unfolding

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Aim/Introduction: The precise estimation of dose absorbed by the tumor and healthy organs is essential to increase therapeutic effectiveness and optimize the treatment planning in Molecular Radiotherapy (MRT). To address this requirement, we proposed WIDMApp (Wearable Individual Dose Monitoring Apparatus), a multi-channel radiation detector and data processing system for in vivo patient measurement and collection of radiopharmaceutical biokinetic data [1,2]. The two key software components of WIDMApp are a Monte Carlo simulation and a deconvolution algorithm. ***Materials and Methods:*** We employed a Geant4 simulation with a male anthropomorphic ICRP110 phantom to model photon propagation in a patient undergoing Lu-177 prostate therapy. Six organs, including the prostate and four at-risk organs (liver, kidneys, spleen), were activated as radiation sources. Following the WIDMApp approach, a sensor was strategically placed near each organ to collect radiation counts over time. We developed a Bayesian deconvolution algorithm capable of estimating time-activity curves (TAC) in each organ from the signals detected by these sensors without assuming specific functional forms. To assess the algorithm robustness, we simulated four prototype patients with different organ biokinetic profiles, including single, double, triple exponentials, and mixed trends derived from prior literature. We studied the deviations of the reconstructed cumulative activity from the true values as a function of the algorithm initialization priors and the percentage of uniform noise affecting the detected signals. ***Results:*** This study demonstrates that by analyzing the time-dependent counts recorded by various detectors placed at specific locations on the patient's body, the Bayesian algorithm enables the reconstruction of cumulative organ activity for each of the four prototype patients. Notably, the algorithm achieved a 4% accuracy in cumulative activity reconstruction, even with 40% fluctuations on the measured signals. ***Conclusion:*** This study presents a novel Bayesian unfolding approach for reconstructing organ-specific time-activity curves, offering potential enhancements to personalized dosimetry in MRT compared to current methods. The algorithm's flexibility and robustness make it applicable to a wide range of clinical scenarios. ***References:*** [1] S. Morganti et al.; A wearable radiation measurement system for collection of patient- specific time-activity data in radiopharmaceutical therapy: system design and Monte Carlo simulation results. Med Phys. - ISSN 0094-2405. - 48:12(2021), pp. 8117-8126. [10.1002/mp.15311][2] C. Mancini-Terracciano et al.; Experimental validation of an innovative approach in biokinetics study for personalized dosimetry of molecular radiation therapy treatments. Phys Med Biol. 2023 Sep 25;68(19). doi: 10.1088/1361-6560/acf910. PMID: 37747087.

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Monday, October 21, 2024, 15:00 - 16:30
Hall G1

Technologists' e-Poster Presentations Session - Technologists Committee: Techs' e-Posters

TEPS-001

Benefit of using an allergen-free diet to optimize gastric emptying scintigraphy

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Aim/Introduction: The objective of the study is to establish normal values for gastric emptying scintigraphy of a hypoallergenic food that can be used in all patients, by verifying that the protocol used in our service, based on the latest consensus guide published by the SNM (Society of Nuclear Medicine) from a solid diet, had a high percentage of food intolerances and allergies. ***Materials and Methods:*** When retrospectively reviewing gastric emptying since the implementation of the protocol of a solid diet composed of: 120 g pasteurized egg marked with 99m Tc-DTPA, 2 slices of white bread, 30 g of jam, 10 g of margarine and 200 ml of juice and acquisition of periodic images after ingestion at 0, 30, 60, 120, 180 and 240 minutes. We present a research project carried out in our service, based on a prospective and observational study in volunteers (good health, without gastrointestinal diseases). Gastric emptying of a new hypoallergenic meal was evaluated by scintigraphy at 0, 30, 60, 110, 120, 130, 180, 230, 240 and 250 minutes, in a SPECT-CT gamma camera, acquiring static images for one minute in anterior projection. and later, in a standing position (or sitting in specific cases), using a 128x128 matrix after ingestion. Diet composition: 100 g of pasteurized egg marked with 2 mCi of 99 mTc-DTPA, 100 g of cooked potato, 50 g of white rice, 16 ml of olive oil and 120 ml of water. The preparation consists of fasting for 6 hours. ***Results:*** Of the 84 patients reviewed since the implementation of the solid diet: 46 patients were able to complete the procedure without incident (54.8%), 11 of the patients were unable to complete the complete diet (13.1%) and 27 had food intolerances or allergies (32.1%): 17 intolerances (82% lactose, 18% gluten) and 10 allergies (60% fruit). That is why we started this study with the new diet, which included 50 healthy volunteers (age range 26-69), 29 women and 21 men), in order to obtain a normality curve for our service. ***Conclusion:*** The current diet that we use for gastric emptying, based on the latest consensus guide, has a high percentage of food intolerances and allergies (32.1%). For this reason, a multidisciplinary research project has been initiated in our service that has the objective is the standardization of a solid, allergen-free diet.

TEPS-002

The Benefits of SPECT/CT over whole body acquisition in bone imaging

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Aim/Introduction: The frequency of tomography imaging of the skeletal accumulation of radiotracers has increased in Finland. Planar imaging of the bone has been performed usually as a whole body aqcuisition. As well known the underlying objects disturb the evaluation of the accumulations. Since the overall development of data processing has given the possibility to calculate tomographic images faster. Nowadays the acquisition and processing of the tomographig data takes only few minutes. Our department took SPECT/CT acquisition method in use two years ago. The aim of this study is to determine the benefits of SPECT/CT over conventional whole body acquisition. ***Materials and Methods:*** Fourteen patients were imaged with both whole body and SPECT/CT methods. An experieced nuclear medicine physician evaluated first whole body images. Later he took SPECT/CT-images under evaluation. Accumulations from whole body images were compared to the ones from SPECT/CT-images. Their clinical conclusions were compared, as well. ***Results:*** Two patients had normal accumulation in both acquisitions. Two patients had metastase suspected accumulations all over the skeleton. Four patients had degenerative type of accumulations. Totally in eight cases there were no significant new findings in SPECT/CT-images. With six patients unsure accumulations in whole body confirmed to appear bening type after SPECT/CT. ***Conclusion:*** Accumulations in neck or lower part of the lumbar spine were easier to define as degenerative type when evaluating from SPECT/CT-images. In one case SPECT/CT confirmed the accumulation to be in ureter rather than skeleton at all. Once the summation disturbed whole body images. And once spine accumulation was confirmed to be in skull after SPECT/CT evaluation. These results indicate that SPECT/CT is better method than planar whole body for bone imaging.

TEPS-003

Continuous SPECT acquisition mode provides faster scan time with comparable or better image quality to step-and-shoot for detection of reduced tracer uptake

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Aim/Introduction: Step-and-shoot (SS) and continuous SPECT acquisition modes are available. SS acquires data only when detectors are stationary in each projection, using additional scan time for detector movement between projections. With continuous mode, detectors acquire data whilst moving continuously throughout the acquisition, hence no additional detector movement time is used, thereby reducing acquisition time compared with SS. Greater reductions in total scan time could be made in lung ventilation/perfusion imaging with two SPECT acquisitions. The aim was to determine whether continuous mode provides comparable image quality to SS, for faster imaging of reduced uptake. ***Materials and Methods:*** The NEMA image quality phantom was imaged with a hot background (111MBq Tc-99m-pertechnetate) and cold spheres. Six SPECT acquisitions were made on a conventional dual-headed SPECT-CT system, with low energy high resolution (LEHR) collimator. Acquisitions were made with 120 projections, with continuous and SS acquisition modes, at 5, 10 and 20 minutes sampling time, and acquisition times decay-corrected to the start of the first acquisition. Reconstructions were made with 16 updates, resolution recovery and CT-based attenuation correction. Volumes-of-interest were assigned to the four largest spheres (≥17mm, relevant to sizes of lung perfusion defects) and the background. Contrast-to-noise ratio (CNR) was calculated for each sphere in each dataset and compared between acquisition modes at each sampling time. ***Results:*** Using SS mode resulted in an additional 3:18 mins scan time for equivalent sampling time, as compared with continuous. CNR values, although dependent on sphere size and sampling time, were comparable between continuous and SS modes at 5 mins sampling, with CNR measured in 17-37mm spheres at 14.9-18.1 and 14.8-17.9, for continuous and SS respectively. At longer sampling times, image quality was better for continuous as compared with SS, with CNR measured at 21.6-24.7 vs. 18.0-22.4 for 10 mins, and 27.4-33.2 vs 24.3-31.1 for 20 mins sampling. ***Conclusion:*** Continuous mode provides >3 mins reduction in scan time per SPECT acquisition, for image quality comparable to or better than SS, when imaging reduced uptake. This allows a total scan time reduction of >6.5 mins for lung ventilation/perfusion SPECT comprising two acquisitions, making this examination more tolerable for patients who may have difficulty breathing and lying flat. Since differences in resolution would be more likely detected with the LEHR collimator, it can be inferred that continuous mode could also be used with lower resolution collimators, for same scan time reduction and comparable image quality to SS.

TEPS-004

Optimizing image quality and scan time for DatScan studies on CZT -based 3D digital SPECT-CT - comparison to current clinical protocol on conventional SPECT-CT

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Aim/Introduction: We scan approximately 200 DatScan patients per year, and availability of this study is 1-2 months. Current clinical protocol uses conventional SPECT-CT with an acquisition time of 35min, which can be challenging for this patient group. To scan more patients per day and increase patient comfort, we explored options to shorten scan time by using our 3D digital SPECT-CT (3D-CZT).The aim was to find optimal reconstruction for our protocol and see if we can achieve equal or better image quality with shorter scan time using 3D-CZT compared to current clinical protocol. We also wanted to study if EARL reference database could be used with 3D-CZT data. ***Materials and Methods:*** Twelve patients referred to 123I DatScan study were scanned on 3D-CZT and on conventional SPECT-CT. Scans were performed 3-4h after injection with 20min acquisition time on 3D-CZT and according to clinical protocol on conventional SPECT-CT. To optimize scan time, 15min and 10min scans were rebinned from 20min 3D-CZT data. Data was reconstructed with OSEM with and without PSF correction. Image quality was evaluated based on contrast, noise and visually by experienced nuclear medicine physician, rating best image or equal image quality. For EARL database analysis we also scanned DatScan-phantom. ***Results:*** Preliminary results from five patients are presented. Based on visual evaluation of the data, physician rated image quality on 3D-CZT better or equal

in all cases. When decreasing scan time small average change of 6.0% in contrast was observed whereas noise level increased as expected, on average 44.6%. By visual evaluation PSF improved image quality which was also seen in as average increase of 17.9% in contrast. Possibility to use EARL reference database with 3D-CZT data will be further evaluated in ongoing data analysis of phantom and patient data. ***Conclusion:*** By using 3D-CZT we can shorten scan time from current 35min to 15min or even to 10min, if needed. This would be significant improvement to patient comfort, and it would allow us to increase number of scans per day. Based on preliminary analysis, image quality is equal or better compared to our current clinical protocol, but we are still looking to optimize PSF reconstruction which improves contrast further.

TEPS-005

Challenges Imaging Transposition of the Great Arteries on a Dedicated Cardiac Single Photon Emission Computed Tomography Camera - A Case Report

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Aim/Introduction: Transposition of the great arteries (TGA) is a congenital cardiac defect as a result of embryological discordances between the pulmonary trunk and aorta1. In Nuclear Cardiology, imaging TGA is rare. Myocardial Perfusion Imaging (MPI) can evaluate myocardial viability as a result of coronary disease1. Patient X has a complex cardiac history, diagnosed with congenitally corrected (cc)-TGA at birth; the left atrium is connected to the right ventricle (RV), and the left ventricle (LV) connected to the right atrium1. They had continuous chest pain over recent years, resulting in the requested MPI to evaluate myocardium viability. This case report aims to discuss challenges Technologists/Radiographers face when imaging a rare heart disease e.g. cc-TGA on a dedicated cardiac cadmium zinc telluride (CZT) Single Photon Emission Computed Tomography (SPECT) camera. ***Materials and Methods:*** The patient underwent Technologist lead Regadenoson stress. At one minute of arm lifts Regadenoson was given and TL201- Thallous Chloride, 30 seconds later. Images were acquired less than 20 minutes post-injection to visualise stress due to TL201 time sensitivity as it actively redistributes. Positioning the patient on the camera presented as a challenge. The patient was centred more over the LV which was morphologically the RV. There was initial confusion on what exactly was the LV. The duty physicist was called, and in conversation it was decided to acquire over the morphological RV. ***Results:*** Two consultant cardiologist with support for a consultant clinical scientist reported this images based on the morphological RV. It summarised that the morphological RV which lies in the LV position had reduced perfusion mid-basal anteriorly and inferiorly. There was no significant improvement on redistribution imaging at 3 hours 11 minutes. There is a limited view of the morphological LV in the RV position. No evidence of reversible ischaemia. ***Conclusion:*** Imaging cc-TGA patients on a dedicated cardiac CZT-SPECT using TL201 presents difficult time sensitive challenges with positioning. Awareness of how to image patients with rarer heart diseases, where positioning on the scanner may differ from what is typically done, must be considered before imaging. Furthermore, multidisciplinary team involvement for rarer heart conditions prior to imaging is essential to ensure the correct data is acquired. ***References:*** 1. Kumar TKS. Congenitally Corrected Transposition of the Great Arteries. J Thorac Dis [Internet]. 2020 [cited 20 April 2024]; 12(3): 1213-1218. Available from: Congenitally corrected transposition of the great arteries - PMC (nih.gov).

TEPS-006

Correlation of Inflammatory Markers with ^{18}F FDG PET/CT Imaging in Patients with Pyrexia of Unknown Origin

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Aim/Introduction: Pyrexia of Unknown Origin (PUO) is defined as fever >38.3 degree Celsius on at least two occasions with duration of more than 3 weeks in immunocompetent patients, post extensive baseline evaluation.The aim of our study is to investigate the correlation between different inflammatory markers in blood with the ratio of standardized uptake value (SUVmax) of spleen to liver in 18F FDG PET/CT in the patients with pyrexia of unknown origin (PUO). ***Materials and Methods:*** Data of consecutive patients, clinically suspected/diagnosed with PUO, who underwent 18F FDG PET/CT at our center from April 2023 to March 2024, was retrospectively reviewed. The spleen to liver SUVmax ratio was correlated with inflammatory markers-erythrocyte sedimentation rate (ESR), C-reactive protein (CRP), and lactate dehydrogenase (LDH). Quantitative variables were checked for normality using Shapiro-Wilk test and the relationship between the variables was evaluated using Pearson's correlation. ***Results:*** 164 patients with Pyrexia of Unknown Origin (PUO), comprising 81 females and 83 males (median age: 46.5 years), underwent 18F FDG PET/CT evaluation at our center. Of the 110 patients in whom ESR levels (mean: 41.46 mm/hr) were obtained within 72 hours of PET/CT, the spleen to liver SUVmax ratio (mean: 1.14), showed a positive correlation with plasma ESR levels ($r=0.585$, $p<0.001$). In the 46 patients in whom LDH levels were obtained 72 hours within PET/CT study, a positive correlation was noted ($r=0.545$, $p=0.022$) between LDH levels (mean: 486U/L) and spleen to liver SUVmax ratio (mean: 1.22). Among the 33 patients with documented CRP levels (mean: 35.47 mg/L) within 72 hours of PET/CT study, a significant correlation ($r=0.517$, $p<0.01$) was observed with spleen to liver SUVmax ratio (mean: 1.13). ***Conclusion:*** The study findings suggest that spleen to liver SUVmax ratio can be used as an indirect functional marker of the degree of inflammation in patients with PUO and it correlates with inflammatory markers such as ESR, CRP and LDH. Further studies may help in ascertaining if such PET parameters can potentially point towards the etiology of PUO.

TEPS-007

BMI-Based Myocardial Perfusion Imaging: Reducing Patient Exposure by Optimizing the Administered Activity

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Aim/Introduction: This study evaluates the differences of using Body Mass Index (BMI) or Patient Weight to calculate the administered activity on Myocardial Perfusion Imaging (MPI) and its potential implications on radiation dose optimization. ***Materials and Methods:*** Mastrocola LE et al. (2020) described that the injected activities can be adjusted using BMI: 8 mCi for BMI

<25; 9 mCi for BMI [25-30[; 10 mCi for BMI [30-35[; 12 mCi for BMI >35 for 1-day MPI protocols.We have adjusted linear, logarithmic and exponential models and performed a least-squared analysis to the BMI points previously described, creating a BMI Model. The exponential model had the best fit to the curve with an R2=0.9822 for y = 4.0833e0.0264(BMI). We have determined the theoretical activity for the stress and rest injection by this BMI Model and using a model based on weight [Activity(mCi) = (patient weightx10)/70] for a sample of 103 patients [average weight of 75.39±14.50kg, average height of 1.65±0.10m, and corresponding BMI of 27.64±3.88] who underwent an 1-day stress-rest protocol. We also calculated the total effective dose for the two activities administered for each patient based on ICRP 128. The mean differences between the two methods for theoretical administered activities (1st and 2ndinjection) and total effective dose were compared by pared-samples t-test (SPSS25®). ***Results:*** For all the selected patients, the activities administered were based on the BMI model and good diagnostic accuracy images were assured by a Nuclear Medicine Physician. For first injection, average activities calculated were 8.52±0.88 mCi (315.24±32.56 MBq) by the BMI method and 10.77±2.03 mCi (396.48±75.11 MBq) for the weight method. For the second injection average activities calculated were 25.54±2.64 mCi (944.98±97.68 MBq) by the BMI method and 32.20±6.09 mCi (1195.1±225.33 MBq) for the weight method. Differences between the two methods were -2.25±1.53 mCi (-83.25±56.61 MBq) in the 1st injection and -6.76±4.58 mCi (-250.12±169.46 MBq) in the 2nd injection. For all paired sample test results, statistically significant differences were observed between the BMI and weight methods (p=.000). The total effective dose showed a reduction of -2.22±1.85 mSv in the case of the BMI method when compared to the weight-based method. ***Conclusion:*** The BMI method, according to the formula y = 4.0833e0.0264(BMI), allowed a better optimization of administered activity in 1-day MPI protocols, resulting in a lower effective dose for the patient compared to the previously used method based only on a patient weight factor.

TEPS-008

^{18}F-FDG PET/CT examinations in patients with Li-Fraumeni Syndrome

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Aim/Introduction: Li-Fraumeni Syndrome (LFS) is a hereditary cancer predisposition syndrome in which cellular tumor antigen p53 is mutated. Patients with LFS who receive radiation are more susceptible to radiation exposure effects. In order to minimize stochastic and deterministic effects of radiation in patients with LFS who undergo [18F]FDG PET/CT examinations, protocols need to be adjusted for this specific patient group. The aim of this study is to share knowledge about LFS so involved parties can prevent an (unnecessarily) high exposure by taking precautionary dosimetric measures. ***Materials and Methods:*** To reduce radiation dose to LFS patients, the following changes were made to standard [18F]FDG PET/CT protocols: lowering of administered activity (3.5 MBq/kg standard protocol vs 120 MBq activity in dose-reduced protocol), a doubling of time per bed position (BP) in PET (4 minutes/BP instead of 2 minutes/BP), LD-CT dose reduction measures (25 mAs instead of 43 mAs), and hydration measures (use of urinal catheter on indication and diuretics to lower the time of exposure to the urogenital system). With the installment of a LAFOV PET/CT scanner, the administered activity for patients with LFS is lowered from 1.5 MBq/kg to 0.3 MBq/kg (with a minimum activity of 15 MBq) with a quadrupling of time/BP (20 minutes instead of 5 minutes). ***Results:*** In a retrospective period of 13 years, 17 LFS patients (6 male, 11 female) received a total of 35 dose-reductive [18F]FDG PET/CT scans. The most common indications for [18F]FDG PET/CT in LFS patients was breast cancer (33%) followed by lung cancer (17%). The scan quality is comparable to [18F]FDG PET/CT scans using a regular acquisition protocol and regular patient preparation protocol. The dose-reductive protocol has been edited in the past 10 years to facilitate for newer models PET/CT-scanners in which use of lower mAs on LD-CT provides comparable image quality. ***Conclusion:*** 17 LFS patients received a total of 35 [18F]FDG PET/CT scans being scanned according to dose-reductive protocol. The scan quality is comparable to [18F]FDG PET/CT scans using a regular acquisition- and patient preparation protocol. Dose-reductive protocols are successfully used in LFS patients, providing images of good quality and an ALARA radiation dose for LFS patients.

TEPS-009

Validation of reduced patient dose for [18F]FDG PET/CT brain examinations through list-mode reconstruction

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Aim/Introduction: As part of our efforts to fulfill the ALARA principle, we wanted to reduce our administered fixed dose of 200 MBq [18F]fluoro-2-deoxy-D-glucose (FDG) to brain PET CT examinations. The EANM recently recommend an administered dose of 150 MBq or even lower. The aim of this study was to validate image and diagnostic quality with reduced patient dose without changes in acquisition time. The hypothesis was that assessing PET images at different acquisition time frames would be a useful method to evaluate PET images with different administered doses. ***Materials and Methods:*** Forty dedicated brain PET CT scans were acquired on a LSO PET/CT system with a time-of-flight (TOF) of 214 ps. Acquired datasets were reconstructed list-mode by using a five and a ten minutes acquisition dataset. Datasets were processed and displayed in an imaging software system used routinely. An experienced nuclear medicine physician assessed the qualitative pattern of each dataset by using visual criteria only. Furthermore, the diagnostic PET pattern was evaluated and it was assessed whether the diagnostic outcome was identical regardless of acquisition time. ***Results:*** Forty examinations were included in the study, resulting in 80 datasets. Comparing the five and ten minutes datasets showed that all examinations were of the same qualitative PET pattern. There was one examination with visually lower uptake in the five-minute acquisition, however the PET pattern was identical, hence the diagnostic outcome for all 40 patients was the same, regardless of acquisition time. With a 50% reduction in acquisition time, our goal was to reduce the administered dose by 50% as well. The EANM Guidelines recommends a factor 2 dose reduction for digital systems with TOF < 400 ps. However, brain PET CT scans are performed on two systems, one with TOF < 400 ps. and one with TOF > 400 ps. Therefore, we were not able to directly transfer the results to both systems, leading to a fixed dose of 150 MBq for all patients. ***Conclusion:*** As images from the five and ten minutes acquisition times were of equal diagnostic quality, the administered patient dose was reduced by 25% to 150 MBq. List-mode reconstructed datasets of PET brain scans are a simple and useful method to simulate dose reduction by reviewing examinations at different time of acquired frames. Performing this study on the digital PET/CT system with TOF > 400 ps., could lead to a further reduction in patient dose.

TEPS-010

Positronium lifetime measurements in patients with a commercial long axial field-of-view PET/CT

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Aim/Introduction: Before a positron annihilates with an electron from the surrounding tissue, it often forms a bound state with an electron. This metastable electron-positron bound state is called positronium. The lifetime of positronium depends on the size of intramolecular spaces and on the concentration of oxygen. Therefore, measuring the positronium's lifetime in patients could provide additional information about the local tissue composition, which is possibly of diagnostic value. We report the first in vivo positronium lifetime measurements with a commercial long axial field-of-view (LAFOV) PET/CT scanner. ***Materials and Methods:*** Three subjects (m 58y, f 39y, m 39y) underwent a standard PET/CT scan with [68Ga]Ga-PSMA-11, [68Ga]Ga-DOTATOC and [82Rb]Cl. In addition, the subjects were scanned using a special acquisition mode which saves the single-crystal interactions, i.e. in the so-called singles mode. We explain why we can only measure positronium lifetimes with radionuclides that emit positrons together with prompt photons. In addition, we discuss the selection of triplet events, i.e. the detection of a prompt photon and two annihilation photons that originate from the same nuclear decay, and the data processing that is required for the determination of positronium lifetimes. ***Results:*** We illustrate the practical operation of the singles mode on a commercial LAFOV PET/CT system and how a singles mode scan is performed and analysed. The positronium lifetimes measured in different organs of the three patients are reported. Most interestingly, the ortho positronium lifetimes in the left and right heart chambers (combining atria and ventricles) of the [82Rb]Cl patient are 1.38 ± 0.12 ns and 1.66 ± 0.15 ns, respectively. This may hint towards the different blood oxygenation levels in the two heart chambers. ***Conclusion:*** Positronium lifetime measurements in organs are feasible on a commercial LAFOV PET/CT system and may provide additional diagnostic information to the clinicians in the future.

TEPS-011

Can Delayed Pelvic PET/CT with [^{68}Ga]Ga-PSMA-11 Improve Prostate Cancer Detection?

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Aim/Introduction: [68Ga]Ga-PSMA-11 PET/CT is a non-invasive diagnostic technique to image prostate cancer with increased PSMA expression. Due to its urinary excretion, high residual activity in the urinary system may lead to halo artefacts, and activity in the ureters may lead to false positive findings. Late imaging may be useful to identify lesions in close proximity to the ureter/bladder.The aim of this study is to evaluate the utility of additional delayed pelvic imaging by comparing lesion detection rate, diagnostic confidence, relative image quality and lesion SUV measurements. ***Materials and Methods:*** 99 continuous [68Ga]Ga-PSMA-11 patients who met the EANM guideline PSMA imaging criteria regarding uptake time (50 - 100 min. WB p.i.) and dose administered (1.8 - 2.2 MBq/kg), were included. The patient protocol consists of skull base to mid-thigh imaging (5 minutes pelvic bed) followed by a localised 1 bed 5-minute pelvic image. Patients micturated before each image was acquired. The pelvic area of whole-body scan (WB) was initially reviewed followed by delayed post-micturition pelvic imaging. Two experienced consultants analysed the images for location and number of lesions detected. Where there were differences, consensus was obtained. Images were evaluated regarding lesion count, location, readers' confidence score, image quality and to see if there was a change in patient outcome using the extra pelvic view. Scanner followed recommended QA programmes to ensure accurate SUV measurements. ***Results:*** WB [68Ga]Ga-PSMA-11 PET-CT and Delayed pelvic imaging detected PSMA avid pelvic lesions in 70 patients. The post-micturating pelvic imaging detected no additional lesions. Between WB and post micturating pelvic imaging there was a median increase of 6.6% in SUVmax ($p = 0.009$) and a 0.3% median decrease in SUVpeak ($p = 0.008$). Reader's confidence score was changed in 3 patients after evaluating post-micturating pelvis imaging. Image quality was better on pelvis imaging on 4 patients. In total, the readers found the additional pelvic imaging did not change patient's management in the total of 99 patients evaluated. ***Conclusion:*** Additional post micturition pelvic image did not show an increase in lesion detection. Post micturition pelvic imaging slightly improves diagnostic confidence and image quality. For all patients, eliminating post-micturation pelvic imaging would not alter patient management, however, it would enhance patient throughput and satisfaction. ***References:*** Wolfgang P. Fendler et al. (2017). 68Ga-PSMA PET/CT: Joint EANM and SNMMI procedure guideline for prostate cancer imaging: version 1.0. Eur J Nucl Med Mol Imaging, 11

TEPS-012

Optimising CT scan direction for different PET-CT examinations at anatomical high/low attenuation boundaries when using large CT detector width

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Aim/Introduction: Tube current modulation (TCM) is standard practice for optimising radiation dose and image quality (IQ) across the CT scan range. However, TCM can present challenges for IQ at boundaries of low and high attenuation (e.g. neck/shoulder) with wide detectors, which can cover low and high density regions in the same rotation. Thus, scan direction affects TCM. The aim was to study the differences in whole-body mAs profiles between craniocaudal and caudocranial scan directions on a 128-slice system, and determine which direction is most suitable for the different types of PET-CT exams without contrast enhancement. ***Materials and Methods:*** CT scans of an anthropomorphic whole-body-phantom were made in standard and obese configurations with arms up (whole-body scan), and arms down (head and neck scan) using a 128-slice system, with craniocaudal and caudocranial scan directions. Delivered mAs was recorded in each slice and mAs profiles plotted in the Z-direction, for each scan. The ratio of delivered mAs was calculated between the two scan directions for each slice (highest/lowest) to detect anatomical areas with large relative difference in delivered mAs. It was then determined which scan direction is optimal for different PET-CT exams, according to which direction gives the highest mAs in the prioritised anatomical regions. ***Results:*** Scanning in the direction of low-to-high attenuation provided

the highest mAs at low/high density boundaries. For the standard phantom/arms-up, craniocaudal provided higher mAs at the boundaries of the vertex/arms (maximum mAs ratio 3.8), neck/shoulder (2.5), lung/liver (1.5) and abdomen/pelvis (1.9). With arms-down, a higher ratio was seen at the neck/shoulder (4.6). Caudocranial provided highest mAs at the skull-base/elbows (3.4), thorax/shoulder boundary (2.9), mid-liver (1.4) and femur/pelvis boundary (1.8). Similar findings were made with obese configuration, except that caudocranial delivered higher mAs at the pelvis/abdomen boundary (1.6). The offset in mAs profiles was consistent with detector width, suggesting that the TCM profile is based on the position of the first detector in the direction of travel. ***Conclusion:*** Large differences in delivered mAs were seen between scan directions at a given location. However, knowledge of important anatomical locations for given scan types allows scan direction to be optimised according to PET-CT exam, using the whole-body mAs profiles generated in this study. Craniocaudal appears optimal for parathyroid imaging (prioritising thyroid bed IQ), whilst caudocranial is preferred for PSMA (priortising prostate), whilst for FDG oncology examinations it depends on the specific clinical indication and expected disease sites.

TEPS-013

Evaluation of the effect of data-driven motion correction on $^{13}NH_3$ myocardial perfusion PET/CT

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Aim/Introduction: Myocardial bloodflow (MBF) measurements on dynamic myocardial perfusion PET/CT are frequently hampered by errors produced by patient movement, and errors up to 500% have been described. Data-driven motion correction (DDMC) algorithms can be used to improve both image quality and quantitative MBF measurements in cardiac PET imaging studies. For the present study, a prototype DDMC algorithm, able to track and correct movement, was applied to dynamic myocardial perfusion PET/CT data. This study aimed to assess the prototype algorithm's impact on MBF measurements and generic scan quality parameters of 13NH3 myocardial perfusion PET/CT scans. ***Materials and Methods:*** Datasets of 28 patients who were referred for 13NH3 PET/CT between January 2020 and November 2022, were retrospectively included in this study. The prototype DDMC algorithm was used to correct for patient movement and then the data was further reconstructed. Next, a comparison was made between both regional MBF measurements of motion corrected versus non-motion corrected dynamic datasets and analyzed using paired t-tests ($p < 0.05$ was considered significant). Also, the effects of the DDMC algorithm on the automatic myocardial contour detection was assessed by two experienced readers (KH, SL), as well the effects on interference of extracardiac 13NH3 uptake on dynamic PET/CT data. ***Results:*** Significant differences in MBF were detected between data driven motion corrected versus uncorrected datasets in the RCA perfusion territory in both stress (p 0.016) and rest (p 0.009), and in the LCX territory in stress (p 0.048) and rest (p 0.006). Measurements of the LAD territory showed no significant differences between corrected versus uncorrected scans for both stress (p 0.210) and rest (p 0.485). Upon visual inspection, the original dynamic images showed an incorrect contour detection of the myocardium in 3.6% of the rest scans and 14.3% in stress. After motion correction, contour detection was flawless in all datasets. In the uncorrected data, extra-cardiac uptake of 13NH3 obscuring the inferior wall was present in 32.1% of the dynamic rest datasets and 39.3% in stress. After motion correction this was reduced to 3.6% of the rest and 17.9% of the stress datasets. All scans with remaining interference of extracardiac uptake on the myocardial 13NH3 uptake, did improve visually after correction by the DDMC algorithm. ***Conclusion:*** Application of DDMC to 13NH3 myocardial perfusion PET/CT scans optimizes MBF quantification, facilitates automatic contour detection and decreases interference of extracardiac 13NH3 activity on visualization of myocardium.

TEPS-014

Residual Activities in Lu-177 Molecular Radiotherapy - How Much is Left Out of the Patient Dose?

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Aim/Introduction: In this study, we aimed to evaluate whether residual activity forms a significant part of the dose prescribed to the patient - and how much this varies - in Lu-177-DOTATATE (dodecane tetraacetic acid-octreotate) and Lu-177-PSMA (prostate specific membrane antigen) treatments. Therefore, we made measurements to determine the residual activities in syringes, tubings, and IV (intravenous) administration sets collected post-administrations. ***Materials and Methods:*** We evaluated the residual activity in the drug administration equipment of 32 Lu-177-DOTATATE (5.5 GBq or 7.4 GBq diluted in 100 ml saline and administered as 30 min infusion) and 37 Lu-177-PSMA (5.5 GBq or 7.4 GBq administered as 1-5 min injection) treated patients. We measured the residual activities in the glass bottles or syringes and 3-way stopcocks with a radionuclide calibrator (same Lu-177 setting for all). The IV infusion set activities were evaluated using SPECT-CT imaging. The residual activities were then subtracted from the initially measured activity of the radiopharmaceutical with decay correction, and the resulting administered activity was compared with the prescribed activity. ***Results:*** For Lu-177-DOTATATE, the mean difference between the administered and prescribed activity was -1.2% (standard deviation 1.7%, range -5.2 to +1.58%). The IV-lines contained significantly smaller amounts of activity (M=13.1 MBq, SD=5.3) compared to the bottles (66.0 MBq, SD=13.6, $p<0.0001$). In PSMA treatment, the administered activity differed from the prescribed activity by -1.8% (SD=2.7%, range -9.0% to 2.8%). There were no significant differences between 5.5 and 7.4 GBq target activities. In a few of the studied patient cases, the disparity exceeded 5% (six in total, comprising one DOTATATE and five PSMA treatments). The absolute difference between administered and prescribed activities was smaller for Lu-177-DOTATATE (M=1.6%, SD=1.5%) than for Lu177-PSMA (M=2.4%, SD=2.1%); $t(67)=2.0$, $p=0.05$, which is probably due to the different flushing technique. ***Conclusion:*** Upon analyzing the residual activities in the radiopharmaceutical administration equipment, we found out that the mean difference between the prescribed and administered activities was well within our tolerance range of ±5% for both Lu-177-DOTATATE infusions and Lu-177-PSMA injections. Thorough flushing in the end of the treatment is encouraged. The administration set material (glass bottles versus plastic syringes) and dilution of the radiopharmaceutical may influence outcomes.

TEPS-015

Efficacy of adenosine vasodilatation in Rubidium PET perfusion for risk stratification prior to renal transplantation

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Aim/Introduction: Vasodilator nuclear stress testing is frequently requested for risk stratification prior to kidney transplantation. However, Adenosine receptor expression is reduced in end stage renal failure (1), which may affect the efficacy of vasodilatation, rendering the scan less reliable.This quality improvement project sought to demonstrate the efficacy of adenosine vasodilatation in candidates for renal transplantation undergoing Rubidium PET perfusion. ***Materials and Methods:*** A retrospective search of the department database between January 2020 and February 2023 to identify patients referred for risk assessment prior to renal transplantation.The haemodynamic effects of adenosine, visual reduction splenic counts during stress compared to rest, global myocardial flow reserve (MFR), and normalcy rates were recorded. ***Results:*** 154 patients were identified who had been referred for Rubidium imaging as part of the renal transplant pathway. 87 of these were male (56.5%), 67 were female (43.5%) with an average age of 54.3 ± 11.7 years. 81 patients (52.6%) included a calcium score as part of their procedure; i.e.: had no known coronary artery disease. 148 patients received adenosine at 140 µg/kg/min. One of these patients required a second infusion at 210 µg/kg/min due to inadequate reduction in splenic activity initially. 6 patients required the higher infusion rate of 210 µg/kg/min due to caffeine consumption beforehand. All of the patients completed both the rest and stress imaging. All patients were adequately stressed, according to a combination of haemodynamic change, splenic reduction of counts on stress, and global myocardial flow reserve, 153/154 after their original adenosine infusion and 1/1 after infusing at a higher rate. ***Conclusion:*** Adenosine administration at the usual concentration achieves satisfactory vasodilation and clinical results in Rubidium PET perfusion. The higher dose also attenuates the effect of caffeine.Despite the theoretical risk with reduced adenosine receptor expression in end stage renal failure, adenosine achieves effective vasodilatation in all patients undergoing MPS for risk assessment prior to renal transplantation. ***References:*** 1) Carrega L, Fenouillet E, Giaime P, Charavil A, Mercier L, Gerolami V, Berge-Lefranc JL, Berland Y, Ruf J, Saadjian A, Dussol B. Influence of haemodialysis and left ventricular failure on peripheral A2A adenosine receptor expression. Nephrology Dialysis Transplantation. 2007 Mar 1;22(3):851-6.

TEPS-016

Pilot study on the technical fusion of 3D ultrasound and SPECT/CT data sets in thyroid imaging

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Aim/Introduction: Hybrid imaging in nuclear medicine has become an increasingly important part of diagnostics, but ultrasound imaging has received little attention in the fusion process so far. The aim of this pilot study is the technical fusion of 3D ultrasound data sets and single photon emission computed tomography/computed tomography (SPECT/CT) data sets on an external workstation using the latest technology in nuclear medicine. Instead of being limited to separate SPECT, CT and ultrasound data sets this study uses combined SPECT/CT data sets from one and the same hybrid device. The CT images were used as the basis for the fusion of CT and ultrasound data sets. The fused US/SPECT data subsequently served both as a result and as an optical quality control. ***Materials and Methods:*** The methodology was chosen based on technical scientific documentation. As part of the pilot study 14 data sets (from 7 patients) were fused. The existing data, consisting of the 3D ultrasound and the SPECT/CT, were analysed and fused in a fusion software. ***Results:*** As a result, a process method for the fusion procedure was developed. Additionally, 13 landmarks selected and tested, serving as anatomical reference points for fusion. The outcome was an average deviation of 4.91 mm and an average fusion time of 6.17 min. ***Conclusion:*** It is possible to fuse data using offline fusion without any limitations in time. Although there still is a need for further research on using this fusion on a regular basis, it is evident that this type of fusion of data sets could be an important tool for diagnosing, planning treatments and monitoring various thyroid diseases in the future.

TEPS-017

Developing communication support for information-sharing to patients in conjunction with an ^{18}F-FDG-PET/CT examination

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Aim/Introduction: An 18F-FDG-PET/CT examination requires the patient to follow instructions before and during the examination procedure to ensure a high image quality. There is thus a need to develop ways to ensure that patients absorb the information given in connection with the examination. Aim To develop communication support for information sharing related to an 18F-FDG-PET/CT examination. ***Materials and Methods:*** The study has a qualitative design adapting a multiphase structure. A prototype of the communication support consisting of illustrations and text related to an 18F-FDG-PET/CT examination was developed. Interviews were conducted with patients scheduled for an 18F-FDG-PET/CT examination for the first time and questionnaires were collected from healthcare professionals with experience of 18F-FDG-PET/CT. The communication support was revised until consensus about the material. ***Results:*** The results are based on interviews with patients (n=10) and questionnaires collected from healthcare professionals (n=9). The overall theme revealed that information in conjunction with the 18F-FDG-PET/CT examination is a balancing act between text and illustrations. The analysis showed two categories; "illustrations as a complement" and "easy to understand lay-out". ***Conclusion:*** The participants strengthened the development of the communication-support by bringing in valuable viewpoints from various perspectives. The results support a person-centered approach, where the information in conjunction with an ^{18}F-FDG-PET/CT examination can be adapted to each patient's needs as a balancing act between text and illustrations.

TEPS-018

The role of the technologist - a case study

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Aim/Introduction: To ensure a patient centered approach, technologists work in close collaboration to Nuclear Medicine Physicians in a Nuclear Medicine Department. In most situations,

the Nuclear Medicine Physician does not see the patient but needs to submit an interpretation of the examination put forward by the technologist. He/she needs to rely solely on what the technologist has described, performed and accomplished the examination in question. ***Materials and Methods:*** In this presentation, a couple of case studies will be put forward and discussed. The session will be interactive, and it will involve recent studies of some patients presented with different ailments and symptoms, together with their relevant complications. The technologist's role and the findings and/or results. Scenario's such as a female patient referred for PET/CT with possible lung malignancy. However the scan had to be terminated after 5 minutes because she felt unwell and had an acute headache - how would the technologist handle this and go about it? Another example is a young pregnant patient presented with dyspnoe referred for V/Q scan - what is the role of the technologist here? Another example is whether the technologist knows which organs should be visible according to the radiopharmaceutical being injected and what to do in the case when something odd is seen and is not supposed to be there. ***Results:*** All of the examples discussed in this presentation demonstrate a possible impact on the imaging to be performed, which will then determine on how to proceed with the image interpretation and the management of the patient. ***Conclusion:*** At the end of the presentation, there will be some take home messages that the technologist could put into practice back home.

TEPS-019

Creating a modern workforce: standardising and certifying Clinical Technologist competence

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Aim/Introduction: Technological advancements in Nuclear Medicine (NM) outstripped a co-ordinated response in guidance, standards and provision of suitable education to skill the Clinical Technologist workforce to meet current & future requirements. Hybrid techniques rapidly redefined working practice over the last decade. [1-3] ***Materials and Methods:*** The Institute of Physics and Engineering in Medicine (IPEM) is the UK's largest trainer of Clinical Technologists. Their Professional Standards Council (PSC) engaged the workforce to produce a curriculum[4] in addition to the Register of Clinical Technologists (RCT) scope of practice. Coupled with new standardised national plans and pro-forma portfolios (2023) documenting: knowledge, skills and experience. Candidates practice is examined in-situ via external examiners and a final viva is performed. PSC have been working with Higher Education Institutes (HEI) to gain academic recognition for the IPEM Diploma. Resulting in a training programme that certifies skills and provides education satisfying relevant Education Career Frameworks (ECF). [5] This presentation will draw from experience of leading a national training scheme combined with evidence and reflection from current candidates. ***Results:*** The IPEM Diploma meets National Occupation Standards (NOS), relevant ECF and adapts to meet workforce needs through standardised national training plans and portfolios documenting candidate's knowledge and skill base. 2024 IPEM launched an innovative IV contrast online work-shop, giving training centres and candidates a framework to acquire the required knowledge and skill base. ***Conclusion:*** IPEM has successfully updated its training model; certifying Technologists skill base while meeting the educational requirements of the modern NM environment. It is an organised national collegial network of expertise with innovative resources in training and assessment. It could serve as a model for European wide standardisation of education, training and certification of Clinical Technologists. ***References:*** Marc Griffiths (2015) "Creating the Hybrid Workforce: Challenges and Opportunities" Journal of Medical Imaging and Radiation Sciences, 2-15-09-01, Volume 46, Issue 3, Pages 262-272; Society of Radiographers (2016) Computerised Tomography (CT) scanners in Nuclear Medicine facilities; use by nuclear medicine practitioners from both radiographic and technologist backgrounds; Marcel and Owers, E.C. (2023). Hybrid training in nuclear medicine: where are we going to? European Journal of Nuclear Medicine and Molecular Imaging, 50(8), pp.2231-2235. doi:https://doi.org/10.1007/s00259-023-06223-2; Institute of Physics and Engineering in Medicine: IPEM (2021). IPEM Diploma in Clinical Technology (Nuclear Medicine) Scope of Practice: Updated Curriculum 2021. [online] Available at: https://www.ipem.ac.unitedkingdom/media/pdghtxsz/nuclear-medicine-updated-curriculum.pdf [Accessed 2 Apr. 2024]; Education and Career Framework for the Radiography Workforce (4th Ed) The Society of Radiographers.

TEPS-020

Assessment of Somatostatin Receptor Expression in Normal Prostate Tissue: Insights from ^{68}Ga-DOTANOC PET/CT Imaging

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Aim/Introduction: Prostate gland physiological uptake is documented in 68Ga-DOTANOC PET/CT studies. This study pretends to characterize somatostatin receptor expression in normal prostate gland by calculating its maximum and mean standardized uptake value (SUVmax and SUVmean) as well as prostate/liver and prostate/mediastinum ratios using 68Ga-DOTANOC PET/CT. ***Materials and Methods:*** A prospective study was performed with 48 men (60.18±17.06 yrs; 26 - 85 yrs) who underwent a 68Ga-DOTANOC PET/CT for NET assessment. Oncological prostate disease and octreotide interference were excluded. Qualitative 3-point visual score was performed to compare normal prostate (P) to mediastinum (M) and liver (L) uptake (0≤mediastinum; 1≤liver; 2>liver). SUVmax and SUVmean were measured and SUVmax P/L, SUVmean P/L, SUVmax P/M and SUVmean P/M ratios were also calculated. Prostate volume was estimated based on CT measures to create subgroup 1 with normal volumes (<30cc) and subgroup 2 with enlarged volumes (≥30cc). Statistical analysis was performed (ANOVA and Pearson Correlation) using SPSS25®. ***Results:*** Visual score demonstrated a weak correlation with SUVmax P/L (R2=0.231 p=0.000) and with SUVmax P/M (R2=0.296 p=0.046) and had no correlation with SUVmean P/L and SUVmean P/M. Mean 68Ga-DOTANOC SUVmax values in prostate were 6.12±1.95, in liver 7.56±2.36 and in the mediastinum 2.83±0.72 while mean SUVmean was 3.29±0.99; 4.26±1.44 and 1.09±0.19, respectively. Aging was related to an increase in prostate 68Ga-DOTANOC uptake, when considering SUVmax (Pearson's correlation 0.349 p=0.015), SUVmean (Pearson's 0.365 p=0.011), SUVmax P/L (p=0.001), SUVmean P/L (p=0.000) and SUVmax P/M (p=0.013). No correlation was observed with SUVmean P/M (p=0.083). Prostate enlargement was also related to an increase in 68Ga-DOTANOC uptake when considering all measured parameters (p<0.05). Subgroup 2 registered a 32.71% 68Ga-DOTANOC increase uptake for mean SUVmax and a 46.53%

increase for mean SUVmean when compared with subgroup 1. Between the ratios analyzed, SUVmax P/L seems the most robust measure to study normal prostate uptake (variance 0.077). ***Conclusion:*** Prostate physiological uptake in 68Ga-DOTANOC PET/CT is higher compared with the mediastinum and lower than the liver. Moreover, it appears to increase with age and prostate volume. SUVmax and SUVmean P/M and P/L ratios tend to provide more valuable insights for assessing normal prostate behavior, particularly the SUVmax P/L ratio. Therefore, visual assessment alone should not replace semiquantitative parameters.

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Monday, October 21, 2024, 15:00 - 16:30
Hall Y1-Y3

TROP Session: Radiation Protection Committee: Radiation Protection in Diagnostic Imaging Procedures

OP-445

Revision of the ICRP reference dose coefficients in diagnostic nuclear medicine

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Aim/Introduction: The current reference dose coefficients for patients in diagnostic nuclear medicine published by ICRP [1] are still based on the dosimetric assumptions of the 1990 recommendations [2]. In the last year the ICRP Task Group (TG) 36 has been working on a revision of the dose coefficients for radiopharmaceuticals using the dosimetry methodology of the 2007 recommendations [3], including the new adult and paediatric reference voxel phantoms and updated nuclear decay data. ***Materials and Methods:*** The descriptive biokinetic models used in [1] were replaced by more physiologically based compartmental models. Recycling structures with a central exchange blood compartment were set up based on the available biodistribution data. For urinary bladder, a dynamic bladder model that allows to consider realistic voiding schemes, and changes in the urinary bladder volume and geometry due to filling and emptying was used. The Specific Absorbed Fractions (SAFs) calculated with the ICRP anthropomorphic adult and paediatric reference voxel phantoms were employed. For urinary bladder, the dynamic bladder model was used to calculate the volume-dependent SAFs. A computer code developed within the Task group was used as the reference benchmark and validated using three other available software codes for quality assurance purposes. ***Results:*** Compartmental models for about one hundred radiopharmaceuticals used in diagnostic nuclear models were developed and the corresponding dose coefficients calculated for reference patients of different age and sex,As far as reasonable, a harmonisation of biokinetic and dosimetric models with those developed for occupational and public exposures was sought. For some specific patient groups, for which the concept of effective dose cannot be applied, detriment-weighted dose coefficients were provided instead. The new report also includes revised recommendations in case of extravasation as well as on breastfeeding interruptions for lactating patients. The draft document was reviewed by the members of ICRP Committees 2 and 3. ***Conclusion:*** The revised document tabulates reference dose coefficients computed following the current state-of-the-art in internal dosimetry for diagnostic substances. After clearance from the Main Commission, the document will be released for public consulation to collect valuable comments from relevant stakeholders before its final publication. ***References:*** [1] ICRP Publication 128. Ann. ICRP 44(2S), 2015. [2] ICRP Publication 60. Ann. ICRP 21 (1-3), 1991. [3] ICRP Publication 103. Ann. ICRP 37 (2-4), 2007.

OP-446

Intensive care staff radiation exposure during [18F]FDG PET/CT procedures in critically ill patients

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Aim/Introduction: The accessibility of [18F]FDG PET/CT scans for critically ill patients has significantly improved with the introduction of long axial field of view PET/CT scanners. This leads to new diagnostic opportunities, and an increase of scans performed in ICU patients. Since these patients require constant monitoring and frequent care, maintaining a sufficient physical distance between the staff and the patient during [18F]FDG PET/CT procedure is challenging. For the procedure a strict scan protocol was developed including staff radiation safety based on the 'as low as reasonably achievable' principle. The objective of this study was to measure the radiation dose received by ICU staff during a [18F]FDG PET/CT procedure while using this protocol. ***Materials and Methods:*** Staff radiation dose was measured during all [18F] FDG PET/CT procedures performed within our center for 1.5 years. A procedure was defined as tracer administration at the ICU department, transport to the scan facility, and the remaining decay time of 4 hours (equalling 2 half-life times) after returning at the ICU. During the procedure staff were advised to limit patient contact and to stay at a reasonable distance from the patient. To facilitate this, a checklist was provided encompassing transport preparation and patient care. Procedures had to be evenly divided between colleagues, only necessary staff was allowed to participate. A electronic personal dosimeter (EPD) was provided to the participating nurse en physician to measure the received radiation doses. The EPD was carried ventral on top of the clothing at thoracic hight. The EPD was transferred between staff when shifts ended. Four hours after administration of [18F]FDG, readings were taken from the EPD. ***Results:*** In total 18 [18F]FDG PET/CT procedures were performed in 16 patients. Three procedures were excluded due to incorrect use of the EPD, resulting in 15 procedures in 13 patients. The mean (±SD) administered dose was 155 MBq [18F]FDG (±2 MBq/kg). The radiation dose received by nurses and physicians was respectively 15 µSv (SD± 7) and 8 µSv (SD± 4). For one physician the received dose was relatively high (20 µSv). This physician was present during the CT-scan as a precaution because of the presence of a cardiac assist device. The legal upper limit for additional radiation dose for ICU personnel in the Netherlands is 1 mSv. ***Conclusion:*** The received radiation dose for ICU nurses and physicians during a [18F]FDG PET/CT procedure was acceptable and well below recommended limits for hospital staff.

OP-447

Implementing Ultra-low-dose CT in Molecular Imaging: Impact of CT Artefacts on Attenuation-corrected SPECT and PET Reconstructions

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Aim/Introduction: Ultra-low-dose CT scans can be used for attenuation correction (AC) of PET and SPECT images but may exhibit artefacts with reduced Hounsfield Units (HU) around very dense structures, which may limit how low the CT exposure settings can be. Time-of-flight (TOF) PET is more robust to data inconsistencies, and PET timing resolution has been markedly improved in recent years. The aim of this study was to assess the impact of artefact-induced reduction in CT HU on signal intensity in SPECT and PET reconstructions made with CT-based AC. ***Materials and Methods:*** Cylindrical uniformity phantoms of water-equivalent density containing Tc-99m and Ge-68 were imaged using a SPECT-CT system and a PET-CT system with 214 ps timing resolution, respectively. High-density objects were placed either side of the phantom to induce CT beam hardening (BH) artefacts. One high-count PET/SPECT acquisition was made, along with three CT acquisitions at different exposure settings generating different BH severities, and PET/SPECT reconstructions made using each of their three respective CT reconstructions for AC. At each CT exposure setting, absolute difference in CT HU was measured between BH-affected and unaffected regions of the phantom and plotted against the corresponding percentage differences in measured PET/SPECT activity concentration. Linear fits were applied to establish the relationship between the artefact's absolute difference in CT HU (x) and percentage difference in SPECT, TOF PET and non-TOF PET signal intensity (y). ***Results:*** Non-TOF PET reconstruction was most impacted by artefact-induced reduction in CT HU (y=0.069x+2.04), followed by SPECT (y=0.052x+2.26), whilst TOF PET was least affected (y=0.009x+0.52). Thus, with artefactual reduction of 200 HU, signal intensities would be reduced by 1%, 8% and 12% for TOF PET, SPECT and non-TOF PET respectively. If a limit of ≤2% effect on PET or SPECT signal intensity were demanded with ultra-low-dose CT for AC, artefacts with reduction of just ≤60 and ≤80 HU could be tolerated for non-TOF PET and SPECT respectively, whilst a ≤285HU reduction can be tolerated for TOF PET with state-of-art timing performance. ***Conclusion:*** TOF PET AC reconstruction is most robust to CT artefacts, followed by SPECT and non-TOF PET. Hence, exposure settings and thus radiation dose for CTAC could potentially be more greatly reduced for TOF PET, as compared with SPECT and non-TOF PET. This study allows determination of how much difference in CT HU can be tolerated for a given percentage difference in PET or SPECT signal intensity.

OP-448

Harmonizing $CTDI_{vol}$ Values of Auxiliary CT for Lung Perfusion (^{99m}Tc-MAA) Scintigraphy: Validation of a Phantom-Based Scaling Method to Adjust Patient Data between CT Protocols

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Aim/Introduction: Current nuclear medicine guidelines for lung perfusion scintigraphy provide limited information on the acquisition parameters for auxiliary CT as it is typically acquired for attenuation correction in SPECT/CT [1, 2]. The publication of national diagnostic reference levels (NDRLs) for auxiliary CT in SPECT/CT lung studies (CTDIvol of 2.9mGy in Nordic countries [3] and 2.0mGy in Germany [4]) shows the readiness for optimization. This study proposes a scaling method to identify optimal combinations of kilovoltage (kVp) and quality reference mAs (QRM) for lung auxiliary CT scans, with the aim of achieving compliance with NDRLs. ***Materials and Methods:*** An anthropomorphic thoracic phantom (ATP) equipped with lung inserts, a removable soft tissue layer, and removable arms was scanned using a (SPECT/)CT system. CTDIvol was measured over four phantom geometries at 110kVp with QRMs of 20, 25, 30, and 35mAs: ATP, ATP plus soft tissue layer, ATP plus arms, and ATP with soft tissue layer and arms. Water equivalent diameters for each geometry were calculated using 35mAs images. Linear relationships between water equivalent diameter and CTDIvol were calculated for each QRM. For validation, the water equivalent diameter was calculated for 2 groups of 21 patients each acquired with different clinical protocols: Protocol1 (110kVp, 35mAs) and Protocol2 (110kVp, 25mAs). CTDIvol values from Protocol1 were rescaled to match the (110kVp, 25mAs) setting based on the scaling factor from the phantom studies. In addition, CTDIvol from both patient groups were scaled to the same imaging parameters (110kVp, 20mAs) for further comparison with published NDRLs. The third quartile of CTDIvol was calculated for all patient data (real and scaled). ***Results:*** Statistical comparison between Protocol1, rescaled to (110kVp, 25mAs), and Protocol2 (110kVp and 25mAs) showed no statistically significant difference between the datasets (p-value = 0.56). CTDIvol third quartiles were 3.5mGy for rescaled Protocol1 and 3.1mGy for Protocol2. When both protocols were rescaled to the same imaging parameters (110kVp, 20mAs), there was also no statistically significant difference (p-value = 0.54). CTDIvol third quartiles for Protocol1 and Protocol2 under these conditions were 2.7mGy and 2.5mGy, respectively. ***Conclusion:*** This study provides a method for identifying the optimal combination of kilovoltage (kVp) and quality reference mAs (QRM) for lung auxiliary CT used for attenuation correction to harmonize the CTDIvol third quartiles for compliance with NDRLs. ***References:*** [1] Bajc M., et al. EJNMMI. 2019. [2] Parker A., et al. JNucMedTechnol. 2012. [3] Bebbington N., et al. EJNMMIPhysics. 2019. [4] Giussani A. Bundesamt-für-Strahlenschutz. 2021.

OP-449

Optimization of Iterative Reconstruction Safire CT protocol to reduce patient's effective dose in PET/CT studies

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Aim/Introduction: To implement the use of the Safire CT Iterative Reconstruction (IR) protocol, available on our PET/CT tomograph, instead of the standard filtered backprojection (FBP) reconstruction, in order to reduce the CT component's effective dose of the PET/CT scans, preserving both image quality and SUV accuracy, according to the principle of radiation protection optimization. ***Materials and Methods:*** a) Alderson-Rando anthropomorphic phantom was used to assess the CT image quality, using Safire IR protocol at level 3 with five decreasing values of the modulation parameter CareDose4D Quality-ref-mAs (100, 80, 70, 60 and 50 mAs, respectively); b) the NEMA IQ PET phantom (equipped with 6 hot spheres with ^{18}F-FDG at a nominal contrast

of 8:1) was used to evaluate the SUV reproducibility and accuracy with the progressively reduced CT dose; c) clinical evaluation on 25 PET/CT scans using the optimized safire CT protocol was performed by comparing whole body PET/CT with standard CT FBP reconstruction, with additional late segmental PET/CT acquisition with the optimized iterative Safire protocol and dose reduced of 30%. ***Results:*** a) applying the Safire level 3 IR protocol on the anthropomorphic phantom, a CT dose reduction between 20% and 40% didn't worsen the image quality in any anatomical district; b) comparing Safire IR vs FBP standard protocols on NEMA IQ phantom with five decreased CT doses, SUV values didn't show significant variation (deviations <0.4%); c) nuclear medicine physician clinical evaluation showed in all patients the non-inferiority of PET/CT image quality with 30% CT dose reduction and Safire level 3 IR protocol compared to the standard CT full dose with FBP reconstruction. By the means of this new reconstruction protocol the average total effective dose to the patient in a whole body PET/CT scan would be reduced from 10.8 to 8.8 mSv (-18%). ***Conclusion:*** the use of the Safire IR Protocol at level 3 in whole body PET/CT studies allowed an overall reduction of patient's effective dose of about 2 mSv, without any worsening neither of the image nor in the SUV accuracy calculation.

OP-450

CT Radiation Dose Reduction with Tin Filter for PET-CT Quantitative Analysis in a Whole-body Patient Phantom for Bone, Lung and Soft Tissue

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Aim/Introduction: A CT tin filter has demonstrated large radiation dose reductions in some standalone CT examinations providing diagnostic image quality without contrast media. PET-CT on the other hand, often uses 'low-dose' CT exposure settings for lesion localisation and/or characterisation, where a higher noise level is tolerated. Hence, different relative dose reductions with tin filter may be appropriate for localisation/characterisation level CT. The aim was to determine how much CT dose reduction is afforded by the tin filter for comparable image quality to using standard filtration in localisation/characterisation level CT, determined by quantitative image quality analysis. ***Materials and Methods:*** A whole-body CT phantom was scanned in standard and obese configurations. Scans were made with tube current modulation, with two sets of exposure settings without tin filter, representing standard practice for localisation/characterisation CT (120kV/20mAs-ref, 120kV/40mAs-ref), and with a range of mAs settings with tin filter applied at Sn100kV (25, 50, 100, 150, 200, 250, 300, 350 and 400mAs-ref) and Sn140kV (7, 12, 25, 50 and 100mAs-ref). Regions of interest (ROIs) were drawn in uniform areas of the brain, lung, bone, liver, kidney and fat. Mean and standard deviation HU were recorded, together with dose length product (DLP). Contrast-to-noise-ratio (CNR) of brain, lung, bone, liver and kidney ROIs were calculated relative to fat. Plots of DLP versus CNR were generated for each tissue, and linear regressions applied to Sn100kV and Sn140kV datapoints. These were used to calculate the percentage dose reduction with tin filter for equivalent CNR to standard filtration scans. ***Results:*** The dose reduction afforded by the tin filter for comparable CNR was dependent on tube voltage, tissue, phantom configuration, and exposure settings of the non-tin filter reference dataset. Using Sn100kV afforded dose reductions in all conditions, whilst Sn140kV only provided dose reduction in the lung compared with the 120kV/40mAs-ref standard filtration reference. Dose savings with Sn100kV ranged from 8-43% in brain, 27-51% in lung, 50-76% in bone, 36-61% in liver and 32-52% in kidney. ***Conclusion:*** These findings suggest that large CT dose reductions can be afforded by the tin filter using Sn100kV, for comparable image quality to CT without tin filter, in bone, lung and soft tissues, relevant to a wide range of PET-CT examinations. The marked CT dose reductions for bone imaging could help justify transition to whole-body cross-sectional imaging from planar radionuclide scintigraphy where CT dose has previously been a limitation.

OP-451

An ultra-low dose CT protocol does not affect $^{[18F]}$FDG PET image quality

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Aim/Introduction: While CT is an integral part of PET/CT for anatomical mapping and attenuation correction, its use increases radiation exposure. The purpose of this clinical study was to evaluate PET image quality while reducing CT radiation doses by incorporating a tin filter1. ***Materials and Methods:*** Twenty-nine oncological patients undergoing follow-up were scanned with whole-body $^{[18F]}$FDG PET/CT, each receiving a low-dose (LD) CT with standard settings for clinical care and an experimental ultra-LD (ULD) CT employing a tin filter and reducing the tube current to 6 mAs. Multiple volumes of interest were delineated for five healthy tissues (brain, heart, lung, liver, and subcutaneous fat) and for confirmed lesions in 10 patients. Parameters such as standardized uptake value (SUV), coefficient of variation, and signal-to-noise ratio were assessed in healthy tissues. Lesions were assessed for SUVmean, SUVmax, and tumor-to-background ratio (TBR). Three nuclear medicine physicians independently rated PET images, reconstructed using both LD-CT and ULD-CT for attenuation correction, on a 5-point Likert scale, considering image noise, lesion margin demarcation, and overall image quality. Physicians independently evaluated the number and location of lesions in 10 patient datasets, while the images were randomly divided between two scoring rounds (three-week interval). Intra- and inter-observer variability were analyzed using the Two-Way Mixed-Effects Model and intraclass correlation coefficient (ICC). ***Results:*** ULD-CT resulted in a remarkable 97% reduction in CT-related radiation dose (0.059±0.03 mSv) compared with LD-CT (1.932±0.61 mSv). Across five different healthy tissues, SUVs exhibited minimal relative variances between both reconstructions. SUVmean, SUVmax, and TBR results underscored the negligible absolute disparities between the two attenuation-corrected image types. The 5-point Likert scale scores remained consistent across both cohorts. Evaluation of physician reports revealed an impressive level of agreement regarding lesion detection between both types of reconstructions (intra-observer ICC values: 0.85, 0.96, and 0.99) and good agreement regarding the inter-observer variability between physician reports (0.69 and 0.66 for LD-CT and ULD-CT attenuation corrected images, respectively). ***Conclusion:*** $^{[18F]}$FDG PET image quality and quantification remain unaffected when using a 33-fold lower-dose CT protocol in a long Axial field-of-view scanner. This means that in cases where anatomical detail is not critical, and PET imaging alone can provide sufficient diagnostic information, the radiation exposure can be further reduced using the proposed ULD-CT protocol. High intra-observer agreement in lesion detection supports the clinical viability of ULD-CT protocols based on the incorporation of a tin filter. ***References:*** 1. Mostafapour, S., et al., Medical Physics, 2024.

OP-452

Radiation protection considerations with [^{89}Zr]Zr-girentuximab PET/CT experience in France

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Aim/Introduction: The recent ZIRCON trial endorsed the use of [89Zr]Zr-girentuximab PET/CT imaging in patients with indeterminate renal masses suspect of clear cell renal cell carcinoma scheduled for partial or radical nephrectomy. 89Zr is emerging as a popular radionuclide for imaging; however, safety procedures for healthcare providers working with the radionuclide have not been well established. We took radiation dose rate measurements from the drug vial, syringe, and patients to aid in the assessment of the radiation risk and necessary control procedures. ***Materials and Methods:*** A ZIRCON trial site in France measured radiation dose rates from a vial and syringe containing 12 mL [89Zr]Zr-girentuximab with and without shielding . Radiation doses were measured at 1 metre from 28 patients enrolled in the ZIRCON trial on Day 0, Hour 1, Hour 2, and on the day of imaging, which ranged from 3-7 days with a median of 5 days. Radiation doses were also measured during surgery for the surgical assistant's hands, eyes, and whole body at 0.8 metres. ***Results:*** Radiation dose rates from a vial of [89Zr]Zr-girentuximab at 0 and 1 metre was 15.6 and 0.32 µSv/hr/MBq, respectively, with no shielding, and 4.2 and 0.05 µSv/hr/MBq, respectively, with shielding. A syringe containing [89Zr]Zr-girentuximab at 0 and 0.3 metre had a dose rate of 111.11 and 2.74 µSv/hr/MBq, respectively, with no shielding, and 11.28 and 1.79 µSv/hr/MBq, respectively, with shielding. The mean dose rate (SD) from patients enrolled in the ZIRCON trial was 11.7 (3.6) µSv/hr on Day 0, 10.0 (2.4) µSv/hr on Hour 1, 10.3 (3.4) µSv/hr on Hour 2, and 3.9 (1.2) µSv/hr on the day of imaging. Radiation doses were measured at a surgical assistant's hands, eyes, and whole body, which received 21, 3, and 5 µSv/hr, respectively. Surgery ranged from 5-89 days after infusion with mean 14.2 days and median 6 days after injection with patient surgery occurring 20.5±20.1 days (mean ± SD) after administration in the ZIRCON study. ***Conclusion:*** Our results demonstrate low radiation exposure levels associated with [89Zr]Zr-girentuximab administration, imaging, and subsequent surgery. Given the short delay observed between [89Zr]Zr-girentuximab administration and surgery, our on-site measurements represent the upper end of the range of expected dose to staff. With recent positive Phase 3 trial results and potential integration of [89Zr]Zr-girentuximab into clinical practice, appropriate radiation protection procedures are needed. Dose rate measurements such as those presented here can help guide development of best practices.

OP-453

Dose Rates and Patient Contact Restrictions Following Zirconium-89 (Zr89) Positron Emission Tomography (PET) Studies

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Aim/Introduction: Unlike short-lived radioisotopes (Fluorine-18, Gallium-68), Zirconium-89 is less often used in diagnostic PET. The longer half-life of Zr89 (78.4h) is ideal for imaging tissue pharmacokinetics of longer half-life biologicals but means longer radiation exposure to subject contacts , potentially necessitating subject contact time restrictions . However, data on contact radiation exposure from subjects receiving Zr89 is scanty. This ongoing study aims to clarify restrictions required to ensure radiation exposure remains within typical dose constraints. ***Materials and Methods:*** Following administration of 37MBq±20% of Zr89-Crefmirmilab-bedroxam (PRETZCEL study; NCT05744128) , dose rates were measured at 0.1m, 0.3m, 0.5m and 1m anteriorly and posteriorly at chest height for 6 patient studies (3 patients studied twice). Dose rates at 2m were estimated using the IAEA method [1]. Dose rates at 3m and 5m were estimated using the inverse square law. Effective doses were estimated based on contact patterns for adult partners and children living at home with the subject [2] and for babies [3], as described previously [4]. The time duration subjects were required to avoid contacts at distances of 1m or less to keep doses to 0.3mSv, 0.5mSv or 1mSv were calculated using the maximum encountered dose rate for each distance. ***Results:*** Maximum dose rates at 0.1m, 0.3m, 0.5m, 1m, 2m, 3m, and 5m were 67.5, 22.9, 12.9, 4.5, 1.6, 0.5, and 0.2 µSv/h, respectively. For a dose constraint of 0.3mSv, close contact restrictions of 88h, 56h, and 260h are needed for adults, children and babies respectively. For 0.5mSv the restriction times are 21h, 0h, and 202h. For 1mSv contact restrictions are only needed for babies (124 hours). ***Conclusion:*** Advice on contact with others should be provided to patients administered with Zr89. To comply with a 0.3mSv constraint, restrictions (<1m) are required for adults (88h), children (56h) and babies (260h). For 1mSv, contact restrictions are only needed for babies (124h). ***References:*** [1] IAEA, "Release of Patients After Radionuclide Therapy Safety Reports Series No. 63," 2009. [2] M. L. Bartlett, "Estimated dose from diagnostic nuclear medicine patients to people outside the nuclear medicine department," Radiation Protection Dosimetry, vol. 157, no. 1, pp. 44-52, 2013. [3] P. J. Mountford, "Radiation dose rates from adult patients undergoing nuclear medicine investigations," Nucl Med Commun, vol. 12, no. 9, pp. 767-777, 1991. [4] P. J. Mountford, "Estimation of close contact doses to young infants from surface dose rates on radioactive adults," Nucl Med Commun, vol. 8, pp. 857-863, 1987.

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Monday, October 21, 2024, 16:45 - 18:15
Hall 1

CME 8 - Oncology & Theranostics + Bone & Joint Committee - Locoregional Therapies in Nuclear Medicine

OP-454

Local intra-vascular therapy with nanoparticles

F. Nijsen;
Radboud university medical center, Nijmegen, NETHERLANDS.

OP-455

Cutaneous tumour therapy

P. Castelluci;
Azienda Ospedaliero-Universitaria di Bologna, Bologna, ITALY.

OP-456
Radiosynoviorthesis
K. Liepe;
Hospital Frankfurt (Oder), Frankfurt (Oder), GERMANY.

OP-457
RFA of thyroid nodules
A. Becherer;
Academic Teaching Hospital Feldkirch, Feldkirch, AUSTRIA.

1102

Monday, October 21, 2024, 16:45 - 18:15
Hall 4

Special Track 8 - Physics and Oncology & Theranostics Committee - Debate: Health Economics in Nuclear Medicine

OP-458
Point of View: Health Economics is essential for the sustainability of new Nuclear Medicine technologies
A. Barnes;
King's Technology Evaluation Centre, KCL, London, UNITED KINGDOM.

OP-459
Point of View: Health Economics stifles innovation and the rapid introduction of new Nuclear Medicine services
K. Muylle;
Nuclear Medicine, UZ Brussel, Brussels, BELGIUM.

1103

Monday, October 21, 2024, 16:45 - 18:15
Hall X9-X12

LIPS Session 8 - Radiation Protection Committee - What would you do if…? Radiation Protection Issues in Special Cases of Everyday Practices

OP-461
Extravasation of diagnostic and or therapeutic radiopharmaceutical
F. Mottaghy; *Department of Radiology and Nuclear Medicine, Maastricht University Medical Center, Department of Nuclear Medicine, University Hospital RWTH Aachen, and Center for Integrated Oncology Aachen Bonn Cologne Düsseldorf, Aachen, Maastricht, Aachen, Bonn, Cologne, Düsseldorf, NETHERLANDS, GERMANY.*

OP-462
Early Vomiting <10min after administration of 131I
J. Kurth;
Department of Nuclear Medicine, Rostock University Medical Centre, Rostock, GERMANY.

OP-463
Misadministration (extra-articularly) during radiosynoviorthesis (RSO)
K. Badiavas;
Papageorgiou General Hospital, Thessaloniki, GREECE.

OP-464a
Patient death during hospitalization for therapy.
U. Eberlein;
Universitätsklinikum Würzburg, Klinik und Poliklinik für Nuklearmedizin, Würzburg, GERMANY.

OP-464b
How to deal with cases of organ transplantation Experience with liver transplant after SIRT
L. Stegger;
University Hospital Münster, Department of Nuklearmedizin, Münster, GERMANY.

OP-464c
HemoDialysis of a patient during treatment
S. Leide Svegborn;
Lund University, Dept of Radiation Physics, Lund, SWEDEN.

OP-465
FAP Therapies: Mechanisms and Response
S. van Lith;
Radboud Universtity Medical Center, Nijmegen, NETHERLANDS.

1104

Monday, October 21, 2024,16:45 - 18:15
Hall X1-X4

M2M Track - Featured Session: Radiopharmaceutical Sciences + Translational Molecular Imaging & Therapy Committee: FAP Therapies: Mechanisms and Response

OP-465
FAP Therapies: Mechanisms and Response
S. van Lith;
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OP-466
How rapidly does the FAPI-PET signal reverse following therapy?
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Aim/Introduction: Reactive fibrosis is a complex response to a variety of chronic insults that contribute to the onset and progression of heart failure (HF). FAPI-PET has shown potential in differentiating active fibrosis from established fibrosis. Though anti-fibrotic therapies hold potential for enhancing left ventricular (LV) function in preclinical settings, their clinical translation is hindered by the absence of established non-invasive imaging methods for assessing fibrosis regression following treatment. We aimed to assess the potential of the FAPI-PET to determine

the speed of transition of active fibroblasts to a dormant state in response to therapy. ***Materials and Methods:*** Male C57BL/6 mice were implanted subcutaneously with Alzet mini-osmotic pumps (2006), infused with Ang-II/PE (Dose: 1.5/50 mg/kg/D) for up to 6 weeks, and scanned with 68Ga-FAPI-46 (480-500 pmol, 8-10 MBq) PET/CT longitudinally for up to 8 weeks. Mini-pumps in control animals were filled with saline. Structural and functional changes of LV was assessed by echocardiography. Tissue fibrosis was assessed through histological analysis, while FAP expression was evaluated using immunofluorescence staining. ***Results:*** Compared to control mice, a significant 68Ga-FAPI uptake in the myocardium peaked at W1 (0.06±0.01 %ID/g vs 0.23±0.08 %ID/g). An increase of 68Ga-FAPI uptake was also observed in the liver. Liver uptake peaked at W3 (0.84±0.12 %ID/g) and decreased significantly at W4 (0.18±0.16 %ID/g). Withdrawal of the Ang-II/PE at W1 and W2 resulted in PET signal decline to indiscernible level in the heart (from 0.23±0.08 %ID/g on Day 7 to 0.06±0.01 %ID/g on Day 10) and liver (from 0.77±0.27 %ID/g at W2 to 0.11±0.03 %ID/g at W3). Co-injection of mice with an excess of unlabeled FAPI (30 nmol/mouse) resulted in a 53±5% reduction in liver and heart uptake. Despite a significant increase in the thickness of the LV anterior and posterior walls at W1 (the peak of FAPI-PET signal in the myocardium), the ejection fraction (EF) remained stable (Base: 58±2 % vs W1: 50±5 %). ***Conclusion:*** Rapid reversibility of the PET signal after Ang-II/PE withdrawal demonstrated that 68Ga-FAPI can visualize dynamic changes in FAP expression and is suitable for rapid assessment of treatment response aimed at eliminating activated fibroblasts. Cardiac cirrhosis is a well-known complication of HF and FAPI may also be able to visualize the complications of HF. The cardiac FAPI signal emerges prior to functional alterations in the myocardium, suggesting that FAPI-PET could serve as a valuable tool for visualizing the initial phases of fibrosis in HF.

OP-467

[18F]AlF-NOTA-FAPI-04 PET/CT can predict treatment response and survival in patients esophageal squamous cell carcinoma treated with concurrent chemoradiotherapy.

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Aim/Introduction: The prospective study investigated whether uptake of [18F] AlF-NOTA-FAPI-04 on positron emission tomography/computed tomography (PET/CT) could predict short-term response and survival in patients with locally advanced esophageal squamous cell carcinoma (LA-ESCC). ***Materials and Methods:*** 33 patients with LA-ESCC who underwent baseline [18F] AlF-NOTA-FAPI-04 PET/CT before concurrent chemoradiotherapy (CCRT) were included in this study. The maximum, mean and peak standard uptake values (SUVmax, SUVmean and SUVpeak), FAPI -avid tumor volume, and total lesion FAP expression of the primary tumor were evaluated on PET images. Additionally, the SUVmax of the primary tumor and SUVmean of blood were measured, and their ratios were denoted as target-to-background ratios (TBRblood). Correlations between baseline PET parameters and clinical variables were assessed with Spearman's rank test. Receiver operating characteristic curve analysis was used to define the optimal cut-off value. Cox regression and Kaplan-Meier methods were used to examine associations between progression-free survival (PFS) and overall survival (OS) with baseline clinical/PET parameters. ***Results:*** Median follow-up time, PFS and OS were 30.23, 19.83 and 24.57 months, respectively. The SUVmax (P=0.010), TBRblood (P=0.040) were significantly higher in non-responders than in responders. In multivariate analysis, high baseline TBRblood on [18F] AlF-NOTA-FAPI-04 scans was associated with poor PFS (hazard ratio [HR]=1.096, 95%CI 1.017-1.181, P=0.016) and OS (HR=1.101, 95%CI 1.010-1.201, P=0.029). Kaplan-Meier analysis showed that the baseline TBRblood on [18F] AlF-NOTA-FAPI-04 scans can predict PFS (cut-off 11.60; P=0.009) and OS (cut-off 14.25, P=0.010). ***Conclusion:*** High baseline TBRblood on [18F] AlF-NOTA-FAPI-04 scans was associated with poor short-term response, PFS, and OS for CCRT treatment in LA-ESCC patient, which may help optimize their treatment.

OP-468

Predictive Value of ^{68}Ga-FAPI-04 Micro PET/CT Imaging in Abdominal Aortic Aneurysm Growth in Rats

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Aim/Introduction: In the pathogenesis of abdominal aortic aneurysm (AAA), fibroblast-like differentiation plays a dominant role expressing fibroblast activation protein (FAP) molecules. Utilizing 68Ga-FAPI-04 PET/CT imaging might unveil fibroblast activation in the arterial wall. This study aims to investigate whether FAP promotes AAA formation or merely coexists in AAA lesions. ***Materials and Methods:*** ApoE-/- mice aged 12 weeks were used to induce aortic aneurysm model by continuous subcutaneous infusion of AngII (1000 ng/kg/min) with Alzet (2004 model) sustained release pump for 28 days. There were 6 model mice and 6 normal control mice. 68Ga-FAPI-04 Micro PET imaging was performed on all the mice at different time periods (3, 7, 14, 28 days), and the diameter of abdominal aorta was measured by B-ultrasound. Anatomical ROI was plotted around the aortic region of the superior kidney, and TBR (Target-to-background ratio) PET parameters were obtained. The rank sum test was used to compare the TBR between the 28-day AAA group and the normal control group. Immunofluorescence staining was used to detect the expression and localization of FAP in the tissue sections of mice with abdominal aortic aneurysm. The protein level of FAP was detected by Western blot. ***Results:*** FAP upregulation was observed in AAA mice. Enhanced FAPI uptake preceded substantial aortic expansion. FAP-positive mice displayed aortic enlargement from day 3 of AngII infusion through days 7 to 28, contrasting with FAP-negative and control mice. The 28-day AAA group exhibited higher TBR compared to the control group (2.27±0.25 vs. 1.87±0.14, P<0.05). ***Conclusion:*** This study unveils FAP as a potential mediator and novel pathological characteristic of AAA, emphasizing the significant value of FAP changes in the abdominal aorta observed through PET/CT imaging for predicting the onset and progression of abdominal aortic aneurysm. ***References:*** Kosmala A, Serfling SE, Michalski K, et al. Molecular imaging of arterial fibroblast activation protein: association with calcified plaque burden and cardiovascular risk factors. Eur J Nucl Med Mol Imaging. 2023 Aug;50(10):3011-3021.

OP-469

Comprehensive Preclinical Evaluation of the dimeric FAP Inhibitor DOTAGA.Glu(FAPi)$_2$ labeled with gallium-68 and lutetium-177. Exploring its Potential for Theranostic Applications

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Aim/Introduction: The development of radiotheranostics targeting tumor stroma through Fibroblast Activation Protein (FAP) is a promising approach for diagnosis and treatment of various types of cancers. This study aims at evaluating the dimeric FAP inhibitor DOTAGA.Glu.(FAPi)2, labeled with gallium-68 and lutetium-177, with the potential to be used for theranostic applications of FAP-positive tumors. ***Materials and Methods:*** DOTAGA.Glu(FAPi)2 was labeled with gallium-68 and lutetium-177. Both [68Ga]Ga-DOTAGA.Glu(FAPi)2 and [177Lu]Lu-DOTAGA.Glu(FAPi)2 were evaluated in vitro (lipophilicity, protein binding, saturation, and internalization studies) on immortalized FAP+ CAFs. In vivo studies (PET/SPECT/CT imaging, metabolic stability, biodistribution, autoradiography) were performed on PC3 xenografts. ***Results:*** Both tracers were prepared in >98% radiochemical purity with molar activites of 17-22 MBq/nmol for [68Ga]Ga-DOTAGA.Glu(FAPi)2 and up to 30 MBq/nmol for [177Lu]Lu-DOTAGA.Glu(FAPi)2, exhibiting a hydrophilic profile with logDoctanol/PBS values of -2.9±0.1 and -3.0±0.1 respectively. About 9% of the activity was found to be bound to proteins after 30 min of incubation with human serum for both radiotracers. Their affinity for FAP was high, with Kd values of 0.7±0.1 and 0.9±0.3 nM. Both tracers were rapidly internalized, with a maximum of about 35% of the total cell associated activity being internalized. Metabolic studies 10 min after their injection to mice revealed only intact radiotracer in blood. Biodistribution studies for [68Ga]Ga-DOTAGA.Glu(FAPi)2 demonstrated a specific tumor uptake of 16.6±2.3 %IA/g at 1h p.i., preserved at a high level of 18.4±2.1 %IA/g at 3h p.i., while blood uptake maintained a low level of 3.2±0.5 and 2.5±0.1 %IA/g at 1 and 3h, respectively. In the case of [177Lu]Lu-DOTAGA.Glu(FAPi)2, the tumor uptake of 33±5% IA/g at 4h p.i. slowly decreased over time, reaching 10.4±0.2 IA/g and 4.4±0.3 %IA/g at 48 and 96 h p.i., respectively. The activity in blood decreased from 4.2±0.2 at 1h p.i to 0.4±0.1 and 0.1±0.01 % IA/g at 48 and 96 h p.i.. Both tracers exhibited high tumor-to-background ratios at all tested time points. These findings are well illustrated by PET/SPECT/CT imaging. In vivo autoradiography exposed the distribution and specificity of [177Lu]Lu-DOTAGA.Glu(FAPi)2 in PC3 xenografts across all examined time intervals. ***Conclusion:*** The favorable characteristics of [68Ga]Ga-DOTAGA.Glu(FAPi)2 as a PET probe for tumor stroma imaging, coupled with the therapeutic potential demonstrated by [177Lu]Lu-DOTAGA.Glu(FAPi)2, render these radiotracers a promising theranostic pair for targeting of FAP-positive tumors.

OP-470

Investigating the Efficacy and Mechanism of FAP-targeted Radioligand Therapy Combined with Immune Checkpoint Blockade: A Translational Study

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Aim/Introduction: Radiotherapy combined with immune checkpoint blockade holds great promise for synergistic antitumor efficacy. Targeted radionuclide therapy delivers radiation directly to tumor sites. LNC1004 is a fibroblast activation protein (FAP)-targeting vector conjugated with the albumin binder Evans Blue for enhanced tumor uptake and retention. Combining radionuclide-targeted therapy against pancancer targets with immunotherapy may be a promising treatment strategy for certain advanced tumors. Moreover, single-cell RNA-sequencing (scRNA-seq) technology offers a comprehensive view of cellular and molecular interactions at an unprecedented resolution. However, to date, no studies have reported the application of scRNA-seq in radionuclide-targeted or combined immunotherapies. ***Materials and Methods:*** We investigated the therapeutic efficacy of 177Lu-LNC1004 in combination with PD-L1 in a preclinical setting. We pioneered the use of scRNA-seq for analyzing the changes within the TME and elucidated the underlying mechanisms of action of this combination treatment. Additionally, we assessed the safety and efficacy of 177Lu- LNC1004 in a small cohort of patients (clinical trial: NCT05963386) with various cancer types and analyzed the abundance of immune cell types among peripheral blood mononuclear cells (PBMCs) pre- and posttreatment. ***Results:*** 177Lu-LNC1004 stimulation increased tumor PD-L1 expression both in vitro and in vivo. We further explored the antitumor efficacy of a combination treatment including anti-PD-L1 antibody and 177Lu-LNC1004 radioligand therapy. Combination therapy led to complete eradication of all tumors in MC38/NIH3T3-FAP mixed tumor xenografts, with mice showing 100 % tumor rejection upon rechallenge. The combination therapy reprogrammed the tumor microenvironment in mice to foster antitumor immunity by suppressing malignant progression and increasing cell-to-cell communication, CD8+ T-cell activation and expansion, M1 macrophage counts, antitumor activity of neutrophils, and TCR diversity. A preliminary clinical study demonstrated that 177Lu-LNC1004 was well-tolerated and effective in patients with refractory cancers, resulting in an increase in antigen processing and presentation juxtaposed with T-cell inactivation. ***Conclusion:*** In conclusion, our preclinical data suggested that 177Lu-LNC1004 can amplify the antitumor efficacy of ICB. Furthermore, preliminary clinical data indicated that 177Lu-LNC1004 is a safe and well-tolerated therapeutic regimen with encouraging antitumor activity. Our data foster further exploration of the synergy between 177Lu-LNC1004 and immunotherapy in patients with advanced and refractory disease, particularly in those with FAP-positive tumors.

OP-471

Feasibility of [68Ga]DATA.SA.FAPi-PET/MRI for locoregional staging in bladder cancer: preliminary results of prospective, comparative study

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Aim/Introduction: Fibroblast activation protein (FAP) targeting cancer-associated fibroblasts is frequently overexpressed in various tumor types. This study aimed to compare the diagnostic accuracy of [68Ga]DATA.SA.FAPi PET/MR and $^{[18F]}$-FDG PET/CT imaging in predicting locoregional tumor stages in patients with muscle-invasive bladder cancer (MIBC). ***Materials and Methods:*** In this prospective, comparative study, MIBC patients planned for radical cystectomy (RC) with or without prior neoadjuvant chemotherapy (NAC) were enrolled. Prior to RC, patients underwent [68Ga] DATA.SA.FAPi-PET/MRI and $^{[18F]}$-FDG-PET/CT. Patients receiving NAC underwent [68Ga]DATA.SA.FAPi-PET/MRI and $^{[18F]}$-FDG-PET/

CT before and after treatment with chemotherapy, mainly with Gemcitabin und Cisplatin. The primary outcome of interest was the diagnostic accuracy of [68Ga]DATA.SA.FAPi-PET/MRI (mean time PET-RC (days) - 28.7 (± 25.3)) and [18F]-FDG-PET/CT (mean time PET-RC (days) - 20.61 (± 20.20)) for local and nodal staging in MIBC patients with pathology results serving as the reference test. ***Results:*** Nineteen MIBC patients (67.26 (± 11.91) years, 74% male) were included, with 42% (8/19) receiving NAC. Sensitivity and specificity for [18F]-FDG PET/CT and [68Ga]DATA.SA.FAPi-PET/MRI in histologically positive primary tumors were identical with 58.3% and 71.4%, respectively. For the prediction of histologically positive lymph nodes, [18F]-FDG PET/CT exhibited superior performance with a sensitivity, specificity, PPV and NPV of 75.0%, 100%, 100% and 90.9% versus 50.0%, 90.0%, 66.7% and 81.8%, respectively, for [68Ga]DATA.SA.FAPi-PET/MRI. ***Conclusion:*** Preliminary findings suggest inferiority of diagnostic accuracy of [68Ga]DATA.SA.FAPi-PET/MRI compared to [18F]-FDG PET/CT. While the detection of cancer lesions in the bladder wall was similar for both modalities, [18F]-FDG-PET/CT showed better results for lymph node staging compared to [68Ga]DATA.SA.FAPi-PET/MRI.

OP-473

Preclinical evaluation and first-in-human imaging of [203/212Pb]Pb-PSV359, a novel cyclic peptide targeting fibroblast activation protein-alpha (FAP)

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Aim/Introduction: Alpha particle radionuclide therapy for cancer is a promising treatment that delivers alpha radiation specifically to tumor sites. Lead-212 (212Pb; alpha-particle therapy; half-life 11 h) and 203Pb (SPECT imaging; half-life 52 h) are an elementally identical isotope pair for image-guided targeted-alpha-particle therapy. Fibroblast activation protein-alpha (FAP) is overexpressed in a variety of cancers making it a favorable target for radiopharmaceuticals. High-throughput screening of approximately 3 billion amino acid sequences and affinity maturation identified PSV359, a cyclic peptide targeting FAP. This study details the in vitro and in vivo evaluation and first-in-human SPECT/CT imaging of [203Pb]Pb-PSV359. ***Materials and Methods:*** Radiolabeling was accomplished using in-house protocols. Surface plasmon resonance (SPR) and enzyme inhibition assays determined binding specificity and affinity. In vivo biodistribution (n=3), planar imaging (n=2), and efficacy studies (n=9-10) were carried out using female athymic nude mice bearing either HT1080-hFAP or U87MG xenografts. Fractionated dosing (5-7 MBq [212Pb]Pb-PSV359) was chosen for efficacy studies. For first-in-human imaging, three patients with FAP expressing cancers received 259-266 MBq [203Pb]Pb-PSV359, and SPECT/CT images were acquired at 1, 4, and 18h post venous administration. ***Results:*** PSV359 exhibits strong binding affinity (Kd=1.8 nM, Ki=0.4 nM) and selectivity for hFAP. Preclinical biodistribution and imaging studies revealed strong tumor uptake of PSV359 with fast renal clearance and low background in off-target tissues. In the HT1080-FAP model (in which FAP is expressed on the cancer cells), the tumor uptake was 20% ID/g at 1.5 h, and 14% ID/g at 24 h. For the U87MG model, which is expected to express mFAP in the mouse stroma and a low level of hFAP on the cancer cells, high tumor uptake was observed (2 h: 11% ID/g, 6 h: 15% ID/g). 100% survival and 80% tumor remission were observed in the treated cohort during a 90-day therapy study in HT1080-hFAP bearing nude mice. A 60-day efficacy study with U87MG bearing nude mice revealed an 89% survival rate. First-in-human SPECT/CT images of [203Pb]Pb-PSV359 were performed in three patients with FAP expressing cancers (chrondoblastic osteosarcoma, neuroendocrine, and lung adenocarcinoma). Strong tumor uptake, fast clearance through the renal system, low accumulation in normal organs, and long tumor retention were observed in all three patients. ***Conclusion:*** A novel radiopharmaceutical targeting FAP, PSV359, exhibits superior binding affinity, binding specificity, and in vivo tumor targeting in preclinical and clinical settings. Strong anti-tumor efficacy of [212Pb]Pb-PSV359 was found in both HT1080-hFAP and U87MG xenograft models.

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Monday, October 21, 2024,16:45 - 18:15
Hall Y4-Y9

Cutting Edge Science Track - TROP Session: Physics Committee: Data Analysis: Onco

OP-474

PSMA PET/CT radiomics: Assessment of Adverse Pathological Risk and Proteomic Biomarker Correlations in Prostate Cancer

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Aim/Introduction: Prostate cancer (PCa) is a highly heterogeneous malignant disease, making it essential to explore markers that can aid in the early detection of adverse pathological characteristics of PCa and ultimately enhance patient prognosis. In this study, we utilized radiomics machine learning models to predict the aggressiveness of PCa, pinpoint quantitative radiomic features, and discover protein biomarkers linked to unfavorable pathological traits. The objective of the study was to build a multi-omics marker model to refine clinical risk stratification. ***Materials and Methods:*** This was a retrospective study on 191 patients who were diagnosed with PCa or benign prostatic hyperplasia (BPH) and were pathologically confirmed after undergoing 68Ga-PSMA-617 PET/CT scan. CT imaging was utilized for anatomical localization, while PET/CT scans were employed for image fusion and manual contouring of the prostate gland was performed. Radiomic features were then extracted from the contours to analyze the imaging characteristics. Six machine learning algorithms were applied to construct radiomics models for predicting malignancies and combinations of adverse pathological features (Gleason score (GS), ISUP group, pathological stage (pT), lymph node infiltration (LNI), and perineural invasion (PNI). Two methods, minimum redundancy maximum relevance (mRMR) and LASSO, were utilized conduct feature selection and identify quantitative radiomic features with high predictive ability. Moreover, proteomics analyses were performed on 39 patients to identify protein biomarkers associated with adverse pathological features at the molecular level in PCa. Correlation analysis was performed to determine the association of quantitative radiomic features with protein biomarkers. ***Results:*** The optimal radiomics model constructed using machine learning methods showed an area under the curve (AUC) of 0.938 (95% CI: 0.893 to 0.983) for

predicting malignant prostate lesions and an AUC of 0.916 (95% CI: 0.854 to 0.977) for adverse pathological feature combinations in the test set. Results of the validation set obtained AUC values of 0.918 (95% CI: 0.848 to 0.989) for predicting malignancy and 0.855 (95% CI: 0.728 to 0.983) for adverse feature combinations. Three quantitative radiomic features and ten protein molecules associated with adverse pathological characteristics were identified. Moreover, a significant correlation was observed between quantitative radiomic features and protein biomarkers. The radioproteomic analysis demonstrated that molecular changes in protein molecules could affect the imaging biomarkers. ***Conclusion:*** The machine learning models constructed based on 68Ga-PSMA-617 PET/CT radiomic features demonstrated strong performance in stratifying patients.This can aid in clinical risk stratification and reveal significant connections between quantitative radiomic characteristics and protein biomarkers.

OP-475

Can PET Quantitative Differences Between ^{18}F And ^{68}Ga PSMA Suspected Prostate Cancer Patients Impact On Clinical Trial Therapy Cohort Selection?

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Aim/Introduction: We characterize SUV using various lesion and liver normalizations, tumour/liver background (T/B), lesion metabolic volume estimates (MTV and TLG) and %COV between [18F]F-PSMA-1007 and [68Ga]Ga-PSMA-11 tracers in suspected prostate cancer patients. We discuss how this influences decision making in clinical trials where parameters like T/B thresholds are used to select patients for therapy e.g. VISION study. This study can help validate a framework for centrally commissioned funding and approval of suitable PET PSMA imaging agents nationally. ***Materials and Methods:*** 61 68Ga and 72 18F different PSMA subjects were PET-CT scanned using clinical protocols and analyzed as 2 separate radiopharmaceutical imaging cohorts. Each group consisted of 200 suspected lesions including metastatic disease identified and reported by experienced radiologists. Lesion and liver SUV were normalized to weight as standard, lean body mass (lbm) and body surface area (bsa) for comparison while vendor software was used to estimate MTV and TLG. Data were analyzed by medical physicists with >20 years PET experience each. ***Results:*** Sig differences were recorded between 68Ga and 18F PSMA for: Lesion SUVmax ($p = 0.0004$), SUVpeak ($p = 0.0017$) and SUVmean ($p = 0.0007$), SUVlbm ($p = 0.0002$) and SUVbsa ($p = 0.0005$) with higher mean and median 68Ga PSMA values. Liver SUVmax ($p < 0.0001$), SUVpeak ($p < 0.0001$) and SUVmean ($p < 0.0001$) with higher mean and median 18F PSMA values. T/B ratio ($p<0.0001$) with higher median and lower mean 68Ga PSMA values. % COV showed greater variability for 68Ga PSMA in all lesion SUV, liver SUVmean and T/B. Greater variability was seen for 18F PSMA in other liver SUV, MTV and TLG volume estimations. ***Conclusion:*** Significant differences with some arising from biodistribution effects in prostate cancer were seen between [18F]F-PSMA-1007 and [68Ga]Ga-PSMA-11 PSMA PET imaging parameters e.g. lesion SUV, liver SUV, %COV, T/B and TLG. Caution is required when using different radiopharmaceuticals as significantly higher T/B seen in 68Ga PSMA may not be suitable for 18F PSMA as a discriminator for patient therapy selection in clinical trials like the VISION study. Results presented further increase knowledge with caveats when using multiple radiopharmaceuticals and support potential for regulatory approval/commissioning of current and new imaging agents in prostate cancer imaging. ***References:*** Cook GJR, Wong WL, Sanghera B, et al. Eligibility for 177Lu-PSMA Therapy Depends on the Choice of Companion Diagnostic Tracer: A Comparison of 68Ga-PSMA-11 and 99mTc-MIP-1404 in Metastatic Castration-Resistant Prostate Cancer. J Nucl Med. 2023 Feb;64(2):227-23

OP-476

Identifying corresponding lesions in longitudinal PET/CT scans using a hierarchical descriptor and adaptive overlap framework

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Aim/Introduction: Interpretation of PET/CT images to assess oncological disease progression or therapy response routinely involves comparing a current scan with one or more prior scans. In cases with multiple metastases it is impractical to manually quantify individual lesion changes over time. This study aims to develop an automated framework to identify corresponding lesions in longitudinal PET/CT studies. ***Materials and Methods:*** Under an approved IRB, 18F-FDG data was collected from 30 patients diagnosed with different types of cancer and scanned on multiple PET/CT systems. Each patient underwent imaging at least twice (min=2, max=12, avg=4.3). Linking was performed between each two consecutive timepoints, resulting in 61 scan pairs and a total of 915 lesions. These lesions were segmented from the PET images and mapped across consecutive timepoints by a nuclear medicine physician. The lesion linking framework comprises two main steps: (1) Fast point matching is applied on the CT images to efficiently map lesion centroids across time points. (2) An adaptive overlap algorithm is employed, commencing from the mapped centroid and searching for the corresponding lesion label for each voxel within an adaptive search space at another time point. This search space evolves spherically until a maximum predefined diameter is reached or a lesion label is found based on overlapping voxels. The linking framework handles disappearing, one-to-one, splitting, merging, and new lesions. Classification accuracy was used to evaluate the matching scenario for each lesion. True positives, false positives, false negatives, precision, recall, and F1-score were utilized to assess the linkage between each pair of lesions. ***Results:*** Setting the tuning hyperparameters to 5mm search radius and 15% minimum overlap for establishing correspondence between lesions, the accuracy of the lesion classification for the disappearing, one-to-one, splitting, merging, and new lesions are as follows: 99.6%(278/279), 96.9%(281/290), 100%(7/7), 100%(4/4), and 99.4%(333/335), respectively. For linking evaluation, the number of true positives, false positives and false negatives was 158, 5 and 1, respectively, and the precision, recall and F1-score was 96.9%, 99.4% and 98.1%, respectively. A single linking correction is thus only required once every 10 scan pairs for this cohort. ***Conclusion:*** This work presents a method to achieve fast and highly accurate linking of corresponding lesions across time, elegantly handling complex mappings (splitting, merging, etc.) and eliminating the need for a computationally demanding image registration step. This approach facilitates longitudinal quantification at the lesion level, which could potentially be used for more precise patient management.

OP-477

Automatic diagnosis of obstruction in Tc99m-EC renal scanning by aid of deep learning

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Aim/Introduction: Deep learning, a subset of artificial intelligence (1), has emerged as a powerful tool in various fields of medicine (2,3). In the context of renal disease, accurate diagnosis of complications associated with hydronephrosis is crucial for timely intervention and improved patient outcomes. This research endeavor aims to develop and apply a deep learning algorithm to detect obstructive processes and differentiate them from non-obstructive diseases in Tc-99m ethylene dicysteine (EC) scans. By leveraging the power of deep learning, early detection of these complications could be achieved, leading to more effective and prompt treatment strategies for patients. ***Materials and Methods:*** Participating in this research were 317 patients who had undergone EC renal scans (173 patients with abnormality). Image acquisition was performed after administering 4 to 7 mCi of Tc-99m EC intravenously gamma camera in two phases. The image had a matrix dimension of 128 x 128. Flow phase data was collected for one minute (60 frames), while second phase data was collected for thirty to sixty minutes (thirty to sixty frames). Figure 1 shows example of a normal and abnormal patients. To standardize and normalize each phase for individual patients, we scaled them to their maximum values across all frames. Following this, 60 frames were added to the uptake phase, and the flow and uptake phases were concatenated to create a single 120-frame frame. The patients were divided into two distinct groups including training (75%), and test (25%). Fifteen percent of the training dataset was selected for validation. The InceptionResNet model was utilized for backbone of deep learning. We implemented two 128 dense layers and sigmoid dense layer for final layer. For model training, 2 batch size and 300 epochs were utilized. As performance metrics, the area under the curve (AUC), recall, f1 score, precision, and accuracy were utilized to assess the model's performance on the test data. ***Results:*** The accuracy and AUC were 0.67 and 0.69 for the InceptionResNet model. Using InceptionResNet, recall (0.58 and 0.66), precision (0.58and 0.66), and f1-score (0.58 and 0.66) were resulted for obstructive and normal patterns, respectively (Figure 2). ***Conclusion:*** The findings of this inquiry suggest that deep learning models may have utility in identifying and diagnosing irregularities occurring in renal abnormalities. Nevertheless, it is feasible to attain superior outcomes through the implementation of alternative filtering, using other artificial intelligence algorithms, and augmenting the data set.

OP-478

Use of Peptide Receptor Radionuclide Therapy in Neuroendocrine Tumour Patients in Germany - A Retrospective Evaluation Based on Chart Review Data

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Aim/Introduction: Gastroenteropancreatic neuroendocrine tumours (GEP-NET) are a rare disease with an incidence of approximately 1.33-4.76/100.000 patients per year in Europe. A current treatment option - which is recommended by various clinical guidelines - is the peptide receptor radionuclide therapy (PRRT). PRRT is available as Lutetium (177Lu) radiolabeled somatostatin analogues manufactured on a per-patient basis by hospitals (locally compounded preparation, LCP) but also as EMA approved product, both targeting non-resectable or metastatic, progressive, well differentiated somatostatin receptor-positive (G1, G2) GEP-NETs in adults. Currently, only limited data are available on the use of PRRT regarding patient population and treatment pattern in routine care in Germany. This study therefore addressed this information gap by analysing data of patients being treated with both LCP (177Lu-DOTATATE/DOTATOC) and the approved product (177Lu-oxodotreotide). ***Materials and Methods:*** This non-interventional study was conducted via a retrospective chart review using patient data from 7 participating medical centres. Data of adult GEP-NET patients in Germany receiving their first cycle of primary PRRT between 01st July 2020 and 30th June 2021 were included. The analyses focused on patient characteristics, medical history and treatment patterns. Clinical outcomes were assessed descriptively. ***Results:*** In total, data of 117 patients fulfilling all criteria were included in the analysis set. The majority of the patients were male (60.7%) and aged between 51-75 years (72.6%) with a progressive tumour (87.2%). The patients mainly received PRRT as second line therapy (77.8%). Mean time from initial diagnosis to initiation of primary PRRT was approximately 4 years. Administration of PRRT (dosage, treatment interval, co-medication) mostly corresponded to guideline and treatment recommendations. Among the study population, 45 patients (38.5%) received LCP, 63 (53.8%) were treated with the approved product and 9 (7.7%) switched substance within the PRRT cycles. No clinically relevant differences were observed between the PRRT alternatives regarding clinical outcomes. Also, both therapies were well tolerated, corresponding to established safety profile. Three months after completion of last PRRT, the disease control rate (DCR) was 74.6%. ***Conclusion:*** The results of the study indicate that PRRT is used in accordance with guideline recommendations regarding target population and administration. The results support the relevance of PRRT in treating GEP-NET patients with high DCR and good tolerability. This real world data as well as upcoming new comparative data on efficacy and safety (NETTER-2) might lead to PRRT becoming an integral part of treatment.

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Deep Learning-Based Acceleration of Monte Carlo-Based Dosimetry at Voxel Level

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Aim/Introduction: High time and computational effort, among other things, currently prevent the application of patient-specific Monte Carlo (MC) simulations for estimating absorbed doses in radiopharmaceutical therapies. In this study, we propose a new method to reduce the number of simulated nuclear transformations required in MC-based voxel-level dosimetry. This

is achieved by a u-shaped convolutional neural network (u-net) that transforms fast simulated, low-statistic dose-rate images into high-statistic dose-rate images. ***Materials and Methods:*** The dataset consisted of 220 SPECT/CTs obtained from 87 patients one day after receiving [177Lu]Lu-PSMA-I&T therapy at our hospital. Imaging was performed on one clinical SPECT/CT system (quantitative OSCGM reconstruction, matrix size: 256×256, voxel size: 1.95mm). Dose-rate maps were obtained using the DoseActor scoring tool of the GATE MC simulation toolkit (version 9.3 [1], based on Geant4 version 11.1.0). Simulations of 2·109 nuclear transformations were defined as ground-truth dose-rate maps. Four lower-statistic dose-rate maps were simulated using fewer nuclear transformations (1.4·106/5.2·106/1.0·107/5.0·107) , corresponding to accelerations of about 1,400/400/200/40. For each statistic, a separate 2D u-net was trained (50 epochs, L1 loss function). The dataset was divided in 160/30/30 for training/validation/testing. For each training step, the input consisted of a total of nine 2D images: CT, SPECT and one of the lower-statistic dose-rate maps for three adjacent axial slices. The ground-truth dose-rate map of the central slice was used as target. For each dataset, input and target were advanced slice by slice to cover the entire SPECT/CT scan. Performance of the four u-nets was evaluated using SSIM, NRMSE, and volume activity accuracy (VAA) [2] between output and target dose-rate maps for the test data. ***Results:*** In general, the performance measures (SSIM/NRMSE/VAA) with regards to the ground-truth dose-rate maps decreased with increasing acceleration: 0.990/0.32%/17.0% (40-fold acceleration), 0.955/0.71%/7.5% (200-fold acceleration), 0.916/1.00%/5.2% (400-fold acceleration), and 0.754/1.98%/2.2% (1,400-fold acceleration). After application of the u-nets the same trend was maintained with performances of 0.998/0.17%/42.7% (40-fold acceleration), 0.994/0.26%/37.5% (200-fold acceleration), 0.993/0.28%/35.1% (400-fold acceleration), and 0.988/0.37%/23.4% (1,400-fold acceleration). In all cases, the application of the u-net resulted in a clear improvement in performance. ***Conclusion:*** Our study shows that deep learning reduces the number of simulated nuclear transformations required for 177Lu SPECT/CT-based dosimetry. Our method considerably cuts the time and computational effort required for voxel-based absorbed dose-rate calculations, paving the way for real-time calculation of patient-specific dosimetry. ***References:*** [1] Jan S et al. PMB 2011;56(4):881. [2] Leube J et al. JNM 2024. Online AoP.

OP-480

PET/CT radiomics combined with clinical features in predicting sarcopenia and prognosis of diffuse large B-cell lymphoma

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Aim/Introduction: To assess the role of 18F-FDG PET/CT radiomics combined with clinical features using machine learning (ML) in predicting sarcopenia and prognosis of patients with diffuse large B-cell lymphoma (DLBCL). ***Materials and Methods:*** A total of 178 DLBCL patients (118 and 60 applied for training and test sets, respectively) underwent pretreatment 18F-FDG PET/CT were retrospectively enrolled. Clinical characteristics and PET/CT radiomics features were analyzed, and feature selection was performed using univariate logistic regression and correlation analysis. Sarcopenia prediction models were built by ML algorithms and evaluated. Besides, prognostic models were also developed, and their associations with progression-free survival (PFS) and overall survival (OS) were identified. ***Results:*** Fourteen features were finally selected to build sarcopenia prediction and prognosis models, including 2 clinical (SUVmax of muscle and BMI), 9 PET (7 gray-level and 2 first-order) and 3 CT (3 gray-level) radiomics features. Among sarcopenia prediction models, combined clinical-PET/CT radiomics features models outperformed other models; especially the support vector machine (SVM) algorithm achieved the highest area under curve (AUC) of 0.862, with the sensitivity, specificity and accuracy of 79.2%, 83.3% and 78.3% in the test set. Furthermore, the consistency index based on the prognostic models were 0.753 and 0.807 for PFS and OS, respectively. The enrolled patients were subsequently divided into high-risk and low-risk groups with significant differences, regardless of PFS or OS (P<0.05). ***Conclusion:*** ML models incorporating clinical and PET/CT radiomics features could effectively predict the presence of sarcopenia and assess the prognosis in patients with DLBCL.

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Survival prediction of glioblastoma patients at initial diagnosis using multimodal radiomics analyses

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Aim/Introduction: Patients with glioblastoma continue to have a poor prognosis even with multimodal therapy. Therefore, enhancing diagnosis, patient stratification, and treatment planning is crucial. In this regard, noninvasive medical imaging plays a vital role in the ongoing monitoring of tumor progression. This study aimed to assess and compare the prognostic value of radiomic analyses from various imaging techniques - FET-PET, TSPO-PET, and MRI - in patients newly diagnosed with glioblastoma. ***Materials and Methods:*** We included 40 glioblastoma patients at initial diagnosis undergoing multimodal imaging prior to radiation therapy. The following images were included: 5-15 and 20-40 min p.i. FET-PET, 60-80 min p.i. TSPO-PET, contrast-enhanced (CE) T1-MRI, and T2-MRI. Furthermore, dynamic FET-PET data were described using time-to-peak and slope images. MRI volumes were determined using the BraTS Toolkit, while PET volumes were defined using a threshold of 1.6 times the background level. We employed Cox's proportional hazards model with an elastic net penalty to predict overall survival, evaluating model performance using the C-index from nested cross-validation with five folds and five repeats. ***Results:*** Multivariate analysis of individual modalities revealed a higher CI for the TSPO model (0.75±0.17) compared to the other modalities (FET20-40 0.67±0.15; CE T1 0.64±0.12; T2 0.55±0.13). Multimodal multivariate analysis did not outperform the model trained on features from TSPO-PET alone. ***Conclusion:*** The findings have significant implications for the field of neuro-oncology, as they underscore the superior prognostic value of TSPO-PET radiomics. These results need to be validated in larger and more diverse cohorts, especially with respect to the prognostic value of a combination of different modalities.

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Bicentric Validation of a [^{68}Ga]Ga-PSMA-11 PET Based radiomics Signature for Primary Prostate Cancer Characterization

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Aim/Introduction: While numerous studies assessed the role of radiomics in prostate cancer (PCa), scarce attention has been focused towards validating existing radiomics signatures. This gap hinders the ability to draw conclusions regarding results' generalizability. This study aims to validate a radiomics signature identified in a preliminary investigation across a larger cohort within our institution and an external cohort from a separate centre. ***Materials and Methods:*** One hundred and twenty-seven PCa patients were retrospectively enrolled across two independent hospitals. The first centre included 62 [68Ga]Ga-PSMA-11 PET scans, with 20 patients classified as class 0 (ISUP grade<4) and 42 as class 1 (ISUP grade≥4). The second centre provided 65 [68Ga]Ga-PSMA-11 PET scans, with 49 patients labelled as class 0 and 16 as class 1. Manual segmentation of the entire prostate was performed; images were discretised, resampled, normalized, and 102 Image Biomarker Standardization Initiative compliant radiomics features were extracted. Feature selection was based on a prior study, identifying two relevant features: GLSZMZone Entropy and Shape-Least Axis Length. Machine learning (ML) models were trained and tested using 100-fold Monte Carlo cross-validation (70-30% train-test split) at both Centre 1 and Centre 2 independently. Subsequently, ML models were trained in one centre and tested in the other, and vice versa. Finally, data from both centres were combined for training and testing using Monte Carlo cross-validation. Synthetic oversampling of the minority class was used to address class imbalance in the training folds. Accuracy (ACC), sensitivity (SN), specificity (SP), positive predictive value (PPV), negative predictive value (NPV), and area under the curve (AUC), were computed. ***Results:*** In Centre 1, a logistic regression model achieved AUC of up to 80.9% in the test set, while the radiomics signature did not generalize to Centre 2, where it only reached a maximum AUC of 49.3%. When ML models were trained in Centre 1 and tested on data from Centre 2, a support vector machine obtained an AUC of 63%. Conversely, testing the ML models in Centre 1 resulted in an AUC of 76.5%. Finally, in the last section of this study, the reported AUC reached 72.8%. ***Conclusion:*** The highest performances were reached when testing the radiomics signature in Centre 1, where it was first developed. These results suggest the influence of centre-specific imaging protocols, patient populations, and contextual factors on the models' performance. These findings emphasize the need to consider centre-specific factors and dataset characteristics when conducting radiomics analysis.

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Monday, October 21, 2024,16:45 - 18:15
Hall Z

Clinical Oncology Track - TROP Session: Oncology & Theranostics Committee: Lymphoma

OP-483

Comparison of Different Response Evaluation Criteria at the Interim PET/CT in Diffuse Large B-cell Lymphoma: Is ΔTotalMTV Worth Measure?

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Aim/Introduction: We aimed to compare six different treatment response criteria (Lugano, RECIL, Peking, qPET, ΔSUVmax, ΔTotalMTV) on survival prediction at the interim PET (iPET) stage in patients with diffuse large B-cell lymphoma (DLBCL). ***Materials and Methods:*** Patients who received R-CHOP or equivalent treatments for three or four cycles and underwent ^{18}F FDG PET/CT imaging at baseline and interim stages were included. Scans were interpreted in accordance with Lugano, RECIL, Peking, qPET, and ΔSUVmax criteria. Also, the percentage-based change rate was obtained from the change in total MTV between baseline PET (bPET) and iPET and was adjusted as a novel criterion (ΔTotalMTV). ROC curves were drawn for continuous variables based on progression-free survival (PFS) results. Cox regression analysis was performed to compare the predictive value of survival data after the categorical classification of treatment response criteria. Predictive comparisons were made by using Harrell's C-index. The significance alpha value for statistical data was set as p<0.05. ***Results:*** One hundred and two patients were included in this study. Median follow-up was 47(6-90) months for overall survival (OS) and 41.5(3-86) months for the PFS. At the end of follow-up, 34 (33.3%) of the patients had progression and/or death.The relationship between all prognostic markers and survival data is summarised in Table 1. In the time-dependent ROC curve analysis on PFS, the threshold value for ΔTotalMTV percentage was determined as 85.69% (AUC:0.630, p:0.028). In the Cox regression analysis, ΔTotalMTV was statistically significant for PFS (p:0.0171). However, no significant prognostic relationship was found for OS (p:0.0554). In addition, 126.8 cm3 was determined as the threshold value in the ROC curve analysis performed for bPET TotalMTV (AUC:0.676, p:0.004). Cox regression analysis performed on this value revealed a statistically significant relationship between PFS and OS (p:0.0079, p:0.0082). Furthermore, comparative Cox regression analysis revealed that ΔSUVmax was the response evaluation criterion with the highest Harrell's C-Index value for OS and PFS among six criteria (Both p<0.0001)(Table 2). ***Conclusion:*** ΔSUVmax is the criterion with the most predictive value on PFS and OS data among the defined methods in patients with DLBCL. These results suggest that iPET-based treatment management with ΔSUVmax may be beneficial. Although higher initial MTV was predictive for worse survival, ΔTotalMTV was not predictive for OS.

This result suggests that this issue may be solved in the future by the calculation of extranodal disease with better segmentation methods.

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Prognostic value of interim ^{18}F-PET/CT after immunotherapy-based combinations in extranodal NK/T-cell lymphoma, nasal type

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Aim/Introduction: The prognostic value of interim 18F-FDG PET/CT for extranodal natural killer/T-cell lymphoma (ENKTL) patients is still uncertain. We aimed to determine the utility of interim PET/CT in ENKTL patients after immunotherapy-based systemic therapy. ***Materials and Methods:*** In this retrospective study, we recruited 133 newly-diagnosed nasal-type ENKTL patients who underwent interim PET/CT scans after 2-4 cycles of immunotherapy-based treatments that contained anti-programmed cell death-1 (PD-1)/programmed cell death-ligand 1 (PD-L1). Interim PET/CT was interpreted by maximum standardized uptake value (SUVmax), Deauville 5-point scale (DS), and early treatment response. The prognostic value of overall survival (OS) and progression-free survival (PFS) was assessed with survival curves generated using Kaplan-Meier analysis and compared using the log-rank test. Univariate and multivariate Cox proportional hazards analysis were performed to evaluate the independent effects for survival. ***Results:*** In the study cohort, 112(84%) patients were early-staged (Ann Arbor I or II). All patients received anti-PD-1/PD-L1 inhibitors in combination with other systemic treatment regimens before interim PET/CT: 24 patients combined with asparaginase-based chemotherapy, 25 patients with targeted therapy, and 84 patients with asparaginase-based chemotherapy plus targeted therapy. Afterwards, 110 patients underwent radiotherapy. Patients with high SUVmax (>9.2), DS of 5, or early treatment response of stable disease (SD) /progressive disease (PD) on interim PET/CT showed significantly unfavorable OS and PFS with the Kaplan-Meier estimate, respectively. All interim PET/CT parameters remained independent predictors for both OS and PFS after univariate and multivariate analysis. We combined interim DS with the prognostic index for natural killer cell lymphoma- Epstein-Barr virus (PINK-E) model as a novel prognostic index and stratified our cohort into 3 risk categories: low-risk (0-2 risk factors), intermediate-risk (3 risk factors), and high-risk (≥4 risk factors), which showed significant stratifications of OS and PFS. ***Conclusion:*** Interim PET/CT after immunotherapy-based systemic treatments showed independent prognostic value for ENKTL, and the model combining interim PET/CT with PINK-E might be an effective prognostic tool for clinical application.

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PET Radiomics Signature Construction by Automatic Machine Learning for Treatment Outcome Prediction in Diffuse Large B-cell lymphoma: A Multicenter Study

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Aim/Introduction: To develop and validate PET radiomics signatures (RadSig) using automatic machine learning (AutoML) for treatment outcome prediction of diffuse large B-cell lymphoma (DLBCL) patients. ***Materials and Methods:*** A total of 308 DLBCL patients treated with R-CHOP regimen from two medical centers with 1471 lesions were studied. AutoML (AutoGluon) was applied to the baseline PET radiomic features from the training cohort to generate responses heterogeneity-aware RadSigs of lesions. To perform patient-level analysis, the RadSigs of all lesions for each patient were summed and averaged, resulting in the patient's radiomics signature (RadSigpatient).The performance of RadSigpatient for predicting treatment response were validated in external cohort. Furthermore, multi-parametric models were designed, and assessed through calibration curves, receiver operating characteristic(ROC), and decision curve analysis (DCA). The prognostic significance of the RadSigpatient were evaluated by Kaplan-Meier method. ***Results:*** AutoML-generated RadSigs were significantly higher in imcomplete response than that of response group in both training and external validation cohorts (P<0.05). The RadSigpatient for response prediction outperformed metabolic parameters in training (AUC=0.834 for interim and 0.809 for end-of-treatment) and external validation cohorts (AUC=0.745 for interim and 0.707 for end-of-treatment). The multi-parametric prediction models that incorporated RadSigpatient demonstrated superior efficacy and offered more net clinical benefits compared to competing models. The RadSigpatient were significantly associated with progression-free survival (PFS) and overall survival (OS) in both training and validation cohorts (P<0.05). ***Conclusion:*** RadSigpatient generated by AutoML represent valuable biomarker for predicting treatment outcome in DLBCL patients, offering potential assistance in clinical decision-making.

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Prognostic Value of Visual and Quantitative Parameters of FDG PET/MRI in Diffuse Large B Cell Lymphoma

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Aim/Introduction: This study aimed to evaluate the prognostic value of visual and quantitative parameters obtained from primary staging and interim FDG PET/MRI in patients with diffuse large B cell lymphoma (DLBCL). ***Materials and Methods:*** The images of 47 adult patients diagnosed with DLBCL, who underwent PET/MRI for primary staging and interim response evaluation in our department were evaluated retrospectively. In quantitative evaluation, the highest SUVmax and the lowest ADCmin of the lesions, and the longest distance between two FDG positive lesions normalized to patient's height (Dmax/height) were obtained from PET/MR images. qPET values and Deauville scores (DS) were obtained from interim images. In addition, the percentage changes of quantitative parameters (ΔSUVmax, ΔADCmin, ΔDmax/height) were calculated. Primary staging PET/MR images and histopathological bone marrow status were considered together to determine disease stages at diagnosis. Progression-free survival (PFS) and overall survival (OS) times of the patients were calculated from the interim imaging date. Cox proportional hazard regression models were used to identify prognostic factors. Survival curves were estimated by using the Kaplan-Meier method. Statistical analyses were performed on SPSS version 23.0. ***Results:*** The median follow-up duration after interim PET/MR imaging was 31 months. During the follow-up period, progression/relaps was observed in 13 patients and mortality was observed in 7 patients. The univariate and multivariate regression analyses with backward stepwise selection demonstrated that primary and interim ADCmin and ΔDmax/height were found as independent predictors for PFS (p=0.02, p=0.007, p=0.043, respectively). The Cox regression analyses also demonstrated that interim SUVmax was the only parameter which was significantly associated with prognosis for OS (p<0.001). When metabolic response evaluation

criteria (DS, qPET, ΔSUVmax) were evaluated together, the qPET was the only parameter showed significant relations with PFS (p=0.003) and OS (p=0.006). The Kaplan-Meier survival analysis showed that higher interim SUVmax (>5.8), higher qPET (>1.6), lower ΔDmax/height (<65%) were significantly associated with lower PFS and OS rates. Additionally, significantly lower PFS rates were observed in patients with lower primary ADCmin (<43.5) and interim ADCmin (<115.5) values; and significantly lower OS rates were observed in the patient group with lower ΔSUVmax (<66%). ***Conclusion:*** FDG PET/MRI quantitative parameters, which reflect the metabolic activity and cellular density of tumors and the level of the lesion spread, may contribute to identify patients with poor prognosis. In our study, it was also found that qPET had a higher relationship with patient prognosis compared to other metabolic response evaluation criteria.

OP-487

The Value of Pretreatment ^{18}F-FDG PET/CT Radiomic Features in the Prognosis Evaluation of Diffuse Large B-cell Lymphoma

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Aim/Introduction: To investigate the prognostic value of pretreatment 18F-FDG PET/CT radiomic features in predicting Progression-Free Survival (PFS) of patients with Diffuse Large B-cell Lymphoma (DLBCL). A novel combined model was established, and a clinically applicable nomogram was constructed to guide clinical decision. ***Materials and Methods:*** A total of 239 patients with DLBCL were enrolled. Divided the 239 patients into training set (167 patients) and validation set (72 patients) in a 7:3 ratio to build model. SUV threshold segmentation method was used to semi-automatically delineate Region Of Interest (ROI) and extract features. Univariate Cox regression analyses and LASSO regression algorithms were used to select features .Calculating the Radscore for each patient using features's weighted coefficients.Receiver Operating Characteristic (ROC) curve was used to analyze the predictive value of the Radscore for PFS. Univariate and multivariate COX regression analyses were used to select the potential independent prognostic factors.Three models were established, namely clinical model, imaging model and combined model. The predictive efficacy of these models were compared by C-index,timeROC,and decision curve (DCA) . Finally, a nomogram was created based on the model with the best predictive efficiency and validated by the calibration curve. ***Results:*** Radscore determined by 7 radiomics features were signifcantly associated with PFS. The area under the curve (AUC), sensitivity, and specificity of Radscore were 0.843, 0.766, and 0.796. The univariate and multivariate COX regression analysis showed that age,Ann arbor stage,SUVmax ,TLG were independent risk factors for PFS. Three models were established: clinical model, including age and stage; imaging model, including SUVmax, TLG, and Radscore; combined model, including age, stage, SUVmax, TLG, and Radscore.Whether in the training set or validation set, the predictive efficiency of the combined model (training set: 0.807, validation set: 0.737) was better than that of clinical model (0.740, 0.706) and imaging model (0.791, 0.658).And even better than IPI (0.729, 0.663)of the most commonly used model in clinic. The difference in predictive efficacy between the combined model and the other three models was statistically significant (P<0.05). TimeROC shows that AUC of the combined model is best for different time points.DCA shows that the combined model achieves the greatest clinical net benefit. Calibration curves show the predicted values of the combined model are consistent with the actual observed values. ***Conclusion:*** The Radscore could be used as a powerful prognostic indicator for DLBCL. The combined model that integrates clinical and imaging indicators may allow for guiding clinical decision.

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Higher lesions conspicuity in lymphoma patients with delayed [18F]FDG Total-Body PET/CT - a prospective single center AI-aided study

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Aim/Introduction: To evaluate late time point (120 min post-injection) [18F]FDG total-body (TB) PET/CT with regard to lesion and background uptake in lymphoma patients. We hypothesize that 120 min TB imaging may increase diagnostic accuracy. ***Materials and Methods:*** A total of 75 lymphoma patients (male: 46, female: 29) had staging [18F]FDG TB PET/CT imaging PET/CT scan at both 60-and 120-minutes post injection. PET images were automatically segmented using an AI-driven algorithm. Segmentation was scrutinized and edited. Images were read by three nuclear medicine physicians. Lesion uptake was characterized by mean, maximum and peak standardized uptake values (SUVmean/max), metabolic tumor volume (MTV) and total lesion glycolysis (TLG) using a 40%-iso-contour approach. Background uptake was characterized by predefined volumes-of-interest (VOI) in the right liver lobe (30mm diameter) and ascending aorta (10mm diameter). SUVs and standard deviation were used to calculate the coefficient of variation (COV), the tumor-to-background ratio (TBR) and contrast-to-noise ratio (CNR) for each TB PET/CT. Paired t-test was used to assess statistically significant differences (p<0.05). ***Results:*** A total of 977 lesions were identified and analyzed. 60- and 120-minutes PET images showed no significant difference in tumor uptake measured by SUVmax (60min: 3.89±3.43 vs. 120min: 3.65±3.37, p=0.09). MTV and TLG were also not statistically significantly different between the two timepoints. However, liver and blood pool activity were significantly lower in 120min p.i. acquisitions (liver SUVmean 60min: 1.66±0.34 vs. 120min 1.04±0.18, p<0.01). The COV was not significantly different for the background in both acquisition times (60min vs. 120 min liver: 0.14±0.24 vs. 0.10±0.02, p=0.27 and blood pool: 0.15±0.30 vs. 0.10±0.03, p=0.31). Lower liver and blood pool activity and similar lesion SUV values resulted in significantly higher TBR (60min: 3.32±4.54 and 120min 6.40±6.28, p<0.001) and CNR (60min: 13.56±23.07 vs. 120 min: 30.44±41.19, p<0.001) in 120min acquisition. This was confirmed by the visual impression of the late TB PET/CT imaging by three independent nuclear medicine physicians. ***Conclusion:*** [18F]FDG TB PET/CT at 120-minutes post-injection increases lesion conspicuity compared to 60-minutes post-injection due to significantly higher TBR and CNR in late imaging in lymphoma patients. Therefore, late TB PET imaging might be helpful to increase the diagnostic accuracy in lymphoma patients with low disease burden or for therapy response assessment, where lesion detectability can be difficult in standard 60-minutes TB PET imaging.

OP-489

Prognostic value of metabolic indices in baseline ^{18}F-FDG PET/CT for pediatric Burkitt lymphoma

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Aim/Introduction: Burkitt lymphoma (BL) is the most common non-Hodgkin lymphoma (NHL) in children and adolescents accounting for over 40% of NHL in those under the age of 18 (1),The early recognition of patients with poor prognosis and the tailoring therapeutic remediation options to them are undoubtedly key interventions.Our aim is to assess the value of baseline PET metabolic indices [maximum standardized uptake value (SUVmax), mean standardized uptake value (SUVmean), total metabolic tumor volume (TMTV), and total lesion glycolysis (TLG) in predicting treatment response and prognosis in pediatric Burkitt lymphoma. ***Materials and Methods:*** We retrospectively analyzed 98 pediatric patients with BL who underwent baseline and end of treatment ^{18}F-FDG PET/CT from 1st January 2018 to 31 December 2019 with minimum follow up one year up to three years after end of treatment protocol. PET images were analyzed semi-quantitatively by measuring SUVmax, SUVmean, TMTV and TLG. Treatment response groups include Good response (patients with complete remission) and Poor response (patients with partial response or who develop recurrence or progression). Event-free survival (EFS) defined as the duration from start chemotherapy to last contact or first event. Events were defined as death for any reason, progression, or relapse. Overall survival (OS) was defined as the duration from start chemotherapy to last contact or death. Quantitative metabolic indices were analyzed using receiver operating characteristic (ROC) curve and area under curve (AUC) to estimate the optimal cut-of value. EFS and OS curves were constructed using the Kaplan-Meier method and compared with the log-rank test. ***Results:*** SUVmean and SUVmax do not show a statistically significant difference between treatment response groups, TMTV and TLG do exhibit statistically significant differences (p=0.008; p=0.01). After follow-up of three years, TMTV (<570 cm3) and TLG (< 4000) had better 3-year EFS rate compared with those with a high TMTV and high TLG (p=0.001). However, TMTV and TLG were not predictive of OS (p=0.81; p=0.96). ***Conclusion:*** TMTV and TLG could represent potential PET/CT metabolic biomarkers for predicting the response and prognosis of EFS in pediatric Burkitt lymphoma. These results warrant further verification in larger cohorts across multiple institutions. ***References:*** 1: Molyneux EM, Rochford R, Griffin B, et al. Burkitt's lymphoma. Lancet. 2012;379(9822):1234-1244.

OP-490

Metabolic tumor volume after two cycles of chemotherapy in patients treated for advanced-stage Hodgkin Lymphoma: analysis of the German Hodgkin Study Group phase III HD18 and HD21 trials

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Aim/Introduction: Positron emission tomography (PET) guided treatment is standard of care to treat patients diagnosed with advanced-stage classical Hodgkin Lymphoma (AS-cHL). Currently, Deauville Score (DS) is used to determine remission in PET, but metrics such as residual metabolic tumor volume (MTV) hold promise to quantify response. However, there is still insufficient data to support their use in clinical routine. Our aim was to investigate the role of MTV in response assessment of patients treated for AS-cHL. ***Materials and Methods:*** The investigator-initiated phase III trials HD18 and HD21 randomized patients between 18-60 years with AS-cHL to receive BEACOPP (HD21 standard arm, HD18) or BrECADD (HD21 experimental arm). All patients received two cycles of chemotherapy followed by response assessment after two cycles (PET-2). MTV after two cycles (MTV-2) encompassed all lymphoma tissue with standard uptake value > 4. To exclude confounding of PET-guided treatment, we first measured MTV-2 in all patients treated in the standard arms of HD18 following amendment, of which all patients received 6 cycles of BEACOPP (C6-Cohort). Cox-regression models and Kaplan Meier estimates were used to analyse impact of MTV-2 on progression-free survival (PFS). Findings were then validated in the full ITT cohorts of HD18 and HD21. ***Results:*** A total of 645 patients were included in the C6-Cohort, of these 471 (64.6%) were rated as DS1-3 in PET-2 and 569 (88.2%) had no residual MTV-2. Patients with measurable MTV-2 had significantly inferior PFS (HR 3.62, CI95: 1.94-6.76). Results were not significant for patients without detectable MTV-2 and DS4 (HR 1.65; CI95: 0.8-3.38). In the analyzed ITT cohorts of HD18 (n = 1756) and HD21 (n= 1211), Patients with DS4 but with completely resolved MTV-2 had comparable outcomes to patients with DS1-3 (HD18: HR 1.12, CI95: 0.69-1.80; HD21: HR 1.03, CI95: 0.55-1.95), whereas patients with measurable MTV-2 featured higher risk of progression (HD18: HR 2.98, CI95: 1.92-4.64; HD21: HR 4.44, CI95: 2.78-7.09). Results were similar in both trial arms of HD21 (BEACOPP vs. BrECADD) and frequency of measurable MTV-2 remained was comparable between HD18 post-amendment and HD21. ***Conclusion:*** Complete resolution of MTV after two cycles of BEACOPP/BrECADD first-line chemotherapy for AS-cHL is associated with a favorable prognosis. Approximately 10% had measurable MTV-2 (i.e. any lesion with SUV > 4) and face significantly higher risk of progression. Our results advocate implementation of quantitative biomarkers to refine response assessment in AS-cHL.

OP-491

Comparison of Total Metabolic Tumor Volume Segmentation Methods and Their Prognostic Impact in Follicular Lymphoma

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Aim/Introduction: Total metabolic tumor volume (TMTV) is

a significant prognostic factor in lymphoma patients, yet the method for calculating TMTV is debated. The main methods used involve three different segmentation workflows: fixed SUV thresholds (SUV≥2.5 or SUV≥4.0) and a 41% threshold of SUVmax. There are no large-scale studies directly comparing the impact of these three methods. This study aims to evaluate how different TMTV segmentation methods influence prognostic outcomes in a large cohort of follicular lymphoma (FL) patients from the FOLL12 trial. ***Materials and Methods:*** FOLL12 trial is a multicenter, randomized, phase III trial that compared standard vs response adapted maintenance therapy in patients with FL. In this study we included patients for whom baseline FDG PET/CT was available and centrally reviewed. The TMTV was obtained from baseline scans by summing the metabolic volumes of all individual nodal and extra nodal lesions, using the fixed SUV thresholds (SUV≥2.5 and SUV≥4.0) and 41% of SUVmax methods. AUC and log-ranks methods were used to determine the best cutoffs for the survival analysis. Hazard ratios (HRs) were calculated for the three TMTV values (TMTV2.5, TMTV4 and TMTV41), and predictive performance was assessed using the c-Harrel index. The study end point was PFS. ***Results:*** A total of 692 patients from the FOLL12 trial population were included in the study. 48% were over 60 years old, 89% had stage III-IV disease, and 40% had a high-risk FLIPI-2 score. The overall 5-year PFS rate was 79% (95% CI, 76-82%). The median TMTV was 242 mL (IQR 446) for TMTV41, 320 mL (IQR 552) for TMTV2.5, and 158 mL (IQR 332) for TMTV4 segmentation method. The optimal prognostic cut-offs for each method were identified as 200 mL for TMTV41, 250 mL for TMTV2.5, and 300 mL for TMTV4. With a cut-off point of >200 mL for TMTV41, the HR was 1.82 (95% CI, 1.39-2.40) and the c-Harrel's concordance index was 0.569. For TMTV2.5 with a cut-off point of >250 mL, the HR was 1.64 (95% CI, 1.25-2.16) and the c-Harrel's index was 0.557. For TMTV4 with a cut-off point of >300 mL, the HR was 1.62 (95% CI, 1.25-2.11) and the c-Harrel's index was 0.558. ***Conclusion:*** Higher TMTV is associated with a worse prognosis in follicular lymphoma, regardless of the measurement method used or cut point. The predictive performance, as measured by the c-Harrel index, was similar across the three methods used for calculating TMTV.

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Monday, October 21, 2024,16:45 - 18:15
Hall Y10-Y12

Featured Session: Neuroimaging Committee: Movement Disorders

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OP-493

Semiquantitative Approach to DaT SPECT in Scans Without Evidence of Dopaminergic Deficit (SWEDD) in the Era of the Biological Staging of Alpha-synucleinopathies: a PPMI Analysis

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Aim/Introduction: SWEDD are patients clinically diagnosed with Parkinson's disease (PD) but with normal DaT-SPECT. This heterogeneous group deserves renewed attention to increase sensitivity for the identification of patients who will later fit in the new biological staging of alpha-synucleinopathies. In Parkinson's Progression Markers Initiative, SWEDD patients were classified based on visual-reading. We aimed to evaluate the capability of visual- and semiquantitative-analyses of DaT-SPECT to predict the presence of α-synuclein in cerebrospinal fluid (CSF) in SWEDD patients of PPMI. ***Materials and Methods:*** In PPMI, 76/499 patients recruited as PD are classified as SWEDD (median-age 63 years). Baseline Unified Parkinson's Disease Rating Scale (UPDRS_III) and Montreal-Cognitive-Assessment (MoCA) are available for all SWEDD while CSF and 2-years follow-up are available in 51/76. Scans were visually evaluated in our center by 2 experts. Inter-reader-agreement was evaluated (Fleiss Kappa). Semiquantitative-assessment of striatal-binding-ratio (SBR) and z-scores were computed with Datquant® versus 118 healthy-controls. Scans classification based on z-score for striatum, substriatal regions and putamen/caudatus (P/C-ratio) was compared using two z-score cut-offs (ZS -1.3, -2). The predictive value of visual-reading and z-scores for α-synuclein and for the persistence/progression of motor and cognitive impairment was assessed. ***Results:*** Median UPDRS_III and MoCA were 13 [IQR:7-18] and 27 [IQR:26-29] at baseline and 12 [IQR:6-21] and 26 [IQR:24-28] at follow-up. At visual-reading 5 scans were classified as positive, 5 borderline and 40 negative by both experts, leading to an overall fair concordance (Kappa 0.32). As to alpha-synuclein positivity (n = 10), expert-reading achieved the highest accuracy together with P/C-ratio based on -2 ZS (80.4%). Considering positive+borderline categories, a sensitivity of 70% was only reached by the expert-reading (not by semiquantification). P/C ratio of the most affected hemisphere showed the highest correspondence with expert-reading (ROC AUC:0.74) and it was the only parameter able to increase specificity of expert-reading for alpha-synuclein (97.6% for -2 ZS and 92.7% for -1.3 ZS). P/C-ratio also showed a high specificity to predict persistence of motor and cognitive impairment at 2-y-follow-up (100% for UPDRS_III ≥6, MoCA<26 with -2 ZS) however its sensitivity was low. ***Conclusion:*** In most cases SWEDD patients do not reflect an alpha-synucleinopathy. A combined visual-reading and a more conservative quantitative approach (ZS -2) capturing the typical unbalanced reduction of nigro-putaminal versus nigro-caudate deafferentation seems to provide the highest accuracy for the identification of patients with an apparently normal DaT-SPECT which, however, need to find a position in the biological staging of alpha-synucleinopathies.

OP-494

Spatial covariance of cortical metabolism with multiple metrics of nigrostriatal degeneration in Dementia with Lewy bodies (DLB)

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Aim/Introduction: From a biomarker point of view, Dementia with Lewy bodies (DLB) is characterised by a dopamine transporter's (DaT) deficit in the striatum and by specific patterns of cortical hypometabolism, which can be assessed using DaT-SPECT imaging and fluorodeoxyglucose (FDG)-PET, respectively. The relationship between specific features derived from dopaminergic and metabolic neuroimaging is still unclear. Given this background, we aimed to investigate the relationship between dopaminergic deafferentation in different striatal regions (caudate, anterior and posterior putamen) and the presence of specific cortical metabolic patterns. ***Materials and Methods:*** 76 patients with DLB who underwent both Dat-SPECT and FDG-PET were included in the study (27 females, 49 males). The DaT-SPECT scans were analysed using DaTQUANT 2.0 and the striatal binding ratios (SBR) were measured. All FDG PET scans were flipped in order to have the more affected hemisphere on the right side. The correlation between caudate, anterior and posterior putamen SBR and FDG-PET metabolic patterns was assessed by means of standard parametric mapping (SPM12). The analyses were corrected considering age, MMSE and sex as nuisances. P values corrected for family-wise errors (p[FWE])<0.05 at the cluster level were accepted as significant. ***Results:*** SBR reduction in the caudate showed a significant correlation with hypometabolism in the parietal, occipital and lateral temporal cortex, with the most significant cluster located in the lateral temporal cortex (p[FWE]<0.001). The dopaminergic deafferentation of the anterior putamen demonstrated a significant correlation with a less extended cluster of hypometabolism located in the same areas, with the most significant cluster in the angular gyrus of the parietal lobe (p[FWE]<0.005). Posterior putamen SBR values resulted to be significantly associated to the presence of hypometabolism in the occipital cortex and, to a less extent, in the parietal lobule, with the most significant cluster in the inferior occipital gyrus (p[FWE]<0.001). ***Conclusion:*** in DLB patients, the spreading of the dopaminergic deafferentation from the posterior putamen to the anterior putamen and the caudate is associated to a widening of the clusters of cortical hypometabolism. Moreover, the dopaminergic deficit in each different striatal region seems to be linked to the presence of hypometabolism in different specific areas of the cortex.

OP-495

The Role of [18F]FDG PET in the Early Identification of Psychiatric-Onset Dementia with Lewy Bodies: a Preliminary Analysis

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Aim/Introduction: Delirium/Psychiatric-onset dementia with Lewy bodies (DLB) is one of the possible prodromal manifestations of DLB that typically features a primary psychiatric disorder preceding dementia onset and other neurological signs. The identification of patients presenting with prodromal DLB and its differentiation from primary psychiatric disorders is challenging, possibly resulting in diagnostic delays and unsuccessful pharmacological treatments, interfering with correct patient management. The aim of this study is to describe the possible use of [18F]FDG PET in this complex scenario. ***Materials and Methods:*** We retrospectively selected patients with a final diagnosis of probable psychiatric-onset DLB, according to the research criteria proposed by McKeith et al., who underwent brain [18F]FDG PET/CT between 2020 and 2023, for suspect neurodegenerative disease in an early undiagnosed phase. Data on clinical history, neurological examination, neuropsychological assessment, CSF biomarkers analysis, EEG, and morphological brain imaging were available. Brain hypometabolism on [18F]FDG PET was assessed by means of a voxel-wise approach (SPM software) on each patient, and as a group analysis. ***Results:*** Fourteen patients (M:F = 7:7, median age 72.5, range 62-83) were included. The most common presentations were new-onset psychosis (n=8), major depression and/or anxiety disorder (n=7), delirium and/or delusions (n=8). By the time of PET imaging, seven (50%) patients developed mild symptoms of parkinsonism, seven (50%) patients mild cognitive impairment, while only two (14%) a moderate or severe cognitive impairment. SPM voxel-wise subject analysis revealed occipital lobe hypometabolism in the whole series (n=14), in one case unilateral, occasionally extending to the parietal lobe(s) (n=8), temporal lobe(s) (n=5), and/or frontal lobe(s) (n=3). A group commonality analysis revealed a signature area of hypometabolism involving the inferior occipital lobe, bilaterally. ***Conclusion:*** [18F]FDG PET hypometabolic patterns were supportive of DLB diagnosis, thus representing a possible biomarker in the challenging classification of these patients in the early undiagnosed phase. Of note, the identification of a specific imaging signature of inferior occipital hypometabolism may shed light on the complex interplay between visual and emotional networks, crucial for the pathogenesis of the psychiatric manifestations. This study aims to pave the way for larger prospective investigations, to confirm the potential clinical impact and predictive utility of [18F]FDG PET and its capability to significantly improve the management of this rare clinical entity. ***References:*** McKeith IG, et al.; prodromal DLB Diagnostic Study Group. Research criteria for the diagnosis of prodromal dementia with Lewy bodies. Neurology. 2020 Apr 28;94(17):743-755.

OP-496

Brain Regional Metabolic Changes in Isolated REM Sleep Behaviour Disorder Progression Stages

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Aim/Introduction: Isolated rapid-eye-movement sleep

behavior disorder (iRBD) is an early stage of neurodegenerative α-synucleinopathies, such as Parkinson's disease (PD), dementia with Lewy bodies, and multiple system atrophy. At present, no biomarkers are clinically available for predicting phenoconversion to α-synucleinopathy. Despite the revealed metabolic patterns of iRBD and PD, the metabolic changes within iRBD disease progression remain unknown. This study aimed to explore regional brain metabolism changes with iRBD disease progression. ***Materials and Methods:*** Sixty-seven FDG PET scans of 19 iRBD patients with mean follow-up ± standard deviation of 5.9±2.4 years (mean age 64.9±5.7 years, 14 male) were included. These patients eventually converted to PD. We divided scans into 3 stages: S0 - more than 6 years before conversion; S1 - less than 6 years before conversion; S4 - conversion to PD. All scans were spatially normalized to the MNI brain space and intensity normalized by the average of the whole brain. Regions of interest (ROI) were obtained using the AAL3 atlas. Mean standardize uptake value ratios (SUVr) were obtained for each ROI. Kruskal-Wallis test was used to assess differences in ROI between stages and Mann-Whitney for pairwise comparisons. ***Results:*** Significant differences were found in the lingual gyrus (p=0.031), lateral (p=0.007) and medial geniculate nucleus (p=0.033) of thalamus, locus coeruleus (p=0.026) and median raphe nucleus (p=0.029) between stages. From S0 to S1, a significant increase in SUVr was detected on lateral geniculate nucleus of thalamus (p=0.011). From S1 to S2, the lingual gyrus mean SUVr significantly decreased (p=0.020) and the locus coeruleus and median raphe nucleus significantly increased (p=0.030 and p=0.029, respectively). From S0 to S2, there was a decrease in lingual gyrus (p=0.016) and increase in lateral (p=0.006) and medial geniculate nucleus (p=0.011) of thalamus, locus coeruleus (p=0.007) and median raphe nucleus (p=0.009). ***Conclusion:*** In this relatively large longitudinal cohort for the rare disease of iRBD, we found several brain regions that suffer metabolic changes with disease progression. Our results align with previous studies on metabolic regional changes, especially in the lingual gyrus. As a novelty, also the thalamus lateral and medial geniculate nucleus, the locus coeruleus and the median raphe nucleus metabolism seem to change with iRBD progression. These findings contribute to understanding of the underlying neurobiological mechanisms involved in the evolution of iRBD towards α-synucleinopathy. Further studies are warranted to validate these findings and potentially establish biomarkers for predicting phenoconversion to α-synucleinopathies in clinical settings.

OP-497

Decreased striatal blood flow after dopamine transporter inhibition

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Aim/Introduction: 11C-PE2I is a PET ligand with high affinity and selectivity for the dopamine transporter (DAT). In a dual-biomarker approach both DAT availability and relative blood flow can be assessed from the same dynamic scan. In a recent study we found a significant correlation between striatal binding potential (BPND) as a measure of DAT availability and relative tracer delivery (R1) as a measure of relative cerebral blood flow with 11C-PE2I in healthy subjects [1]. Since dopamine can be an inhibitor of neuronal activity, one hypothesis is that higher availability of DAT may implicate less available dopamine, and hence less inhibition of the post synaptic neurons which means they are more active and require a higher blood flow. To test this hypothesis, the aim of the present work was to evaluate whether DAT inhibition results in reduced relative striatal blood flow within individuals. ***Materials and Methods:*** Data from 42 healthy subjects was retrospectively re-analysed. All subjects underwent 80 min dynamic 11C-PE2I PET scans at baseline and at steady-state conditions following once-daily dosing of a dopamine reuptake inhibitor for ten days. Volumes of interest (VOIs) were automatically defined using a probabilistic VOI template and BPND and R1 were calculated using a basis function implementation of the simplified reference tissue model with cerebellum as reference region. Averaged BPND and R1 values were extracted from putamen and caudate and only subjects with more than 10% reduction of BPND in putamen were included in further analysis. The differences between R1 values at baseline and during DAT inhibition were assessed using a paired t-test and correlation between the relative difference of BPND and R1 from both scans were calculated. ***Results:*** Of the 42 includes subjects, 33 had a reduction > 10% of BPND in putamen. A significant reduction of R1 was found between baseline and post-drug scans in both putamen and caudate (p-value < 0.0001 and 0.03 respectively). Mean reductions of BPND and R1 were 24.4% ± 17.7% and 4.0% ± 6.6% in putamen and 27.0% ± 14.4% and 2.3% ± 9.5% in caudate. Correlation between the relative change of R1 and BPND between the two scans was moderate, r = 0.49 and 0.36 for putamen and caudate respectively. ***Conclusion:*** Inhibition of dopamine transporters is associated with reduction of relative striatal blood flow. ***References:*** [1] Jonasson et al., J Cereb Blood Flow Metab., 2023.

OP-498

Dual Biomarker Potential of ^{18}F-PR04.MZ-PET: Assessing Dopaminergic Function and Cerebral Blood Flow in Degenerative Parkinsonian Syndromes.

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Aim/Introduction: 18F-PR04.MZ is a novel dopamine transporter (DAT) radiotracer that exhibits with high affinity and selectivity for this membrane protein. Prior studies involving different radiotracers in dementia and movement disorders have suggested that R1 images derived from compartmental analysis of dynamic studies could serve as an indicator of cerebral blood flow (CBF). This study aims to explore the association between a rough index of CBF obtained from dynamic 18F-PR04.MZ studies (R1) and brain metabolism in patients diagnosed with parkinsonian syndromes. ***Materials and Methods:*** Fourteen patients with degenerative parkinsonisms (11 Parkinson's disease, 3 multiple system atrophy) underwent PET/CT scans with both 18F-FDG and 18PR04.MZ radiotracers within a three-month timeframe. Additionally, 17 healthy controls (HC) examined with 18F-PR04.MZ PET/CT were included. Parametric R1 images were generated via compartmental analysis of dynamic 18F-PR04.MZ studies using the Simplified Reference Tissue Model (SRTM). Specific Uptake Ratios (SUR) were calculated in both patients and HC to assess dopaminergic integrity. Comparative analysis of SUR between patients and HC was conducted, and the correlation between R1 and brain metabolism was explored across cortical and subcortical brain regions using Pearson's correlation (α < 0.05). ***Results:***

Patients with degenerative parkinsonism exhibited lower SUR values (9.0+/-2.6, 5.8+/-4.9 and 1.1+/-0.66 for caudate, putamen and substantia nigra respectively) compared to HC (15.8 +/- 3.2, 20.7 +/- 4.4 and 4.4 +/- 1.7, p < 0.0001). A significant correlation was found in patients between R1 derived from 18F-PR04.MZ studies and brain metabolism in various regions, including the caudate nuclei (p<0.0001, correlation coefficient [CC] 0.86), putamen (p= 0.005, CC 0.70), parietal (p<0.0001, CC 0.79), occipital (p=0.005, CC 0.70), frontal (p=0.01, CC 0.66), and temporal (p=0.018, CC 0.62) cortex. ***Conclusion:*** R1 images derived from dynamic ^{18}F-PR04.MZ studies hold promise in delineating alterations in CBF within cortical and subcortical regions in degenerative parkinsonisms, thereby aiding in the differential diagnosis of these patients.

OP-499

Age-related high-frequency hearing loss and inhibitory neurotransmission - methodological requirements for working out a connection

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Aim/Introduction: High-frequency hearing loss (HFHL) is known to occur with increasing age. Furthermore, also age-related changes in inhibitory processing in the brain are observed. The aim of the present study was to describe possible interrelations between age, HFHL and the binding potential (BP) of inhibitory neuroreceptors for Flumazenil. ***Materials and Methods:*** Pure-tone audiograms (500-12,000Hz) and F18-flumazenil PET/CT-examinations were performed in 23 individuals (51±12 years; range 24-69) without hearing loss in need of treatment (i.e. bilateral loss in pure tone average < 20%). F^{18}-flumazenil PET was performed dynamically from the injection of 370MBq over one hour. BPs of the GABA-A receptors were calculated using the simplified reference tissue model with the pons as the reference region for the primary auditory cortex (Heschl-ROI according to the AAL-atlas) using either the mean or the 75th percentile of the BP-values within the ROI (the latter to avoid partial volume effects due to white matter contained in the region). The density of the gray matter (GMD) in the Heschl-ROI was determined from MR-tomograms (MPRAGE). The normal distribution of the variables was tested using the Shapiro-Wilk and Kolmogorov-Smirnov tests, and a Pearson correlation was only calculated in the case of a normal distribution, otherwise a Spearman correlation was calculated. ***Results:*** The HFHL at 12,000Hz correlated significantly with age (r=0.61, p=0.0019). With regard to the BP, significant negative correlations were found for the mean values in the Heschl-area with age bilaterally (r=-0.49, p=0.0190) and the HFHL (r=-0.45, p=0.0317) for the right side. The 75th percentile of the BPs in the Heschl-region showed with age significant correlation only for the right side (r=-0.47, p=0.0221) and with HFHL no significant correlation at all (p≥0.34). GMD correlated negatively with age (r=-0.71, p=0.0001) and HFHL (r=-0.45, p=0.031). ***Conclusion:*** These results suggest that age-related HFHL might be associated with a reduction in inhibitory GABA-A receptor-binding in the primary auditory cortex as a possible counter-regulation. Restricting the correlated BPs to primary cortical sections (75th percentile) could lead to an overestimation of the receptor binding particularly in older patients with atrophy, which would explain the partly loss of significant correlations. In addition, the parallel correlation of GMD with age and HFHL supports the need for an accurate partial volume correction to identify the specific influence of receptor binding.

OP-500

Metabolic Network Connectivity Disturbances in Parkinson's Disease: A Novel Imaging Biomarker

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Aim/Introduction: While 18F-fluorodeoxyglucose (18F-FDG) positron emission tomography (PET) has provided insight into the metabolic abnormalities associated with Parkinson's disease (PD) at systemic levels, the diagnosis and understanding of the underlying network interactions within the metabolic connectome in these patients remain largely unknown and challenging. ***Materials and Methods:*** We performed a retrospective cohort study, analyzing data from 52 PD patients and 82 well-matched healthy controls (HC). An individual metabolic connectome, based on the standard uptake value (SUV) of 18F-FDG PET, was constructed using the Jensen-Shannon Divergence Similarity Estimation (JSSE) method. Then, this approach was utilized to compare the intra- and inter-network connectivity between PD patients and HC. Finally, a random forest (RF) classifier was utilized to determine the neuroimaging characteristics that most effectively differentiate between PD and HC. ***Results:*** This study used 18F-FDG PET imaging data to construct individual metabolic networks based on the JSSE algorithm to investigate the characteristic pattern of interaction effects among brain functional networks in PD patients. Our results indicated that there is a significant increase in inter-network connectivity between the somatomotor network (SMN) and frontoparietal network (FPN) in PD patients when compared to HC. Notably, only the increased inter-network connectivity between SMN and FPN in the PD group was corrected through the multiple comparisons in the 10% and 20% sparsity (p < 0.05, Bonferroni corrected). Among these results, the altered inter-network connectivity in 10% sparsity could be used to distinguish the PD group and HC group with an accuracy of 70.15%, sensitivity of 50.00%, and specificity of 82.93%. In 20% sparsity, the significantly different inter-network connectivity could be used to identify the PD patients with an accuracy of 67.91%, sensitivity of 46.15%, and specificity of 81.71%. This significantly altered connectivity pattern was able to effectively differentiate PD patients from HC. ***Conclusion:*** By using 18F-FDG PET imaging to construct individual metabolic networks, this study identified heightened inter-network connectivity between SMN and FPN in PD patients. This discovery suggests that it could serve as a potential imaging biomarker for the early detection of PD.

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Monday, October 21, 2024, 16:45 - 18:15
Hall G2

Joint Symposium 5 - Dosimetry Committee / ESTRO - Combination of different Radiation Treatments

OP-501
Combination and Retreatment in External Beam Radiation Therapy
E. Gershkevitsh;
North Estonia Medical Centre, Tallinn, ESTONIA.

OP-502
Lessons from Radiobiology for New Radiation Treatment Approaches
J. Pouget;
Institut de Recherche en Cancérologie de Montpellier (IRCM), INSERM U1194; Université de Montpellier, Institut régional du Cancer de Montpellier (ICM), Montpellier, FRANCE.

OP-503
Combination and Retreatment in Radionuclide Therapies
L. Strigari;
IRCCS Azienda Ospedaliero-Universitaria di Bologna, Department of Medical Physics, Bologna, ITALY.

OP-504
Recommendations and Future Needs
M. Cremonesi;
European Institute of Oncology, IRCCS, Milan, ITALY.

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Monday, October 21, 2024,16:45 - 18:15
Hall F

e-Poster Presentations Session 8: Paediatrics Committee: Paediatric Nuclear Medicine and Adults General Nuclear Medicine

EPS-148
The value of ^{18}F-FDG PET/CT in the evaluation of efficacy and prognosis of gastric cancer patients with peritoneal metastases
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Aim/Introduction: Conversion therapy and conversion surgery (CS) can improve the prognosis of gastric cancer (GC) patients with peritoneal metastasis (PM). However, patients benefit differently. There is no way to confirm the prognostic benefit non-invasively and early. This retrospective study aimed to evaluate the performance of 18F-FDG PET/CT in predicting the conversion therapy outcome and prognosis of GC patients with PM. ***Materials and Methods:*** 104 GC patients with PM were enrolled, undergoing 121 18F-FDG PET/CT scans. 43 scans were before conversion therapy, 56 were after conversion therapy, and 22 were after CS. Maximum standardised uptake value (SUVmax), mean standardised uptake value (SUVmean), metabolic tumour volume (MTV), total lesion glycolysis (TLG), and tumor-to-background ratio (TBR)of primary and peritoneal lesions, anastomotic and recurrent metastatic lesions were recorded to evaluate their association with the conversion therapy outcome and prognosis. ***Results:*** In assessing the conversion therapy outcome, the TBR of primary and peritoneal lesions after conversion therapy could guide the completion of CS. The TBR of the peritoneal lesion to the mediastinal blood pool SUVmax (TBRAmaxp) was the best predictor (cutoff=0.705, specificity 83.3%, sensitivity 79.2%, AUC 0.843, P<0.001). In terms of prognostic evaluation, the TBR of the peritoneal lesion to the hepatic blood pool SUVmax (TBRLmaxp) before conversion therapy was the best predictor of 12 and 18 months survival(cutoff=1.605, OS=12 months, AUC 0.706, P=0.01; OS=18 months, AUC 0.722, P=0.014), the SUVmax of the peritoneal lesion after conversion therapy (SUVmaxp) was the best predictor of 20 and 24 months survival (OS=20 months, cutoff=1.646, AUC 0.838, P=0.001; OS=24 months, cutoff=1.475, AUC 0.803, P=0.004). Metabolic parameters of peritoneal lesions before and after conversion therapy could predict overall survival (OS). During postoperative recurrence assessment, the SUV and TBR of recurrent metastatic lesions could predict OS after CS. Additionally, the SUVmap and TBRAmaxp before conversion therapy, the MTV of the gastric lesion (MTVg), and the SUVmaxp after conversion therapy could predict the prognosis of patients who underwent CS (cutoff were 8.477, 3.477, 20.86, and 1.481 respectively, P were 0.016, 0.037, 0.037, and 0.047 respectively). ***Conclusion:*** Metabolic parameters of 18F-FDG PET/CT have excellent predictive value for the conversion therapy outcome and prognosis in GC patients with PM. ***References:*** 1. Yang Z, Lu S, Shi M, et al. Oncological outcomes of conversion therapy in gastric cancer patients with peritoneal metastasis: a large-scale retrospective cohort study. Gastric Cancer. 2024; 27:387-99. doi:10.1007/s10120-023-01452-8

EPS-149
Value of ^{18}F-FAPI-04 PET-CT for prediction of pathologic response and survival in locally advanced pancreatic ductal adenocarcinoma after neoadjuvant chemotherapy
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Aim/Introduction: Accurate assessment of residual disease of tumor and lymph nodes after neoadjuvant chemotherapy (NCT) is crucial in the active surveillance for patients with pathological complete response (pCR) and the optimal extent of lymphadenectomy for patients with non-pCR. It has been reported that Fluorine-18 (18F)-labeled fibroblast activation protein inhibitor 18F-AlF-NOTA-FAPI-04 (18F-FAPI-04) PET/CT imaging outperformed 18F-FDG PET/CT in oncology for diagnosing and staging tumors. However, there are very few data on the use of 18F-FAPI-04 PET/CT for monitoring therapeutic

efficacy in oncology.This study aimed to evaluate the predictive value of 18F-AlF-NOTA-FAPI-04 (18F-FAPI-04) PET/CT for pathologic response to NCT in patients with locally advanced pancreatic ductal adenocarcinoma (LAPDAC). ***Materials and Methods:*** This retrospective study included 34 patients with histopathologically and radiologically confirmed LAPDAC who received 18F-FAPI-04 PET/CT scans before NCT. After 4-6 circles of NCT, these patients underwent radical resection. Pathological response to NCT was assessed by pathologic tumor regression grades (TRG) based on Evans system. PET/CT parameters, including the maximum standardized uptake value (SUVmax), FAPI-avid tumor volume (FTV), and total lesion FAP expression (TLF), were evaluated for their association with TRG after NCT using Spearman's rank test. Receiver operating characteristic (ROC) curve analysis was used to determine the optimal cut-off points for differentiating pathologic good response from pathologic poor response. Kaplan-Meier and Cox regression methods were used to analyses the relationship between recurrence-free survival (RFS) or overall survival (OS) and potential predictors. ***Results:*** Of 34 patients with LAPDAC, 12 patients were pathologic good response Evans III-IV), and 20 patients were pathologic poor response (Evans I-II). SUVmax, FTV and TLF in the groups of Evans III-IV were significantly lower than those in the groups of Evans I-II (15.22±6.61vs.20.23±7.07, 43.92±29.20 vs.76.80±47.40, 250.62±160.7 vs.532.42±388.26, all P <0.05). Furthermore, SUVmax and TLF were higher in poorly differentiated PDAC than those in well-to moderately differentiated neoplasms (15.33±5.87 vs.22.33±7.14, 303.63±219.40 vs.577.46±422.60, all P <0.05). On multivariate analysis, FTV >54.21 and TLF >290.21 had a poor RFS and OS, respectively (HR = 3.24, P = 0.014 and HR = 3.35, P = 0.019) and OS (HR = 7.35, P = 0.002 and HR = 7.09, P = 0.004) in PDCA after NCT. ***Conclusion:*** The parameters of 18F-FAPI-04 PET/CT showed a significant correlation with tumor aggressive pathological characteristics, and had the excellent performance for predicting pathologic tumor regression grades after NCT in LAPDAC. FTV and TLF were independent postoperative prognostic factors for RFS and OS for LAPDAC.

EPS-150

Comparison of ^{18}F-FAPI-74 PET/CT and Contrast-Enhanced CT in Gastric Cancer

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Aim/Introduction: Treatment decisions for gastric cancer rely on precise evaluation. This study aims to compare the efficacy of 18F-FAPI-74 PET and contrast-enhanced CT (CECT) in diagnosing and staging gastric cancer, as well as assessing their impact on clinical decision-making. ***Materials and Methods:*** This prospective study analyzed patients with confirmed gastric cancer who underwent concurrent 18F-FAPI-74 PET/CT and CECT between June 2022 and July 2023. PET/CT and CECT findings were confirmed by histopathology or radiographic follow-up. Two independent blinded experts read the scans, and their findings were combined for analysis. ***Results:*** Our cohort comprised 24 gastric cancer patients, 12 patients for initial staging and 12 for recurrence detection. Regarding lesion-based diagnostic accuracy, no significant advantage of 18F-FAPI-74 PET/CT over CECT was demonstrated. However, 18F-FAPI-74 exhibited higher sensitivity (55.95% vs. 32.14%) and accuracy (98.15% vs. 98.24%) than CE-CT in detecting lymph node metastasis. Moreover, 18F-FAPI-74 outperformed CECT in detecting abdominopelvic metastases in all regions (100%, 13/13), showing higher sensitivity (99.15% vs. 57.26%), specificity (76.92% vs. 51.28%), and accuracy (93.59% vs. 55.77%) than CECT. Compared with CECT, 18F-FAPI-74 PET/CT resulted in upstaging 6 patients' TNM staging among all patients (24.43%, [6/28]) and significantly altered the clinical management of 4 patients (14.29% [4/28]) in whom recurrence or metastases were detected. ***Conclusion:*** 18F-FAPI-74 PET/CT is more effective in assisting lymph node and peritoneal metastasis detection in gastric cancer patients compared to CECT. Integrated 18F-FAPI-74 is a potential method for staging in gastric cancer patients.

EPS-151

Metabolic activity via ^{18}F-FDG PET/CT is predictive of risk stratification and prognostic of hypermetabolic gastrointestinal stromal tumors

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Aim/Introduction: Most gastrointestinal stromal tumors (GISTs) with positive uptake of $^{[18F]}$-FDG tend to have higher malignant potential. This study aimed to evaluate the value of various metabolic parameters of $^{[18F]}$-FDG PET/CT for predicting the risk stratification and prognosis for hypermetabolic GIST. ***Materials and Methods:*** We retrospectively analyzed 42 hypermetabolic GIST patients who underwent $^{[18F]}$-FDG PET/CT before curative resection as initial treatment. Intratumoral-metabolic heterogeneity (heterogeneity index, [HI] and heterogeneity factor, [HF]) and metabolic parameters (standardized uptake value [SUV], metabolic tumor volume [MTV], and total lesion glycolysis [TLG]) of the lesions were determined. MTV, TLG, HI and HF were calculated based on fixed threshold of SUVmax at 2.5, 3.0, 3.5. The area under the curve (AUC) was used to evaluate the predictive ability of factors for risk stratification. Overall survival (OS) was as endpoints. Based on the multivariate Cox regression analysis, independent risk factors were identified. ***Results:*** This study included 42 patients with GIST in hypermetabolism of the $^{[18F]}$-FDG PET/CT (SUVmax > 3.5), including 20 patients with non-high-risk and 22 patients with high-risk. Location, size, mitotic count, necrosis or hemorrhage, MTV (2.5, 3.0, 3.5), TLG (2.5, 3.0, 3.5), HI (2.5, 3.0, 3.5), and HF, in the high-risk group were significantly higher than those in the non-high-risk group (all P<0.05). Location, size, and metabolic parameters (MTV3.0, TLG2.5, HI3.0, HF) were chosen for logistic regression analyses. In multivariate logistic regression analyses, MTV3.0 (P=0.025, OR: 17.34), location (P=0.05, OR:7.09), and size (P=0.029, OR=9.07) were independently correlated with risk stratification. The AUC of the mathematical model of MTV3.0 + location+ size was 0.926 compare to the AUC of MTV3.0 was 0.805 (P<0.05). Gender, SUVmax, HI3.0 and HI3.5 were significant prognostic factors affecting OS (P<0.05). HI3.0 and HI3.5 were excluded from the multiple regression analysis, because of the VIF > 10 in multicollinearity. Therefore, SUVmax retained statistically significant prognostic value as independent determinants of OS. Patients with values of SUVmax>10.25 had a shorter OS (P=0.013). ***Conclusion:*** Various metabolic parameters derived from $^{[18F]}$-FDG PET/CT were higher in high-risk GIST. MTV3.0, location and size were independent risk factors for risk stratification, and the mathematical model could predict risk stratification more effectively for patients with hypermetabolic GIST preoperatively. In this group of hypermetabolic GIST patients, SUVmax were independent risk factors for OS.

EPS-152

Application of ^{18}F-FDG PET/MRI Guided Chemoradiotherapy in Esophageal Cancers: A Prospective Clinical Trial.

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Aim/Introduction: Esophageal cancer (EC) is a highly fatal disease and causing approximately 500,000 deaths worldwide each year. Curative treatment for advanced EC typically includes chemoradiotherapy followed by surgery, nevertheless, EC patients still have a poor prognosis and with a five-year survival of less than 20%. It is the basis of patient management to evaluate response precisely. 18F-fluorodeoxyglucose positron emission tomography (18F-FDG PET) can reflect metabolism changes during treatment. Thus, we utilized multimodal images based on longitudinal 18F-FDG /magnetic resonance imaging (MRI), correlated imaging parameters with pathological tumor regression scores (TRS), aiming to assess intra-tumor heterogeneity through the dose-response matrix (DRM) and explore potential imaging biomarkers for TRS prediction. ***Materials and Methods:*** This study prospectively included patients with pathologically confirmed esophageal squamous cell carcinoma. All patients received two cycles of chemotherapy (albumin-paclitaxel and carboplatin) plus concurrent radiotherapy (40Gy/20f). Patients underwent 18F-FDG PET/MR scans pre- and post- neoadjuvant therapy. We delineated the region of interest by a cutoff of standard uptake value of 2.5, on which SUVmean and SUVmax were calculated. Following deformable image registration, a DRM model was constructed based on the change ratio of SUV in voxel level. The final response was assessed based on the pathological diagnosis of the surgical specimen. Patients were divided into positive TRS group (score 2 or 3) and negative TRS group (score 0 or 1). The primary outcome was the association of imaging parameters with TRS. ***Results:*** We prospectively recruited 14 EC patients with 13,667 voxels in total from October 2022 to July 2023 (ChiCTR2100051599). Of them, three patients had a positive TRS and ten patients achieved negative TRS. The DRM was 0.40±0.11 for the entire cohort. Only four patients had voxels with DRM>1.0. And the number of voxels with DRM>1 in each patient present significant difference between TRS+ and TRS- groups (p=0.008). However, mean, median, coefficient of variation, 25 and 75 percent values of DRM, SUVmean and SUVmax of pre- and post-therapy scans all did not show significant correlation with TRS. ***Conclusion:*** The voxel numbers with high DRM values in each patient, instead of SUV parameters at sole timepoint, has the potential to predict TRS. Voxel analysis based on longitudinal 18F-FDG PET/MRI might reflect spatial differences of tumor regression during neoadjuvant chemoradiotherapy. Further studies with larger sample size might yield more convincing results. ***References:*** [1] Yan D, Chen S, Krauss D J, et al. Int J Radiat Oncol Biol Phys, 2019, 104(1): 207-218.

EPS-153

Predictive Factors For Postembolization Syndrome After 166-Holmium Radioembolization

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Aim/Introduction: Transarterial catheter-directed therapies are used in primary and secondary hepatic malignancies that are unresectable and not amenable to other local treatments. Transarterial radioembolization(TARE), a subtype of these locoregional therapies, delivers microspheres containing 166Ho or 90Y into the tumor-supplying artery.[1] Post-embolization syndrome(PES) may occur 24-72h after and usually presents with fever, nausea and/or abdominal pain. This study aims to characterize the patients submitted to 166Ho-TARE and to identify predictors of PES. ***Materials and Methods:*** Prospective study including patients with BCLC stage 0, A and B hepatocellular carcinoma(HCC) or neuroendocrine tumor(NET)/colorectal cancer(CRC) metastasis with contraindications for other locoregional therapies submitted to 166Ho-TARE procedure during 2023 in a tertiary referral center. Patients were subdivided between two groups whether PES had occurred. Q-suite was used for dosimetry and SPSS v27 for statistical purposes. ***Results:*** Fourteen patients were deferred for 166Ho-microspheres therapy. The median age at the procedure was 64,0(13,3) years, 64% were female and the main type of cancer was HCC. Most lesions were solitary (1,1±0,4) with a median maximum diameter of 53mm. PES incidence was 29%(n=4), with nausea/vomiting being the most common symptoms. The majority of patients with PES were males(75%) with a median age of 66,5 years, although not statistically significant between groups.The number of vials used for liver malignancies was significantly higher in the PES group than the non-PES group, although the administered activity was similar between groups. Dosimetric and volumetric variables were similar between both groups. The area under curve (AUC) of the ROC curve using the number of vials as a predictive factor for the occurrence of PES was 0,700, which was considered acceptable. ***Conclusion:*** Data on PES occurrence rate after TARE is scarce, but broadly studied after transarterial chemoembolization(TACE). Our PES incidence(29%) was similar to few TARE studies[2], as its minimal embolic effect is associated with a lower incidence of PES (20-55%vs 15-90% in TACE). [3]Our studies suggest that the number of vials used for the treatment may be associated with higher PES occurrence rates(AUC0,700) rather than the administered activity and number of microspheres(AUC0,400). A higher number of vials may be associated with a more complex tumor vascular anatomy and burden. Also, the more vials are used, the greater the volume of saline solution perfused, which ultimately leads to stasis and reflux. These factors may play a role in PES[4], although it is pathophysiologically multifactorial and complex.[5]

EPS-154

The prognostic value of Choline PET/CT for the initial assessment of patients with hepatocarcinoma

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Aim/Introduction: The aim of this study was to assess the added prognostic value of Choline PET/CT compared with MRI and FDG PET/CT as "standard of care" and the correlation with the overall survival (OS) in patients with hepatocarcinoma (HCC). Some articles showed that dual-tracer FDG/Choline PET/CT behavior of uptake shows high overlap between well and poorly differentiated HCC. Few data are available and the usefulness of Choline PET/CT in the clinical decision process in HCC is not established yet. ***Materials and Methods:*** This retrospective study included 78 treatment naïve patients with HCC who underwent Choline PET/CT for the initial assessment together with "standard of care" MRI and 18F-FDG PET/CT. To our knowledge this is the largest population of patients with HCC who underwent dual tracer PET/CT comparing to data already published. MRI and PET/CT exams were analyzed in a workflow created in order to make correlations with the MRI regarding the overlapping. The tumor volume (VOI) was defined on the MRI and this VOI was propagated

on the coregistered FDG and respectively Choline PET/CT in order to perform PET segmentation. MRI, Choline and FDG volumes were tested for association with overall survival (OS). The linear correlation between MRI and Choline volumes was evaluated and multivariate models were created on the basis of dichotomized variables using the median value of MRI, Choline and FDG volume as a threshold. ***Results:*** The results of univariate analyses showed that larger MRI and Choline volumes were associated with poor OS. MRI volume >17,81 was associated with poor OS in comparison with MRI <= 17,81 (p value 0,005; hazard ratio 0,35; 95% CI 0,16- 0,77). Choline volume > 8,4 was also associated with poor OS. The survival curves were significantly different for Choline volume median cutoff > 8,4 in comparison with Choline volume <=8,4 (p value 0,04; hazard ratio 0,4; 95% CI 0,21-1,01). A positive FDG PET/CT was associated with poor OS in comparison with a negative FDG PET/CT (p value 0,02). There was a significant statistical correlation between MRI volume and Choline volume (R squared 0,79; p value <0,0001). The multivariate analyses showed that neither Choline volume nor FDG volume had not statistically significant prognostic value (p value 0,8 and 0,2 respectively). ***Conclusion:*** In our study of a unique population of patients with HCC who underwent dual tracer PET/CT, Choline PET/CT did not have an added prognostic value compared with MRI.

EPS-155

Fibroblast activation protein alpha (FAPα) directed imaging in patients with peritoneal carcinomatosis (PC) of various tumor entities prior to laparoscopy for planned cytoreductive surgery (CRS)/hyperthermic intraperitoneal chemotherapy (HIPEC)

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Aim/Introduction: Although the detection efficacy (DE) of PC on contrast-enhanced CT (ceCT) has improved, it still varies significantly depending on location, size and presence of ascites, resulting in an ongoing diagnostic challenge. The extent of PC and the involvement of the small intestine region are critical factors for the success of CRS/HIPEC. Here, we report the DE of FAPα directed imaging in PC of various tumor entities compared to 18F-FDG PET and ceCT. ***Materials and Methods:*** In a prospective observational study conducted between 01/2022 and 10/2023, 12 patients with expected PC underwent clinical 68Ga-FAPI-46, 18F-FDG PET, and ceCT. One blinded nuclear medicine physicist and radiologist independently performed a region-based analysis. Disagreement was resolved by joint consensus read. Evaluation included sensitivity, specificity, and positive/negative predictive values (PPV/NPV) on a regional basis and by lesion size score using a simplified PC index (PCI) grouping small intestine involvement in one region. Wilcoxon-test was performed to compare SUVmax and Tumor-to-Background Ratio (TBR; blood pool, liver, intestine, muscle). Standard of reference was the PCI obtained during subsequent laparoscopy. Impact on management was evaluated through a post-imaging questionnaire sent to the treating surgeon. ***Results:*** In 12 patients with n=6/3/3 colorectal cancer/gastric cancer/other, 72/120 regions (60%) were detected as tumor-positive during subsequent laparoscopy (mean PCI: 12 (range:0-30); time between 68Ga-FAPI-46/laparoscopy (mean (range): 17 days (1-71 days)). Region-based sensitivity/specificity/PPV/NPV were 53%/93%/90%/56% for 68Ga-FAPI-46 PET, 32%/96%/91%/51% for 18F-FDG PET and 47%/91%/89%/53% for ceCT, For all imaging modalities, DE decreases with decreasing lesion size score (Score 3 vs. 1: 68Ga-FAPI-46: 65% vs. 26%, 18F-FDG: 48% vs. 16%, ceCT: 57% vs. 23%). DE in small intestine involvement was 56% for 68Ga-FAPI-46/50% for 18F-FDG/56% for ceCT. Tumor uptake (SUVmax) for 68Ga-FAPI-46 PET vs. 18F-FDG PET was: 5.1 (2.5) vs. 3.8 (2.1) (average (SD)), p=0.16. Only TBRliver was significantly higher on 68Ga-FAPI-46 PET (5.4 (3.0) vs. 1.6 (1.0) (average (SD)), p=0.012) when compared to 18F-FDG PET. 3/12 patients were not treated with CRS/HIPEC. This decision was based on the finding of a high PCI during laparoscopy in n=2 and on the detection of extra-abdominal metastases on 68Ga-FAPI-46 PET in n=1. ***Conclusion:*** Detection of PC still remains challenging. DE of 68Ga-FAPI-46 PET was slightly superior to 18F-FDG PET/ceCT. It may be used additionally in equivocal cases, especially in the liver region due to better delineation, prior to planned CRS/HIPEC. In some cases, 68Ga-FAPI-46 PET might contribute to avoid unnecessary major surgery.

EPS-156

PET/CT imaging with [^{68}Ga]Ga-NOTA-anti-HER2-VHH1 in cancer patients with potential HER2 expression: first clinical results

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Aim/Introduction: Human epidermal growth factor receptor type 2 (HER2) can be highly expressed on the cell membrane of breast cancer (BC) and gastric cancer (GC). HER2-targeted therapies now also include antibody-drug conjugates that have also shown efficacy in cancers with a lower expression level (HER2-low). Information on the HER2-expression is important for therapy selection, and is currently assessed using tissue biopsies, but this does not allow assessment of spatial and temporal heterogeneity. This could be better assessed using PET/CT imaging. A phase I and-II clinical trial of [68Ga]Ga-NOTA-anti-HER2-VHH1 in 40 patients confirmed the excellent safety profile and repeatability of the tracer. We here report on cohort 2 of the current trial (NCT03924466). ***Materials and Methods:*** This single-centre, open-label, nonrandomized, phase II study evaluates the clinical potential of [68Ga]Ga-NOTA-anti-HER2-VHH1, a radiolabelled single domain antibody fragment for PET/CT imaging of HER2, in patients with different cancer types. Metastatic cancer patients with at least one lesion (minimum 10 mm; short axis for lymph nodes), were included. Per protocol, 37 - 185 MBq with up to 200 µg NOTA-Anti-HER2 VHH1 was administered and PET/CT was performed at 90±15min. Tracer uptake in metastases was measured using Standard Uptake Values (SUV) and compared with SUV-values on [18F]FDG PET/CT, both reported as ranges in different lesions. Liver and liver capsule metastases were analysed separately due to the increased HER2-signal in healthy liver. ***Results:*** Until April 2024, 6 patients were included and injected with 118.54+/-8.56 MBq. In patient 1, HER2-positive BC with skin and bone metastases, HER2-uptake was 0.71-1.61 while FDG-uptake was 3.35-7.03. In patient 2, HER2-positive oesophageal cancer with bone metastasis, HER2-uptake was 3.23 and FDG-uptake was 3.75. In patient 3,

HER2-positive GC with brain metastasis, HER2-uptake was 3.16. In patient 4 and 5, HER2-positive GC and HER2-low BC respectively, only liver metastases where present. In patient 6, HER2-low BC with bone metastasis, HER2-uptake was 2.66 and FDG-uptake was 6.24 on [18F]FDG PET/CT. For liver (capsule) metastasis, HER2-uptake was 6.21-11.28, irrelevant of HER2-status and likely due to nearby normal liver uptake. ***Conclusion:*** In conclusion, [68Ga]Ga-NOTA-anti-HER2-VHH1 is effective in targeting metastasis of HER2-positive and HER2-low metastatic cancer of different cancer types at the level of the brain and bone. Metastatic lesions in liver and gastro-intestinal are difficult to evaluate due to high physiological background activity.

EPS-157

^{68}Ga-FAPI-46 in patients with Gastrointestinal Stromal Tumors (GIST) - An Update of a Single-Center, Prospective, Observational Study (NCT04571086)

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Aim/Introduction: GISTs represent the most prevalent mesenchymal neoplasms of the gastrointestinal tract. Previous studies have demonstrated heterogeneous uptake on 68Ga-FAPI (fibroblast activation protein inhibitor)-46 PET in GISTs. Here, we compared detection efficacy, tumour uptake, and tumour-to-background ratio (TBR) of 68Ga-FAPI-46 PET with contrast-enhanced CT (ceCT) and 18F-FDG PET, and aimed to assess the impact on management in an extended cohort. ***Materials and Methods:*** All patients with GIST in our prospective observational study (NCT04571086) who underwent 68Ga-FAPI-46 PET/CT for initial staging/restaging between 06/2020 and 12/2023 were retrospectively reviewed. Clinical data and histopathology, including mutation status, were collected. A lesion-/region-based analysis was performed to evaluate the detection efficacy of 68Ga-FAPI-46 PET compared to 18F-FDG PET and ceCT, considering true/false positive/negative findings. Histopathology/follow-up were standard of reference. SUVmax/SUVpeak/TBRs were compared using Wilcoxon test. Subgroup analyses for age, sex, primary tumour location, current therapy, and number of prior therapies were performed for both PET modalities (Mann-Whitney U test). Impact on management was assessed using pre-/post-imaging physician questionnaires. ***Results:*** 23 patients with GIST (median age: 61 years; range: 24-84 years) were evaluated. C-KIT/other mutations were present in n=19 (83%)/n=4 (17%) patients. 144 lesions were detected across all imaging modalities (primary: n=34 (23.6%), lymph node: n=1 (0.7%), distant metastasis: n=109 (75.7%)). Detection rates for 68Ga-FAPI-46 PET/18F-FDG PET/ceCT were: n=11/32/34 (primary), n=1/1/1 (lymph node), n=66/50/80 (distant). False-positive findings on 18F-FDG PET/ceCT were n=23 lymph nodes in 3 patients (all true negative on 68Ga-FAPI-46 PET), and false-positive findings on 68Ga-FAPI-46 PET were n=3 distant metastases in 3 patients (all true negative on 18F-FDG PET/ceCT). SUVmax showed no significant difference between both tracers (68Ga-FAPI-46 vs. 18F-FDG: 7.6±5.1 vs. 9.0±8.8). Interpatient heterogeneity was confirmed with mean SUVpeak values ranging from 1.2 to 20.5 for 68Ga-FAPI-46 PET and from 1.6 to 31.2 for 18F-FDG PET. Subgroup analysis revealed a significant difference in SUVmax on 68Ga-FAPI-46 PET between patients with ≤1/>1 pretreatments (mean±standard deviation: 8.8±5.6 vs. 4.9±2.7, p=0.046) and patients on therapy vs. those with >1 month since last therapy (10.9±5.2 vs. 6.3±4.7, p=0.011). TBRliver/TBRbackground was significantly higher for 68Ga-FAPI-46 (p=0.005/p<0.001) and TBRbloodpool/TBRmuscle for 18F-FDG (p=0.011/p<0.001). Biopsy was avoided/additionally performed in n=3/n=2 patients. Based on 68Ga-FAPI-46 PET, treatment was changed from chemotherapy to active surveillance in one patient. ***Conclusion:*** 68Ga-FAPI-46 PET demonstrates a higher detection rate for distant metastases compared to 18F-FDG PET, with ceCT showing the highest overall detection efficacy. 68Ga-FAPI-46 PET uptake was highest in treatment-naïve patients.

EPS-158

Characteristics and Prognostic Relevance of ^{18}F-FDG PET/CT in Hepatoblastoma

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Aim/Introduction: To evaluate the imaging features and prognostic relevance of metabolic parameters derived from pre-treatment 18F-FDG PET/CT scans in pediatric patients with hepatoblastoma (HB). ***Materials and Methods:*** A retrospective analysis was conducted on pediatric patients with extracranial solid tumors suspected of HB who underwent pretreatment 18F-FDG PET/CT scans. The study focused on patients who met specific inclusion criteria, including being under 18 years of age, having complete medical records, and receiving systemic therapy after the nuclide imaging. Patients who had undergone surgery or chemotherapy before the PET imaging or had concomitant tumors were excluded. Clinical data such as age, sex, and alpha fetoprotein (AFP) were collected. Metabolic parameters of the primary tumors, including maximum standardized uptake value (SUVmax), mean standardized uptake value (SUVmean), tumor metabolic volume (MTV), and total lesion glycolysis (TLG), were measured. The prognostic value of metabolic parameters and clinical data for overall survival (OS) and progression-free survival (PFS) was analyzed using the univariate Kaplan-Meier method. ***Results:*** Among the cohort of 47 patients diagnosed with extracranial solid tumors, a total of 12 patients (6 boys and 6 girls) were pathologically confirmed to have HB, and all of them showed positive results on PET imaging (sensitivity and specificity : 100%). The patients were initially diagnosed with HB at a median age of 19.0 months (6.0-73.0 months). The HB lesions exhibited high and heterogeneous accumulation of FDG and PET/CT imaging successfully visualized lymph node metastases in 7 cases. In the primary HB tumors, the median SUVmax was 7.48 (4.92-11.87), SUVmean was 4.02 (2.46-6.32), maximum diameter was 10.64±2.65 cm, MTV was 127.00 cm3 (25.82-696.00 cm3), and TLG was 400.65 g (112.44-1539.84 g). The median survival time was 458 days (3-1163 days). Factors such as age > 37.5 months (P=0.027 and P=0.009), SUVmax < 5.83 (both P=0.027), SUVmean < 3.07 (both P=0.027), and normal AFP (P=0.005) were identified as significant predictors for both progression-free survival and overall survival, with normal AFP predicting a shorter overall survival time. ***Conclusion:*** Our study demonstrated the clinical utility of 18F-FDG PET/CT in

diagnosing and assessing the prognosis of HB. The presence of higher levels of HB and normal AFP levels was associated with OS and PFS, aligning with established guidelines. Interestingly, our findings revealed that lower SUVmax and SUVmean values were also associated with worse OS and PFS outcomes, presenting a unique aspect of our research.

EPS-159

^{68}Ga-FAPI PET imaging assesses tumor immunity and guides TGF-β inhibition to sensitize metastatic colorectal cancer to immunotherapy

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Aim/Introduction: Improving and predicting tumor response to immunotherapy remains challenging. Combination therapy with a transforming growth factor-β receptor (TGF-βR) inhibitor that targets cancer associated fibroblasts (CAFs) is promising to enhance efficacy of immunotherapies. However, the effect of this approach in clinical trials is limited, requiring in vivo methods to better assess tumor responses to combination therapy. ***Materials and Methods:*** We measure CAFs in vivo using 68Ga-labeled fibroblast activation protein inhibitor (68Ga-FAPI)-04 for PET/CT imaging to guide combination of TGF-β inhibition and immunotherapy. 131 patients with metastatic colorectal cancer (CRC) underwent 68Ga-FAPI and 18F-fludeoxyglucose (18F-FDG) PET/CT imaging. Relationship between uptake of 68Ga-FAPI or 18F-FDG and tumor immunity was analyzed in patients. Mouse cohorts of metastatic CRC were treated with TGF-βR inhibitor combined with KN046 which blocks PD-L1 and CTLA4, followed with 68Ga-FAPI and 18F-FDG micro-PET/CT imaging to assess tumor responses. ***Results:*** (1) In our clinical trial, high uptakes of 68Ga-FAPI, but not 18F-FDG, demonstrated strong association with reduced tumor infiltrated T cells in patients with peritoneal or liver metastatic colorectal cancer.(2) In the preliminary trial, Patients who presented high uptakes of 68Ga-FAPI by PET/CT scan in their colorectal metastasis demonstrated poor prognosis upon PD-1/PD-L1 immunotherapy.(3) In preclinical mouse cohorts, TGF-β receptor inhibitor significantly sensitized metastatic colon cancer to KN046 (an ICB blocks PD-L1 and CTLA4), enhancing tumor infiltrated T cell number and function.(4) 68Ga-FAPI PET/CT imaging accurately monitored the dynamical changes of CAFs and tumor response to TGF-β receptor inhibitor combined with immunotherapy. 68Ga-FAPI PET/CT could guide scheduling of TGF-β inhibitor to optimize combination strategy with immune checkpoint blockade (ICB) in treating metastatic CRC. ***Conclusion:*** 68Ga-FAPI PET/CT imaging is powerful in assessing tumor immunity and response to immunotherapy in metastatic CRC. This study supports future clinical application of 68Ga-FAPI PET/CT to guide CRC patients for precise TGF-β inhibition plus immunotherapy, recommending 68Ga-FAPI and 18F-FDG dual PET/CT for CRC management.

EPS-160

FDG-PET/CT as a method of patient selection and response evaluation in patients with peritoneal metastasis treated with Pressurized IntraPeritoneal Aerosol Chemotherapy. The PIPAC-OPC7 study

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Aim/Introduction: Pressurized IntraPeritoneal Aerosol Chemotherapy (PIPAC) is increasingly used in the treatment of patients with peritoneal metastasis (PM). Most studies use RECIST, Peritoneal Cancer Index, or the histological Peritoneal Regression Grading Score (PRGS) to evaluate treatment response, but this assessment remains challenging and lacks consensus. Imaging with FDG-PET/CT is the cornerstone during response assessment in several cancer types, providing information on both morphological changes as well as qualitative and quantitative metabolic changes. This is the first study to evaluate the utility of FDG-PET/CT during PIPAC for patient selection and response evaluation in patients with PM. ***Materials and Methods:*** A prospective pilot study will be conducted on 16 patients suffering from peritoneal metastasis originating from four primary cancers: gastric, pancreatic, ovarian, and colorectal cancer. Patients are treated in a series of three PIPACs; peritoneal biopsies are taken during each treatment and evaluated according to PRGS. The FDG-PET/CT scans will be completed at baseline, and after PIPAC 1, and 3. Patients with FDG-negative PM at baseline are still included to investigate if PIPAC itself leads to FDG-positive changes after PIPAC 1. ***Results:*** The study started inclusion in March 2024. The primary objective is the number of patients with metabolic response according to FDG-PET/CT evaluated by PERCIST 1.0 after PIPAC 3. Secondary objectives include number of patients with metabolic response after PIPAC 1, number of patients with FDG-positive peritoneal surface after PIPAC 1 despite FDG-negative baseline PET/CT (false positive/feasibility), and the number of patients where FDG-PET/CT (evaluated by PERCIST one-lesion) agrees with histological response according to PRGS after PIPAC 1 and 3. ***Conclusion:*** We hypothesize that FDG-PET/CT and PERCIST 1.0 is feasible and can reflect metabolic response in patients with PM treated with PIPAC. This study may provide important data needed to plan future randomized controlled trials within the treatment of PM.

EPS-161

^{68}Ga-FAPI-46-PET/CT in Primary Sclerosing Cholangitis with Suspected Cholangiocarcinoma

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Aim/Introduction: Primary Sclerosing Cholangitis (PSC) is a rare inflammatory, fibrosing and stricturing biliary duct disease, that is associated with a high risk of cholangiocarcinoma (CCC). Recognition of CCC in PSC remains challenging due to a lack of sensitive and specific imaging markers. 68Ga-FAPI-PET/CT has recently been suggested as a suitable CCC imaging tool. We sought to evaluate its potential in the specific setting of PSC. ***Materials and Methods:*** 11 PSC patients (5w, 6m; mean duration of PSC 8.0±5.9y), 8 patients with histologically proven CCC (2w, 6m; mean duration of CCC 2.7±3.3y) and 5 controls without history of hepatic disease (1w, 4m) underwent 68Ga-FAPI-46 PET/CT. Results were compared to endoscopic retrograde cholangiopancreatography (ERCP), laboratory parameters and

clinical Fibrosis-4 (FIB-4) score. For PET analysis, physiological uptake was defined as mean SUVpeak of all controls, plus 2 SD. Non-physiologic liver uptake patterns were visually classified, and a FAP liver volume above physiologic uptake (FAP-livo) was calculated. ***Results:*** Physiological liver FAP signal in controls was homogeneous with a SUVbw of 1.5+0.3. FAP-livo was elevated in CCC as well as in PSC patients, and lesion SUVpeak did not differ between PSC and CCC (mean±SD, 9.9±3.9 vs. 13.7±5.6, p=0.10). Owing to the high level of diffuse FAP signal elevation in active PSC regions, additional detection of focal lesions typical for CCC was not feasible. However, PSC mainly showed diffuse regional uptake, while CCC showed mainly focal uptake. In PSC, FAP expression corresponded with ERCP results, being more intense along dominant strictures. FAP-livo correlated significantly with FIB-4 (r=0.67, p=0.03) and White-blood-cell-count (r=0.66, p=0.03) in PSC. ***Conclusion:*** Active PSC is associated with strongly elevated FAP overexpression, up to the level of CCC. While this complicates the detection of PSC-associated CCC, FAPI PET/CT may be used for the assessment of PSC activity as a measure of fibrotic disease progression risk or response to anti-inflammtory/anti-fibrotic therapy.

EPS-162

The Role of 68Ga-FAPI-04 PET/CT in Predicting Pathological Response to Neoadjuvant Chemoradiotherapy in Rectal Cancer

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Aim/Introduction: Neoadjuvant chemoradiotherapy (nCRT) before surgery is the standard treatment approach in locally advanced rectal cancer.Patients with a complete response can be followed without surgery according to "wait and watch" protocol.Predicting the response to neoadjuvant treatment will reduce mortality and morbidity by personalizing treatment and increase the quality of life in this patient group with long life expectancy. Cancer-associated fibroblasts are responsible for tumor progression and resistance to treatment.Recent studies with 68Ga-FAPI PET/CT have reported its important role in determining treatment approaches as well as diagnosis.In our study, we aimed to determine the role of 68Ga-FAPI-04 PET/CT in predicting the pathological response to nCRT in rectal cancer, in comparison with 18F-FDG PET/CT. ***Materials and Methods:*** A total of 22 patients with newly diagnosed locally advanced rectal cancer were included in the study.68Ga-FAPI-04 PET/CT imaging was performed in the same week as ^{18}F-FDG PET/CT before neoadjuvant treatment.Both scans were acquired 60 minutes after the i.v. injection. SUVmax, SUVmean, SUVpeak of the primary tumor for both; GTV and TLF for 68Ga-FAPI; MTV and TLG values for ^{18}F-FDG were calculated.All patients received nCRT(capecitabine + radiotherapy).According to post-treatment MRI, colonoscopy and colonoscopic biopsy findings, 4 cases with complete response were included in the "watch and wait" protocol.Other patients undergone surgery and pathological response to treatment was evaluated and classified according to the Modified Ryan Tumor Regression Score.PET/CT findings of two main groups: complete responders and non-responders were compared and analyzed. ***Results:*** After nCRT, complete response (score 0) in 7 (32%), partial and poor response (score 2 and 3) in 15 (45% and 23%) patients were reported.While there was no difference between responders and non-responders SUVmax, SUVmean, SUVpeak in ^{18}F-FDG (p>0.05 for all); SUVmax, SUVmean and SUVpeak of the primary tumor in the complete responders were significantly lower than non-responders in 68Ga-FAPI-04 (p:0.003 for all).No significant difference was detected between ^{18}F-FDG and 68Ga-FAPI-04 SUVmax/mean/peak values in responders (p>0.05 for all).^{18}F-FDG SUVmax and SUVpeak were significantly higher than 68Ga-FAPI-04 in non-resporders (p:0.01, p:0.01).No significant difference was detected between SUVmean (p>0.05). MTV, TLG, GTV, and TLF values of responders were significantly lower than non-responders (p:0.001, p:0.012, p:0.004, p:0.005). ***Conclusion:*** Many retrospective studies have reported that stroma-rich colorectal tumors are associated with shorter disease-free and overall survival, and resistance to treatment.According to our study, treatments can be personalized, and treatment-related morbidities can be reduced with the predictive information provided by 68Ga-FAPI PET/CT in rectal cancer.

EPS-163

The Role of Ga68-NODAGA-Exendin-4 PET/CT Imaging in the Diagnosis of Endogenous Hyperinsulinemic Hypoglycemia

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Aim/Introduction: Endogenous hyperinsulinemic hypoglycemia (EHH) commonly involves the differential diagnosis of insulinoma and nesidioblastosis. Conventional methods are limited in localizing insulinoma. 68Ga-Exendin-4 PET/CT has gained attention recently. This study investigates the effectiveness of 68Ga-Exendin-4 PET/CT in detecting insulinomas in cases with suspected EHH and in differentiating nesidioblastosis. ***Materials and Methods:*** In this study, we included cases that were examined with the diagnosis of EHH and whose insulinoma could not be localized with conventional methods.Following the intravenous 68Ga-Exendin-4 injection in all patients, standard whole body images were taken at the 1st hour and abdomen at the 2nd hour. The patients were divided into two groups: cases with a focal focus suspicious for insulinoma on 68Ga-Exendin-4 PET/CT, and cases with no focus detected and suspected nesidioblastosis.Pancreatic volumes(PV), average pancreatic SUVmean(PS), average mediastinal SUVmean(MS) values as background activity and pancreatic burden (PB) = ((PSxPV) / MS)) values were calculated for 19 adult patients. Average PB (± SD) values for both groups were calculated. The level of difference in PB values between insulinoma and nesidioblastosis groups was evaluated by t-test. The findings were confirmed by pathology results. ***Results:*** PET/CT imaging with an average of 2.52 (±0.99) mCi 68Ga and 4.69 (±1.65) µg Exendin-4 was applied on 19 adults and 3 newborns. Focal 68G-Exendin-4 uptake, at least three times higher than physiological pancreatic uptake, was observed in 6 adults and 2 newborns, favoring insulinoma. In the insulinoma group, the average PB was calculated as 447.97±108.05, while in the nesidioblastosis group, it was 847.73± 666.6. Although 10 patients had PB values above the reference value set by the insulinoma group, suggesting nesidioblastosis, no significant difference was found in average PB values between the two groups (p:0.09). One case with PB: 2837.3, initially suspected of

nesidioblastosis, was confirmed to have diffuse cell hyperplasia on pathological analysis after distal pancreatectomy. All cases with focal uptake on 68Ga-Exendin-4 PET/CT were confirmed by pathology. ***Conclusion:*** In cases evaluated for EHH, 68Ga-Exendin-4 PET/CT enables tumor localization favoring insulinoma in those where conventional methods and 68Ga-DOTATATE PET/CT fail, facilitating the selection of limited surgical methods. The absence of focal uptake with 68Ga-Exendin-4 and high diffuse pancreatic uptake strengthens the preoperative diagnosis of nesidioblastosis, supporting total pancreatectomy as a primary method. Based on our results, we propose 68Ga-Exendin-4 PET/CT for diagnosing nesidioblastosis. 68Ga-Exendin-4 PET/CT stands out with its contribution to distinguishing insulinoma from nesidioblastosis, aiding in selecting the appropriate surgical approach.

EPS-164

Structured Reporting for the Diagnosis of Neuroendocrine Tumor (NET) in ^{18}F-SiFAlin-TATE PET/CT - Impact on Quality and Interdisciplinary Communication

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Aim/Introduction: Our retrospective single-center study aims to evaluate the impact of structured reporting (SR) using a self-developed template on report quality compared to conventional free-text reporting (FR) in ^{18}F-SiFAlin-TATE Positron Emission Tomography/Computer Tomography (PET/CT) for the primary staging and therapy monitoring of patients diagnosed with neuroendocrine tumors (NET). ***Materials and Methods:*** We included 50 patients who underwent ^{18}F-SiFAlin-TATE-PET/CTs for NET staging. FR reports were generated post-examination and compared to SR reports, which were composed retrospectively using a self-developed template within an established software tool (Smart Reporting). All findings were evaluated by a radiologist and a surgeon through a questionnaire to determine their contribution to facilitating clinical decision-making and to assess their completeness, linguistic quality, and overall quality. ***Results:*** In SR the rate of missing at least one key feature was significantly lower than in FR with missing information in 51% of FR vs. 11% of SR ($p < 0.001$). SR significantly increased the capacity of facilitating therapy decision-making from 32% in FR to 55% in SR ($p<0.001$). Trust in the report was significantly higher in SR with a mean of 5.0 (SD= 0.5) vs. 4.7 (SD= 0.5) for FR ($p < 0.001$). SR received significantly higher mean ratings regarding linguistic quality with 4.7 for SR vs. 4.4 for FR ($p =0.004$) and overall report quality with a mean of 4.9 for SR vs. 4.6 for FR ($p < 0.001$). ***Conclusion:*** Using SR over traditional FR enhances the overall quality of reports in ^{18}F-SiFAlin-TATE-PET/CTs for NET staging, serving as a tool to streamline clinical decision-making and enhance interdisciplinary communication in the future.

EPS-165

Severe radiation-induced lymphopenia during PRRT is associated with overall survival

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Aim/Introduction: The development of severe radiation-induced lymphopenia (RIL) has been shown to be associated with overall survival (OS) in patients undergoing external beam radiotherapy (EBRT). Since EBRT and peptide radionuclide therapy (PRRT) both utilize radiation, concerns have been raised regarding the potential negative impact of radiation exposure on lymphocytes during PRRT. The aim of this study was to investigate the effects of PRRT on RIL measured by absolute lymphocyte counts (ALC) and its relation with OS. ***Materials and Methods:*** In this retrospective study, all patients with a neuroendocrine tumor (NET) who received PRRT with [177Lu]Lu-HA-DOTATATE were included. ALC was determined in blood samples that were collected at baseline, 3- and 6-8 weeks post-therapy after each cycle, as well as at 3, 6, 9, and 12 months after conclusion of PRRT. The nadir value in this period was determined and used to determine RIL as per common terminology criteria for adverse events (CTCAE v5) criteria. OS was determined from start of PRRT until last follow-up or death of any cause. Additionally, the uptake of [177Lu]Lu-HA-DOTATATE in healthy organs (kidneys, liver, blood pool, and bone marrow) was quantified on SPECT/CT scans 24 hours after treatment. Statistical analysis included the Cox proportional hazard regression analysis to determine the hazard ratio (HR) for OS, and Spearman's rank correlation coefficient to assess correlations between the uptake of [177Lu]Lu-HA-DOTATATE and ALC. ***Results:*** 230 patients were included in this study cohort. Severe lymphopenia grade ≥3 was observed in 47.8 % of the study population. Median OS was 40 months (95% CI 32.3-47.7) in patients with grade ≥3 lymphopenia, in contrast to 53 months (95% CI 37.7-68.3) in patients with grade 0-2 lymphopenia. An association was found between OS and lymphopenia (grade ≥3 vs grade 0-2; HR 1.54; 95% CI 1.04-2.29; p=0.029). Furthermore, a significant negative correlation was found for the uptake of [177Lu]Lu-HA-DOTATATE in the spleen (r=-0.177, p=0.027) and blood pool (r=-0.175, p=0.029) and a percentage decrease from baseline ALC. ***Conclusion:*** In almost half of the patients severe RIL was observed after PRRT, which was associated with reduced OS. In addition, the uptake of [177Lu]Lu-HA-DOTATATE in the spleen and blood pool was found to negatively correlate with ALC. Further research is warranted to enhance knowledge on the etiology of lymphopenia during PRRT and potential beneficial lymphopenia-mitigating strategies.

EPS-166

Quality Of Life in Patients with Neuroendocrine Tumors Treated with Peptide Receptor Radionuclide Therapy

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Aim/Introduction: Peptide Receptor Radionuclide Therapy (PRRT) is an effective treatment for patients with neuroendocrine tumors (NET), but there are few studies related to the impact of this treatment on the quality of life of patients with NET. We aimed to analyze and summarize the effect of PRRT on the quality of life in these patients by performing a Meta-Analysis. ***Materials and Methods:*** Relevant databases including PubMed, Web of

Science, Cochrane Library, and EMBASE databases were searched up to April 2024. A bibliometric analysis of articles highly relevant to the topic was conducted. Literature for meta-analysis was selected according to the PRISMA statement. Data were merged using STATA18 and fixed effects models were used to pool the data. ***Results:*** A total of 490 articles were collected, of which 15 full-text articles were highly relevant to the topic. EJNMMI and Clin Nucl Med. were the journals with the highest number of publications. Clin Nucl Med is the journal with the highest number of citations. A total of 4 articles were finally included in Meta-Analysis. The results showed that after 1-, 2-, 3-, and 4-cycles of PRRT, the quality of life of the patients improved significantly. The global quality of life score, role function score, and emotional function score improved significantly ($P < 0.05$) compared with pretherapy status. The patient's symptoms were also significantly improved compared to pretherapy status, and fatigue score and pain score were significantly decreased ($P < 0.05$). Moreover, by comparing the patients' quality of life after 4 cycles of PRRT with that after 2 cycles of PRRT, we found that the global quality of life score and role function score improved significantly ($P < 0.05$), fatigue score and pain score of patients decreased significantly ($P < 0.05$). ***Conclusion:*** [177Lu]Lu-DOTATATE and [177Lu]Lu-DOTATOC are currently key radiotherapeutics in the treatment of neuroendocrine tumors, and may significantly improve the quality of life of NET patients.

EPS-167

Prognostic value of inflammation biomarkers for survival in patients with neuroendocrine tumors treated with [^{177}Lu]Lu-DOTATATE

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Aim/Introduction: Several analytical parameters and indexes related to inflammation and nutrition are currently used in various solid tumors in relation to patient prognosis and survival. Our aim was to assess the usefulness of different analytical parameters as predictors of survival in patients with neuroendocrine tumors (NETs) treated with [177Lu]Lu-DOTATATE. ***Materials and Methods:*** Retrospective study of 48 patients with NET treated with [177Lu]Lu-DOTATATE between 2020-2023, with a follow-up ≥6 months post-therapy. The following variables were included: origin, grade, Ki67, mitotic index and analytical parameters related to nutritional status (albumin, total protein), inflammation (C-reactive protein, NT-proBNP, systemic immune-inflammation index [SII]), hematological (hemoglobin, haematocrit, leukocytes, lymphocytes, neutrophils, neutrophil-to-lymphocyte ratio [NLR], platelet-to-lymphocyte ratio [PLR], platelets) before and after completion of therapy. Overall survival (OS) outcomes were recorded by Kaplan-Meier analysis and a multivariate Cox regression model was fitted to study factors associated with OS. ***Results:*** 48 patients with a mean age at diagnosis of 56.34±12.81 years, 52.1% male and a mean follow-up of 4.98±4.74 years. 74.5% of the NETs were gastroenteropancreatic and a Ki67 of 9.26±14.74%. Median overall survival (OS) was 96 months and 12 patients (25%) were deceased. Higher pre-treatment (HR:0.21, p=0.005) and post-therapy (HR:0.12, p=0.031) lymphocyte counts are associated with longer OS. Likewise, higher hemoglobin (HR: 0.65, p=0.04) and hematocrit (HR:0.862, p=0.041) values are associated with longer OS. Analytical parameters related to nutritional status were not associated with changes in OS. NT-proBNP values >300 pg/ml (HR: 10.5, p<0.001) in patients with grades 2-3 as well as SII values >400 (HR: 4,337; p=0,037) were significantly associated with lower OS. NLR>2 (HR:3.87, p=0.049) and PLR>300 (HR:11.88, p=0.01) values are associated with lower OS. ***Conclusion:*** Higher pre and post-therapy lymphocyte counts as well as higher hemoglobin and hematocrit values are related to increased OS. NT-proBNP values >300 pg/ml are associated with decreased OS in patients with grades 2-3 NETs. Moreover, higher SII, NLR and PLR values are associated with decreased OS.

EPS-168

Lutadose Trial: the impact on treatment outcomes of dosimetry after the first administration of [177Lu]Lu-DOTATATE in gastro-entero-pancreatic neuroendocrine neoplasms (GEP NENs) patients

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Aim/Introduction: In radioligand therapy (RLT) with [177Lu]Lu-DOTATATE of gastro-enteropancreatic neuroendocrine neoplasms (GEP NENs), questions remain about the potential benefits of personalized dosimetry.This prospective observational study examines the impact of individualized dosimetry on treatment outcomes in patients with GEP NENs G1-G2 following the standard treatment regimen with [177Lu]Lu-DOTATATE (7.4 GBq x 4 cycles). ***Materials and Methods:*** The analysis was conducted on 42 GEP NEN patients treated following the registered [177Lu] Lu-DOTATATE schedule.Dosimetry was performed after the first and the last cycle, with two SPECT/CT scans 1 and 7 days after administration.Global mean tumour absorbed dose (GTD) was calculated as the sum of lesion doses weighted by lesion mass. Cumulative GTD was calculated as the mean between cycle 1 and 4 multiplied by 4. Patients were followed-up for at least one year, up to a maximum of three years, through blood tests and contrast-enhanced CT (ceCT). The study assessed the correlation between global tumour dose (GTD) and median progression-free survival (PFS) through the Log rank test of PFS Kaplan Meyer curves. ***Results:*** Using dosimetry after the first cycle, GTD was statistically associated with PFS. The stratification of patients on GTD with the cut-off at 21 Gy provided significantly different PFS of 27.4 months versus non reached (p=0.03), with a hazard ratio of 3.3. At 20 months, PFS was 100% versus 75%. Using the cumulative GTD_TOT with cut-off at about 77 Gy, the same PFS interval were obtained. Low cumulative GTD correlated with a higher risk of progression (hazard ratio: 4.593, p=0.03). GTD_4 after the fourth administration was not associated with PFS. ***Conclusion:*** Our results support the predictive power of dosimetry after the first cycle predicting PFS. This might enter in the decision-making process, especially in scenarios where therapy might be optimized.

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Monday, October 21, 2024, 16:45 - 18:15
Hall G1

CTE 5 - Technologists Committee - Radioguided Surgery

OP-505

Radioguided surgery in nuclear medicine – "The power to detect and to remove"

S. Vidal-Sicart;
Hospital Clínic in Barcelona, Head of the Radioguided Surgery Group, Barcelona, SPAIN.

OP-506

The role of the Technologists in Radioguided Surgery: techniques and patient care

N. Eecloo;
University Hospital Leuven, Nuclear Medicine, Leuven, BELGIUM.

OP-507

Beta-radioguided surgery – Where do we stand and where do we go from here?

P. Fragoso Costa;
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Monday, October 21, 2024,16:45 - 18:15
Hall Y1-Y3

TROP Session: Case Report Session 1: Building Our Collective Knowledge on Theranostics

OP-508

^{177}Lu-PSMA-617 Therapy in a Patient on Haemodialysis with End Stage Renal Failure

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Aim/Introduction: We present a prospective case-study of a patient, who presented with metastatic castration-resistant prostate cancer (mCRPC) for consideration of [177Lu] Lutetium-PSMA-617 (LuPSMA) radioligand therapy (RLT), following progression through several lines of localised and systemic therapy. A significant co-morbidity was his end-stage renal failure (ESRF), requiring haemodialysis three times a week. ***Materials and Methods:*** At presentation, the patient's eGFR was 13mL/min/1.73m2, serum creatinine was 360µmol/L and PSA was 42.8µg/L. ECOG status 3. Total tumour volume on 68Ga-GaPSMA PET scan was 325mL, with SUVmean of 12.7 and SUVmax of 114, and no discordant sites on 18F-FDG PET scan. The main discussion was around determining safe and effective administered activity. The Vision trial1 used 7.4GBq (200mCi) dosing for each of 6 cycles, delivered 6-weekly. We concluded that halving this dose and giving 3.7GBq (100mCi) should provide a therapeutic benefit without compromising patient safety. We also chose to treat at 8-week intervals due to patient's ECOG status and transport logistics. ***Results:*** The patient received 4 cycles of LuPSMA RLT, with a median dose of 3.7GBq. 24-hour SPECT imaging and dosimetry was acquired after each cycle, with additional imaging and dosimetry performed 4 hours after cycle 1. Salivary glands received an estimated dose of 3-4Gy, comparable to published literature. No appreciable liver/kidney/spleen uptake seen on 4hr or 24hr imaging. Patient maintained his thrice-weekly haemodialysis sessions throughout the process. The patient's PSA dropped from 42.8 pre-treatment to 0.14 after cycle 4 (>99% PSA response). eGFR remained low but did not worsen over the course of 4 cycles (13 pre-treatment to 28 after cycle 4). The patient reported a noticeable decrease in pain with associated decrease in opiate use. The tumour volume on post-therapy imaging dropped from 1367mLs after cycle 1 to 40mLs after cycle 4. Unfortunately a GaPSMA-avid lesion in his lungs did not respond to the LuPSMA RLT and over the course of 4 cycles, the lung lesion increased in size. Due to the decrease in PSMA-avid disease, corresponding drop in PSA, and subsequent increase in size of lung lesion, it was agreed to cease LuPSMA RLT. This is the first such published case-study in Australia. ***Conclusion:*** With careful planning, a patient with ESRF on haemodialysis, with baseline eGFR <30 can be successfully and safely treated with LuPSMA RLT. ***References:*** 1. Sartor O et al. Lutetium-177-PSMA-617 for metastatic castration-resistant prostate cancer. N Engl J Med. 2021;385:1091-103.

OP-509

Treatment of metastatic castrate-resistant prostate cancer patient with two cycles of ^{67}Cu-SAR-bisPSMA (8 GBq) leads to complete response (RECIST) and undetectable PSA level: A case report

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Aim/Introduction: Patients with metastatic prostate cancer (PC) have poor outcomes, despite recent advances in treatment options. Prostate-specific membrane antigen (PSMA) is overexpressed in PC cells and its target is used to image/treat PC patients. The bivalent structure of SAR-bisPSMA (64Cu-SAR-bisPSMA, imaging and 67Cu-SAR-bisPSMA, therapy) may offer advantages (including higher uptake/retention in lesions) compared to current PSMA agents. We report the administration of two cycles of 67Cu-SAR-bisPSMA in a 74-year-old male patient with metastatic castrate-resistant PC (mCRPC) resulting in an undetectable prostate specific antigen (PSA) and complete resolution of his disease. ***Materials and Methods:*** The patient was diagnosed with localized Gleason 9 (PSA 20.5 ng/ml) PC in 2017 and underwent neoadjuvant chemotherapy and definitive radiation with androgen deprivation therapy (ADT) for two years. ADT was resumed in 2020 due to PSA recurrence. The patient had evidence of metastatic disease in 2022 and underwent several lines of systemic therapies including abiraterone, enzalutamide and a clinical trial (PARP inhibitor). Upon progression (May 2023), the patient was enrolled in the phase I/IIa SECuRE clinical trial (NCT04868604) and received one cycle of 67Cu-SAR-bisPSMA, followed by an additional cycle under the FDA Expanded Access Program (EAP) (8 GBq each dose). ***Results:*** Within three months of the first dose of 67Cu-SAR-bisPSMA, the patient's PSA declined from 47.2 to 0.3 ng/ml (99.4% reduction), with a significant decrease in the size of his tumours on imaging and in PSMA uptake (utilizing 64Cu-SAR-bisPSMA). The patient received a second dose of 67Cu-SAR-bisPSMA (September 2023) under the EAP. In October 2023, his PSA further declined to undetectable levels (<0.05 ng/ml, confirmed by two consecutive tests), with all lesions but one achieving complete response (CR) by RECIST v1.1 (one lesion missed CR cut-off by 2 mm, reduction from 27 mm to 12 mm). A CR has been confirmed in all target and non-target lesions at the last follow-up (April 2024), with the PSA remaining at undetectable levels. Adverse events related to 67Cu-SAR-bisPSMA: dry mouth, altered taste and thrombocytopenia (all Grade 1, improved), fatigue (Grade 2, resolved), anaemia (Grade 3, improved to Grade 2). Additional doses are being withheld unless there is disease progression. ***Conclusion:*** This case shows for the first time the anti-tumour effect of two doses of 67Cu-SAR-bisPSMA

in a patient with mCRPC leading to a CR and undetectable PSA level. 67Cu-SAR-bisPSMA had a manageable safety profile and may represent an effective option for the treatment of patients with mCRPC.

OP-510

Alpha-particle therapy in mCRPC: Case Studies utilizing ctDNA as a therapeutic biomarker for early clinical outcome prediction

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Aim/Introduction: First clinical experiences employing prostate-specific membrane antigen (PSMA)-addressing radiopharmaceuticals with the alpha-particle-emitting radionuclide actinium-225 (225Ac) showed astonishing treatment responses in metastasized castration-resistant prostate cancer (mCRPC) patients. In light of the scarcity of 225Ac alongside with eventual treatment resistance, it is crucial to identify patients who will benefit from targeted alpha-therapy (TαT) early in their treatment course. Detecting early clinical outcomes through non-invasive liquid biopsies represents an unmet clinical need in stratifying patient responsiveness. Circulating tumor DNA (ctDNA) is a promising biomarker of disease burden and therapeutic response, since — unlike conventional markers — this metric is agnostic to cancer type. The recent focus has been on stratifying patients based on liquid biopsies. Our case study reports the clinical courses of four distinct patient responses. By comparing clinical data and whole genome sequencing coupled with ichorCNA analysis, we aim to uncover potential mechanisms for treatment resistance and relapse encoded in the patient's ctDNA. ***Materials and Methods:*** Within the framework of ethical approval (S-882/2020), this study involved collecting blood samples from mCRPC patients scheduled for bimonthly [225Ac]Ac-/[177Lu]Lu-PSMA-617 cycles. CtDNA was extracted and prepared for ultra-low-pass whole genome sequencing (ULP-WGS). The study employed ichorCNA algorithm via R (version 3.3.1) for analyzing the sequencing data, which estimates genome-wide copy number alterations (CNA) and tumor fraction (TFx) from the sparse sequencing data. Baseline-adjusted values for TFx and prostate-specific antigen (PSA) percentages are used for comparison. ***Results:*** Patient 10 exhibited a progressive decline in PSA levels across four cycles, -89.0%, with concurrent reduction in tumor fraction to below detection limits, showcasing complete therapeutic response. Patient 5 achieved undetectable PSA levels with a corresponding reduction in initial TFx, demonstrating the treatment's potential effectiveness. Patient 38 experienced a notable initial response with a 74.7% reduction in PSA levels over four treatment cycles, followed by a 22.1% increase indicating progressive disease. Concurrently, TFx decreased by 99.94% along only two cycles followed by relapse to baseline levels, suggesting early relapse detection. Lastly, Patient 34 displayed a partial response with 37.3% reduction in PSA levels after the first cycle, followed by a dramatic 681.1% increase after the second cycle, alongside TFx fluctuations, reflecting large genomic instability. ***Conclusion:*** The reported cases highlight ctDNA`s potential to provide real-time tumor dynamics, offering a nuanced understanding of therapeutic responses over traditional biomarkers like PSA, revealing its capacity to detect both PSMA-positive and -negative metastases, thus offering a complete assessment of tumor burden.

OP-511

Feasibility of ^{99m}Tc-MIP-1404 PSMA Radioguided Surgery in a Patient with Lymph Node Metastases in Recurrent Prostate CancerFeasibility of ^{99m}Tc-MIP-1404 PSMA Radioguided Surgery in a Patient with Lymph Node Metastases in Recurrent Prostate Cancer

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Aim/Introduction: After histological confirmation of prostate cancer (PCa) in a 61-year-old patient, radical prostatectomy with lymphadenectomy was performed in October 2019. With rising PSA levels, a salvage radiotherapy of the prostate region was performed 2020. As PSA levels continued to rise, imaging without evidence of local recurrence was performed in October 2021 (PSMA-PET/CT), in July 2022 (Choline-PET/CT) and in January 2023 (Choline-PET/CT). Only in April 2023, a PET/CT detected two pelvic PSMA-positive lymphnode metastases. Curatively intended radiotherapy could not be realized due to previous radiotherapy. The indication for surgical salvage lymphadenectomy was set. To enable less invasive and successful laparoscopic dissection of the two lymph nodes radiolabeling of the target was requested. ***Materials and Methods:*** We used 99mTc-MIP-1404, a 99mTc-labelled PSMA-radioligand for preoperative labelling of the metastatic lymph nodes. 740 MBq 99mTc-MIP-1404 was administered preoperatively. 18 hours p.i. a preoperative SPECT/CT was acquired. Intraoperatively a laparoscopic gamma probe was used to localize the suspicious lymphnodes. ***Results:*** SPECT/CT acquired 18 hours p.i. a demonstrated activity only in one (of two) PET/CT-positive lesions. Intraoperatively both lymphnodes could be reliably detected. Histopathological work-up of the resected specimens confirmed metastases of the known adenocarcinoma of the prostate. Six weeks after PSMA-RGS, serum PSA decreased from 4.22 ng/ml to 0.02 ng/ml (complete biochemical response). ***Conclusion:*** This is the first implementation of RGS in metastatic PCa in Switzerland. 99mTc-MIP-1404 represents a promising radiotracer for RGS and further use in selected cases is encouraged. In our case one lymphnode was detected intraopoeratively even though it was not visualized in pre-operative SPECT.

OP-512

Multimodal treatment Strategies for Advanced Hepatocellular Carcinoma: a 12-Year Follow-up Case Report

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Aim/Introduction: Multidisciplinary treatment approach is recommended for the management of patients with hepatocellular carcinoma (HCC). ***Materials and Methods:*** A 71-year-old male was diagnosed in 2010 with hepatitis C virus-related hepatocellular carcinoma (HCC). Baseline CT scan showed a single hepatic lesion of 11 cm (VII-VI S). The patient

was initially treated with sorafenib, which was interrupted due to relevant toxicity. Therefore, after evaluation of liver function and discussion in the multidisciplinary board, the target lesion was treated with superselective transarterial radioembolization (TARE) in 2010 (1050 MBq of 90Y-Glass MicroSphere, 120 Gy to target lesion), subsequently with transarterial chemoembolization (TACE) in 2011 (DC-BEADS 100-300 and 300-500 doxorubicin100 mg-loaded particles) and morfological complete response. The patient was followed up with CT scans and liver functional assessment from 2011 to 2017, showing stable disease and liver function. However, in 2017, a CT scan showed a relapse in IVS (2.8 cm), which was subsequently treated with TACE in 2017 and 2018 (respectively, with DC-BEADS 100-300 doxorubicin 75 mg -loaded particles and Lifepearl 200 mu doxorubicin 75 mg-loaded particles), resulting in a partial response. A new dosimetry with 99mTc-MAA was performed in 2018 to predict retreatment with TARE, but the distribution of the macroaggregates was too extensive compared to the margins of the lesion. Therefore, the patient underwent particle-transarterial chemoembolization (p-TACE) in 2019 (100 microns microspheres doxorubicin 75 mg-loaded particles). Nevertheless, a subsequent CT scan in 2020 showed progressive disease due to the presence of new lesions in segments III (11 mm) and IV (4 and 13 mm) of the liver. As a result of disease progression after several loco-regional treatments, systemic therapy was initiated with standard regimen of lenvatinib as a first-line approach, followed by a metronomic capecitabine regimen and, finally, standard regimen of capozantinib. ***Results:*** Unfortunately, the patient died in 2022 at the age of 8,3 due to liver failure, 12 years after the initial diagnosis of HCC ***Conclusion:*** In conclusion, this report highlights the benefits of a multimodal therapy approach, which are reflected in both treatment choice and timing, to achieve a personalized approach and so obtain finally , in an unfavorable prognostic scenario, as the advanced HCC, a survival exceeding 10 years.

OP-513

Exploring [177Lu] PSMA-I&T Therapy in Refractory Multiple Myeloma

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Aim/Introduction: Triple-refractory multiple myeloma (MM) presents a daunting prognosis. It is a neoplasm characterized by notable genomic heterogeneity. Recent investigations within our group have unveiled significant uptake of [68Ga]Ga-PSMA-11 in select MM patients, hinting at the potential theranostic utility of PSMA in specific cases (1). This study reports the initial administration of [177Lu]PSMA in a patient with refractory MM. ***Materials and Methods:*** A 76-year-old male with IgA/Kappa MM, resistant to six therapeutic regimens including daratumumab, lenalidomide, and bortezomib, underwent PET/CT scans with $^{[18F]}$PSMA-1007, exhibiting pronounced tracer uptake in numerous osteolytic lesions, many with extensive soft tissue involvement. Subsequent PET/CT with $^{[18F]}$FDG revealed similar findings. After signing appropriate consent forms, the patient was selected for compassionate treatment with [177Lu]PSMA. ***Results:*** The patient received an initial dose of 7,400 MBq (200 mCi) of [177Lu]PSMA-I&T, which was well tolerated, manifesting slight clinical amelioration in the following week. Visual analysis of whole-body scans at 21h, 30h, and 7 days post-treatment displayed moderate tracer uptake in the lesions, with modest washout observed between the 21h and 30h scans, escalating after 7 days. Following 4 weeks, repeat PET/CTs demonstrated siimilar findings to the initial scans, with a slight reduction in tracer uptake in select lesions and an enlargement in the volume of certain soft tissue lesions, attributed to post-treatment inflammation. A second dose of 7,400 MBq (200 mCi) of [177Lu]PSMA-I&T was administered after 6 weeks, with subsequent whole-body scans showing consistent tracer uptake compared to prior post-therapy images. However, an intercurrent femoral fracture impeded mobility and precluded further imaging evaluations and treatment continuation, culminating in the patient's demise after a brief period. ***Conclusion:*** This preliminary report suggests the feasibility and tolerability of treating MM with [177Lu]PSMA-I&T. While a subtle clinical and imaging response was noted after the first dose, the occurrence of a fracture complication and the severity of the case precluded further assessment and treatment continuation. Nonetheless, [177Lu]PSMA therapy in MM appears safe, with promising initial responses. Comprehensive studies encompassing full treatment cycles (4 doses) and involving less clinically severe patients are warranted to ascertain the efficacy of this therapeutic modality. ***References:*** (1) Souza SPM et al. Eur J Nucl Med Mol Imaging. 2023;50(8):2432.

OP-514

First-In-Human Experience of Peptide Receptor Radionuclide Therapy with ^{177}Lu-DOTATATE in Patients with Advanced Multiple Myeloma

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Aim/Introduction: We conducted an academic prospective phase II trial (SCARLET, NCT04379817) to assess the level of somatostatin receptor 2 (SSTR2) expression in symptomatic relapsing and refractory multiple myeloma (rrMM) patients. Half of the included patients demonstrated favorable imaging criteria (high SSTR2 expression, absence of 18F-FDG positive/SSTR2 negative lesions) and were eligible for peptide receptor radionuclide therapy (PRRT). Two patients included in the SCARLET trial received 177Lu-DOTATATE on an off-label basis. ***Materials and Methods:*** Both patients (1 female 47 y.o, 1 male 67 y.o) were diagnosed with stage III MM according to the Salmon and Durie criteria and had received four previous lines of treatment. Both patients underwent 68Ga-DOTATATE and 18F-FDG PET/CT as part of the SCARLET trial and were subsequently offered treatment with 177Lu-DOTATATE. At baseline, DOTATATE PET/CT demonstrated high SSTR expression at multiple disease sites (patient 1: 6 lesions, patient 2: 17 lesions, no extramedullary lesions) and no 18F-FDG-avid/68Ga-DOTATATE-negative lesions were detected. Both patients had adequate hematological and kidney functions. The treatment was approved by the multidisciplinary tumour board and by the local ethics committee of Jules Bordet Institute. Written informed consent was obtained from both patients. ***Results:*** Patient 1 received 2 cycles of 177Lu-DOTATATE (7.4 GBq) 9 weeks apart. After 2 cycles, a complete metabolic response was observed on 18F-FDG PET/CT, while 68Ga-DOTATATE PET/CT demonstrated the disappearance of target lesions, the stabilization of the remaining lesions and a new discreet uptake in a single preexisting cranial parietal lesion (which was eventually treated with radiotherapy). Light chains remained stable after 2 cycles. Treatment was well tolerated, with grade I nausea, bone pain and alopecia, grade II fatigue and asymptomatic grade III lymphocyte and platelet count decreased. Patient 2 recently received the first cycle of 177Lu-DOTATATE (7.4 GBq) and the treatment was well tolerated

with only a grade II fatigue as an adverse event. ***Conclusion:*** We report the world premiere administration of 177Lu-DOTATATE in two heavily pretreated rrMM patients. The first patient achieved a complete metabolic response after 2 cycles. Disease assessment for the second patient is awaited. Treatment was well tolerated, with minor adverse effects consistent with the known toxicity profile of 177Lu-DOTATATE. A SSTR-based radiotheranostic trial in rrMM patients will soon commence in our Institution.

OP-515

When Lutetium-177 DOTATATE Is Not Available: Insights Into Use of Terbium-161 in the Treatment of Metastatic Paraganglioma

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Aim/Introduction: Multiple publications advocate for the use of radioligand therapy in the treatment of advanced neuroendocrine tumours including metastatic paraganglioma. Lutetium-177 DOTATATE has shown impressive clinical results. Terbium-161 has grown in traction as a potential radionuclide therapy. Minimal published research exists on its clinical outcomes in the management of neuroendocrine tumours1,2. We present its use in the case of a 30-year-old male with previous metastatic grade 2 extra-adrenal paraganglioma and left nephrectomy with disease recurrence. ***Materials and Methods:*** CT imaging showed extensive, inoperable tumour burden with liver metastases. Gallium-68 DOTANOC staging PET-CT demonstrated extensive nodal and liver disease. No discordant lesions were demonstrated on F^{18} FDG PET-CT. His baseline chromogranin A (CGA) was elevated. He had a baseline Eastern Cooperative Oncology Group (ECOG) performance status of 0, with normal haematological and liver biochemistry. His renogram and GFR parameters were acceptable for radionuclide treatment. ***Results:*** After one cycle of Lutetium-177 DOTATATE, post therapy scintigraphy showed uptake concordant with known disease. His CGA also decreased. Owing to logistical issues related to the procurement and delivery of Lutetium-177, he was treated with Terbium-161 DOTATATE. There was post therapy uptake in known disease sites. No additional therapies were administered, and the patient has since demonstrated stable disease. He continued to improve, with a further two-and-a-half fold decrease in CGA ten months post treatment and normal liver function. His serum creatinine, used as a marker of renal function, and bone marrow reserve have shown improvement. His ECOG remains at 0, and his progression-free survival is 14 months. He has also acquired employment, further demonstrating excellent functional status. ***Conclusion:*** Terbium-161 DOTATATE is a potential radioligand alternative to the well-established Lutetium-177 DOTATATE . These results form a foundation for further research into alternative radionuclide therapies in the management of advanced neuroendocrine tumours. ***References:***
1. Baum RP, Singh A, Kulkarni HR, Bernhardt P, Rydén T, Schuchardt C, Gracheva N, Grundler PV, Köster U, Müller D, Pröhl M. First-in-humans application of 161Tb: a feasibility study using 161Tb-DOTATOC. Journal of Nuclear Medicine. 2021 Oct 1;62(10):1391-7
2. Fricke J, Westerbergh F, McDougall L, Favaretto C, Christ E, Nicolas GP, Geistlich S, Borgna F, Fani M, Bernhardt P, van der Meulen NP. First-in-human administration of terbium-161-labelled somatostatin receptor subtype 2 antagonist ([161Tb] Tb-DOTA-LM3) in a patient with a metastatic neuroendocrine tumour of the ileum. European Journal of Nuclear Medicine and Molecular Imaging. 2024 Mar 7:1-3.

OP-516

Prolonged disease-free survival and bladder preservation in a patient with chemotherapy-resistant Muscle Invasive Bladder Cancer (MIBC) after first-in-human ^{177}Lu-FAP radioligand treatment - the RadioMolecularIncubator Experience within the Bladder BRIDGister.

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Aim/Introduction: Patients with MIBC achieving pathological complete response (pCR) upon neoadjuvant chemotherapy (NACT) have improved prognosis. Luminal tumours respond better to NACT. Expression of the radioligand targets FAP and CXCR4 is also found in chemotherapy-resistant tumours. The objective of this study was to validate the predictive value of tissue-based molecular stratification of bladder cancer in vitro for PET/CT imaging and 177Lu-FAP treatment in vivo. ***Materials and Methods:*** FFPE tissues from the first 100 TURB samples from the BladderBRIDGister were collected, RNA extracted, and relative gene expression subtyping markers (KRT5, KRT20, PPARG), ADC targets (TROP2, NECTIN4), CPI targets (PD-L1, PD-1, CTLA4) and radioligand targets (CXCR4, FAP) were analysed by RT-qPCR as well as hierarchical clustering. For exploring the therapeutic potential of FAP expression, a 67-y-o male (initially pT1 high grade bladder cancer in 08/2022) with high FAP in non-luminal MIBC was selected. Re-TURB in 10/22 revealed a high-grade MIBC (pT2a G3) and molecular analysis showed a non-luminal MIBC with high FAP expression. Restaging in 12/2022 (CT) exhibited locally advanced tumour expansion into the perivesical tissue without metastatic lesions. Three cycles Gemcitabin/Cisplatin chemotherapy were applied; however, the patient denied planned cystectomy. ***Results:*** Hierarchical clustering revealed three different clusters by combining target gene quantitation of ADC and theranostic drugs and subtyping markers with luminal characteristics as defined by high intermediate or low mRNA expression of KRT20 and PPARG. Instillation of 177Lu-FAP (3.7 GBq) into the bladder in in 03/23 resulted in high uptake into the non-luminal MIBC invading the perivesical soft tissue and the acetabulum. The second PTRT in 05/23 included intravesical application via transurethral catheter of 2.9 GB 177Lu-3BP-3940 followed by i.v. application of 3.9 GBq 177Lu-3BP-3940 plus 200 mg Pembrolizumab infusion as radiosensitizer 3h after radioligand therapy. Comparison of SPECT/CT at first and second cycle revealed complete elimination of one tumour site in the bladder and significant reduction of the second larger lesion. First endoscopic re-evaluation and resection in 07/23 showed pT2 G3 carcinoma with significant reduction of tumour cell content and markedly increased immune invasion (8fold). Subsequent urethrocystoscopies in 10/23& 01/24 revealed

no malignancy (pCR). ***Conclusion:*** To the best of our knowledge this is the first molecularly stratified, theranostic application of FAP radioligand therapy (RLT) by transurethral intravesical instillation plus systemic administration in combination with immune checkpoint inhibitor therapy after initial immune-sensitizing RLT. Remarkably, complete response of chemotherapy-resistant MIBC was achieved. A phase I/II study is currently initiated.

1201

Tuesday, October 22, 2024, 08:00 - 09:30
Hall 1

CME 9 - Thyroid Committee - From Radioiodine-Refractory to Radioiodine-Sensitive DTC - a Power of Novel Redifferentiation Therapies

OP-517
Which suit fits the BEST? Current approaches of tailoring radioiodine treatment
T. Murat;
Hacettepe University, Ankara, TÜRKIYE.

OP-518
Recent data on redifferentiation – how to do IT the best way…
D. Deandreis;
Institute Gustave Roussy, Villejuif, FRANCE.

OP-519
Go for GOLD with theranostics: Which radioligand therapy is best in radioiodine refractory DTC?
F. Eilsberger;
Department of Nuclear Medicine, University Hospital Marburg, Marburg, GERMANY.

OP-520
TARGETS, targets, targets – also important for non-radioactive systemic treatment
M. Kreissl;
Division of Nuclear Medicine, Department of Radiology and Nuclear Medicine, University Hospital Magdeburg, Magdeburg, GERMANY.

1202

Tuesday, October 22, 2024, 08:00 - 09:30
Hall 4

Special Track 9 - Inflammation & Infection Committee - Challenge the Expert: Diagnostic Challenges in Fever/Inflammation of Unknown Origin in Adults and Children: Clues from FDG-PET/CT?

OP-521
Diagnostic challenges in fever/inflammation of unknown origin in adults and children: clues from FDG-PET/CT?
D. Albano;
Nuclear Medicine, ASST Spedali Civili Brescia, Brescia, ITALY.

OP-522
Challengers' cases
J. Maes;
UZ Leuven, Leuven, BELGIUM.

OP-523a
Challengers' cases
A. Nys;
UZ Leuven, Leuven, BELGIUM.

OP-523b
Challengers' cases
R. Manta;
Institut Jules Bordet, Brussels, BELGIUM.

OP-523c
Challengers' cases
C. Steenhout;
CHU Liege, Liege, BELGIUM.

1203

Tuesday, October 22, 2024, 08:00 - 09:30
Hall X9-X12

LIPS Session 9 - Translational Molecular Imaging & Therapy Committee - Combination Therapies: from Mouse to Man

OP-524
Combination of radioligand versus external beam therapies with immunotherapy – a preclinical perspective
S. van Lith;
Radboud University Medical Centre, Medical Imaging, Nijmegen, NETHERLANDS.

OP-525
Towards (new) rational combinations for radioligand therapy
K. Lückerath;
Universtiy Hospital Essen, Nuclear Medicine Department - Preclinical Theranostics, Essen, GERMANY.

OP-526
Moving to the clinics: synergistic combinations with radioligand therapy
L. Emmett;
Theranostics and Nuclear Medicine Department, St Vincent's Hospital Sydney, Sydney, AUSTRALIA.

1204

Tuesday, October 22, 2024, 08:00 - 09:30
Hall X1-X4

M2M Track - TROP Session: Radiopharmaceutical Sciences + Translational Molecular Imaging & Therapy Committee: From Radionuclide to Clinical Translation

OP-527

Optimized ^{211}At production: a study to unravel the impact of the ^{210}At-contaminant

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[1]VUB (Vrije Universiteit Brussel), Brussel, BELGIUM, [2]Copenhagen University Hospital (Rigshospitalet), Copenhagen, DENMARK, [3]Nantes Université, Nantes, FRANCE, [4]University of Gothenburg, Gothenburg, SWEDEN, [5]Precirix, Brussel, BELGIUM.

Aim/Introduction: A limitation to the availability of 211At via 209Bi(α,2n) is the restriction of the incident α-beam energy during production to avoid the co-production of 210At which decays predominantly to 210Po. However, recent data measured a significant increase in 211At activity at increased beam energy, highlighting the need for an optimised approach and stressing the importance of studying the radiochemical separation and the biodistribution of 210Po after radioligand therapy with 211At/210At-labelled radiopharmaceuticals. For this reason, we acquired targets irradiated at high α-beam energies and performed: (i) the determination of the activity balance of 211At, 210At and 210Po after radiochemical separation of astatine by extraction chromatography [1] and (ii) a preclinical feasibility study to assess the biodistribution of 211At, 210At and 210Po. ***Materials and Methods:*** Targets irradiated by Arronax, Nantes were used to establish activity balances during radiochemical separation. After dissolution of the target and radiochemical separation by extraction chromatography, astatine was measured by gamma spectrometry, whereas 210Po was determined by liquid scintillation counting. Dissolution yields, extraction yields, and separation capabilities were assessed. For the preclinical study, irradiated targets were acquired from Rigshospitalet, Copenhagen. After target dissolution and radiochemical separation, anti-HER2 sdAb 2Rs15d [2] was labelled with 210At/211At, after which 1 MBq 211At was injected in healthy mice. The biodistribution of 211At, 210At and 210Po was assessed 1h post tracer injection. ***Results:*** Activity balances during target processing and radiochemical separation show mean decay-corrected dissolution yields of >84% and extraction yields of 210At/211At >80%. At the same time,>95% of the 210Po formed before extraction was removed. The biodistributions of 211At, 210At and 210Po in healthy mice show the highest uptake in the kidneys (60-70% ID/g) while stomach, small intestine and thyroid range between 2-4% ID/g, the latter ones showing a potentially limited dehalogenation. The time between the end of conjugation and time of sacrifice allowed a total of 0.03% of the 210At activity to be decayed to 210Po (1-2 Bq). Kidney measurements after complete decay resulted in a total 210Po activity (0.5 Bq) which is slightly higher than the expected 0.3 Bq due to the measured 210At at time of sacrifice and subsequent ingrowth. ***Conclusion:*** Our results show that extraction yields are >84% when using extraction chromatography while safely isolating the previously formed 210Po. The biodistributions of 211At, 210At and 210Po in healthy mice indicate a limited impact of 210Po, paving the way towards increased 211At production yield. ***References:*** [1]Burns,SeparationandPurificationTechnology 256(2021):117794 [2]Vaneycken,TheFASEBJournal25.7(2011):2433-2446.

OP-528

Production of the true theranostic matched pair ^{61}Cu and^{67}Cu at the compact cyclotron TR-Flex

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Aim/Introduction: The radionuclide theranostic approach gained prominence in the radiopharmaceutical sciences and nowadays theranostic matched pairs of radionuclides are of utmost clinical interest. Furthermore, out of the handful of true theranostic matched radionuclides, copper radioisotopes stand out as an attractive alternative[1]. With already an FDA-approved 64Cu-radiolabeled somatostatin receptor ligand, DetecnetTM[2], full potential of copper-based radiopharmaceuticals could be further exploited with a shorter-lived PET radionuclide, i.e., 61Cu (3.34 h, Emean=500 keV, 61%) and a therapeutic (β--emitter) counterpart, i.e., 67Cu (61.8 h, Emean=141 keV, 100%). Having our [64Cu]CuCl2 production established at HZDR, we present here our alternative routes for 61Cu and 67Cu production at our compact cyclotron. ***Materials and Methods:*** Targetry for 61Cu production consists of enriched 62Ni electrodeposition onto gold coins, followed by proton irradiation with the HZDR TR-Flex (ACSI) cyclotron, using optimized parameters from simulations and test irradiations for the 62Ni(p,2n)61Cu nuclear reaction (20 MeV and 70 µA for 1-2 h). Radiochemical separation is performed with a single column, containing either anion-exchange AG-1x8 or TK201 resin. Furthermore, 67Cu is produced from enriched 70Zn electroplated targets onto rectangular silver plates via the 70Zn(p,α)67Cu nuclear reaction (17 MeV, 60 µA for up to 20 h). Radiochemical purification is carried out with an AG-1x8 column combined with chromatographic resins TK221 and TK201. Radionuclidic purity, RNP, of [61/67Cu]CuCl2 is analyzed with calibrated HPGe gamma-spectroscopy, while the apparent molar activity, AMA, is tested by titration with the macrocyclic chelator TETA (1,4,8,11-Tetraazacyclotetradecane-1,4,8,11-tetraacetic acid)[3,4]. ***Results:*** Up to 8 GBq and 0.8 GBq of 61Cu and 67Cu, respectively, have been obtained at end of purification. Production scalability could easily be performed by extending the irradiation time; e.g. 200-minute irradiation would result in up to 20 GBq of [61Cu]CuCl2. RNP of over 99.5% for both [61Cu]CuCl2 and [67Cu]CuCl2 solutions and AMA of over 250 GBq/µmol and 150 GBq/µmol, respectively, have been quantified, thus proving quality sufficient for clinical transfer. ***Conclusion:*** Production of 61Cu and 67Cu at HZDR has been established to enable the development of radiocopper-based radiopharmaceuticals. Currently, the produced radiocopper is being used for in vitro and in vivo experiments, although our alternative 61Cu production could easily be upscaled to meet up clinical demands. We believe that radiocopper availability will boost radiopharmaceutical development and enable its safe translation into the clinics. ***References:*** [1]Wadas et al. Curr Pharm Des 2007,13,1,3-16. [2] de la Torre and Albericio, Molecules 2021,26,627. [3]Brühlmann et al. EJNMMI radiopharm. chem. 2024,9,3. [4]Brühlmann et al. Pharmaceuticals 2023,16,314.

OP-529

Mixed-LET ^{161}Tb-ART-101 radiopharmaceutical enhances therapeutic responses in advanced prostate cancer

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Aim/Introduction: 177Lu-PSMA-617 is an effective radiopharmaceutical to treat men with metastatic castration-resistant prostate cancer (mCRPC); however, disease progression remains certain. To improve the clinical activity of RPT in mCRPC, we developed ART-101, a PSMA-targeting small molecule displaying enhanced tumor uptake and retention characteristics to deliver Terbium-161 (t1/2= 6.9 days), a novel therapeutic radionuclide with emissions optimally suited to treat disseminated and occult disease. ***Materials and Methods:*** We radiolabeled ART-101 or PSMA-617 with 161Tb and 177Lu under similar conditions. The radio-stability of the compounds was assessed in saline and human serum by HPLC. In vitro, competitive homologous radioligand binding assay evaluated the PSMA-binding properties of PSMA-617 vs. ART-101 in PSMA-expressing cell PC3-PIP. For cytotoxicity studies, PC3-PIP, LNCaP, and 22RV1 cell lines were incubated with increasing activities of free 177Lu or 161Tb (0-4 MBq/mL), and viability was measured. Therapy studies employed groups of 8-week-old nude male mice (n=5-10) bearing PC3-PIP xenografts injected (IV) with 161Tb-ART-101, 161Tb-PSMA-617, 177Lu-PSMA-617 or vehicle. Tumor growth, animal survival, and well-being were recorded thrice a week. 161Tb-ART-101 and 161Tb-PSMA-617 treated mice underwent serial SPECT/CT scans from 2 to 168h p.i. (post-injection) to evaluate the radioligands' biodistribution and estimate dosimetry. Maximum tolerated dose studies in wild-type ICR mice are undergoing to determine 161Tb-ART-101 safety profile. ***Results:*** 161Tb-ART-101 achieved radiolabeling yield and radiochemical purity surpassing 95%, and remaining stable in human serum over 72h. The competitive binding assays showed comparable IC50s for PSMA-617 (11.0 nM) and ART-101 (3.5 nM). In vitro, free 161Tb and 177Lu showed comparable cytotoxicity, corroborating that the dosimetric advantages of 161Tb's low energy Auger electrons manifest upon radioligand internalization. SPECT/CT imaging revealed elevated and sustained tumor uptake of 161Tb-ART-101 vs. 161Tb-PSMA-617: 11 ± 1 vs. 6 ± 2 %IA/g (p = 0.02) at 24h, and 7 ± 2 vs. 2 ± 1 %IA/g (p= 0.005) at 120h, while largely clearing from critical tissues/organs within 72 hours. This translated into significantly enhanced tumor-absorbed doses delivered by 161Tb-ART-101 compared to 161Tb-PSMA-617. In therapeutic studies, mice administered 161Tb-ART-101/PSMA-617 show significant tumor regression and extended survival compared to 177Lu-labeled agents. No overt radiotoxicity was observed for any of the agents. ***Conclusion:*** Our findings demonstrate enhanced pharmacology of ART-101, leading to superior therapeutic efficacy of 161Tb-ART-101 compared to 161Tb-PSMA-617 or their 177Lu counterparts. These results reiterate our excitement around 161Tb as promising radionuclide for RPT and warrants its clinical implementation, especially in the context of residual or micrometastatic disease.

OP-530

The Rise of Alpha Star: Challenges and Innovations in ^{212}Pb Production for Targeted Therapy

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Aim/Introduction: Over the past decade, Lead-212 (212Pb) has attracted significant interest in the field of targeted alpha therapy (TAT). Its unique properties including a half-life of 10.6 hours, 1 alpha-emission within the decay chain, and imaging capabilities, position it as a promising candidate with considerable clinical potential for TAT. To facilitate ongoing (pre)clinical research and explore its potential in clinical applications, the establishment of an efficient and scalable production route for the 212Pb isotope is necessary. ***Materials and Methods:*** Lead-212 (212Pb) is produced within the decay chain of thorium-228 (228Th). The latter is generated through neutron irradiation of radium-226 (226Ra) targets within a high-flux reactor (HFR) located in Petten, the Netherlands. The source material for the targets, 226Ra, is a highly radiotoxic α-emitter. As it undergoes decay, it releases radioactive radon gas (222Rn). Consequently, handling this material necessitates a shielded environment equipped with dedicated infrastructure (including α-tight containment and radon gas monitoring). This infrastructure is specifically designed to handle the targets before and after irradiation. After 228Th is extracted and purified from the irradiated material, it serves as a longer-lived radioactive source that continuously generates 212Pb through radioactive decay. Two distinct production routes were developed to isolate 212Pb from 228Th based on column chromatography and gas-phase separation. The column method involves a stepwise separation of 228Th decay products, firstly the purification of 224Ra from 228Th, then 212Pb from 224Ra. The gas generator represents an innovative production method for 212Pb based on the emanation and isolation of the gaseous 220Rn, a decay product 228Th. ***Results:*** High-quality 212Pb product was prepared using both column and gas generator methods. The chemical and radionuclide purity of the resulting 212Pb samples was evaluated through gamma-spectrometry and inductively coupled plasma mass spectrometry (ICP-MS). Both production methods were tested at various scales and 212Pb samples were delivered for preclinical research experiments, demonstrating their suitability for further investigation. The feasibility of implementing both production methods within a Good Manufacturing Practice (GMP) facility was carefully evaluated. This assessment considered factors such as scalability, safety, and regulatory compliance. ***Conclusion:*** The successful development of these two efficient and scalable production routes of 212Pb allows this isotope to take a lead in clinical implementation of targeted alpha therapy.

OP-531

Novel ^{212}Pb-PSMA Targeted Alpha Therapy for the Treatment of Metastatic Castration-Resistant Prostate Cancer

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Aim/Introduction: Recent clinical data demonstrated the utility of PSMA-targeted radiopharmaceuticals with Lu-177 and Ac-225 but also revealed toxicities being potentially prohibitive to moving into broader patient populations and earlier treatment

lines. Pb-212, is a promising radioisotope with a short half-life allowing delivery of high energy alpha radiation to target cells while simultaneously being cleared quickly from non-target tissues. 212Pb- ADVC001 is a novel and proprietary 212Pb-based TAT (212Pb-PSMA) which is currently being evaluated in a Phase Ib/IIa clinical trial (NCT05720130) for patients with metastatic Castration-Resistant Prostate Cancer (mCRPC). Here, we present the preclinical data for this novel 212Pb-PSMA targeting radioligand. ***Materials and Methods:*** The affinity of 212Pb-ADVC001 to PSMA was determined by radioligand-binding assays in prostate cancer (PC) cell line overexpressing PSMA. Cytotoxic activity of 212Pb-ADVC001 against PC cell lines was measured by cell viability and clonogenic assays. The molecular mechanisms associated to 212Pb-ADVC001 mediated cell-death were assessed in PC cells. In vivo biodistribution and anti-tumor efficacy studies were performed in human PC-bearing mice. ***Results:*** 212Pb-ADVC001 has strong affinity for PSMA and induces internalization in PC cells. In vitro, 212Pb-ADVC001 exerted specific cytotoxic activity against human PC cell lines expressing PSMA, with no cytotoxic activity against PSMA negative cells. Transcriptomics analysis of PC cells after 212Pb-ADVC001 treatment revealed the activation of signalling pathways related to DNA damage, cell cycle arrest and senescence, and immune response modulation - revealing the multiple mechanisms of action of 212Pb-TAT. In vivo biodistribution of 212Pb-ADVC001 showed favourable biodistribution with rapid tumor uptake, tumor retention, and favorable tumor:kidney ratios. Minimal uptake was observed in other normal tissues. Single dose preclinical efficacy studies of 212Pb-ADVC001 (0.43 MBq) demonstrated improved survival compared to 177Lu-PSMA I&T (20 MBq), at 84 versus 48 days, respectively. Multidose efficacy studies have shown superior tumour response with two cycles of 212Pb-ADVC001 (0.46 MBq) compared to two cycles of 177Lu-PSMA I&T (15 MBq). Follow-up administration of 212Pb-ADVC001 (0.43 MBq) after initial relapse from 177Lu-PSMA I&T therapy (15 MBq) also resulted in improved survival benefit. ***Conclusion:*** Preclinical pharmacokinetic, biodistribution and efficacy data demonstrate the potential of 212Pb-PSMA for the treatment of mCRPC. In vivo, improved efficacy with more durable responses is observed with 212Pb-ADVC001 compared to 177Lu-PSMA I&T suggesting that 212Pb-ADVC001 has the potential to not only limit toxicities associated with conventional PSMA-targeted radiopharmaceuticals, but also to improve treatment of mCRPC.

OP-532

Development of [^{161}Tb]Tb-DOTA-HYNIC-panPSMA for targeted radionuclide therapy of prostate cancer

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Aim/Introduction: Prostate-specific membrane antigen (PSMA) is over-expressed in metastatic castration-resistant prostate cancer (mCRPC). [177Lu]Lu-PSMA-617 is approved for targeted radionuclide therapy of these patients. DOTA-HYNIC-panPSMA (formerly DOTA-HYNIC-iPSMA) is a compound with high affinity for PSMA targeting, and [177Lu]Lu-DOTA-HYNIC-iPSMA ([177Lu]Lu-panPSMA) has been studied in patients with mCRPC and showed overall survival of 21.7 months and decreased prostate specific antigen levels in 73% of patients.1 Terbium-161 (161Tb) is a radiolanthanide that can deliver a high radiation dose to tumour cells due to the abundance of Auger and conversion electrons in its decay spectrum.2 The aim of this work was to develop DOTA-HYNIC-panPSMA radiolabelled with 161Tb. ***Materials and Methods:*** DOTA-HYNIC-panPSMA (600 ± 60 µg) was available in prefilled vials. Radiolabelling with 161TbCl3 (in HCl 0.05M, produced up to 15 days before radiolabeling) was tested using increasing activities (100, 200, 300 and 400MBq) in ammonium acetate buffer. Uncomplexed 161Tb, radiolysis products, and [161Tb]Tb-DOTA-HYNIC-panPSMA ([161Tb]Tb-panPSMA) were monitored using radio-HPLC over 4 days. Affinity, internalized fraction, membrane-bound fraction efflux, and therapy studies (from 0.01 to 20MBq/mL) were carried out on PC3-pip cells over-expressing PSMA. ***Results:*** Quantitative radiolabelling and radiochemical purities >95% were achieved for all tested activities without the need of purification. Radiolysis products remained <1.5% for 100 and 200MBq activities but increased up to 7.5% for 400MBq at day 4. Addition of 10µL ascorbic acid at 150g/L prevents the formation of radiolysis products. Uncomplexed 161Tb rapidly increases up to 14% at day 4 for the 400MBq activity, justifying the addition of a chelating agent such as EDTA. [161Tb]Tb-panPSMA displayed high affinity towards PSMA (6.1nM) similar to that of [177Lu]Lu-panPSMA's affinity (6.3nM), high PSMA specific membrane-bound fraction of 10% of applied dose at 4h, a specific internalised fraction of 5% of applied dose at 4h overpassing the value of 0.5% for [177Lu]Lu-panPSMA1, and moderate efflux of 35% of total binding being externalised at 4h. Therapy study showed a log(dose) dependent decrease in cell viability. ***Conclusion:*** [161Tb]Tb-panPSMA stands as a promising radiopharmaceutical for clinical translation for the treatment of mCRPC. ***References:*** 1. Luna-Gutierrez M, Hernandez-Ramirez R, Soto-Abundiz A, et al. Pharmaceutics. 2023;15(7). 2. Larouze A, Alcocer-Ávila M, Morgat C et al. J Nucl Med. 2023;64(10):1619-1624.

OP-533

^{225}Ac-SSO110 induces long-lasting anti-tumour responses in contrast to ^{225}Ac-DOTA-TATE and ^{161}Tb-DOTA-TATE in the treatment of SSTR2-positive tumour xenografts

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Aim/Introduction: SSO110 (DOTA-JR11) is a somatostatin receptor 2 (SSTR2) antagonist currently under clinical development as 177Lu-SSO110 in small cell lung cancer (SCLC). We have previously demonstrated better efficacy of 177Lu-SSO110 over 177Lu-DOTA-TATE in different xenograft models owing to the ability of SSO110 to target a higher number of SSTR2 binding sites and showing longer tumour retention. Our aim here was to compare differently radiolabelled SSO110 (225Ac, 161Tb, 177Lu) to the respective DOTA-TATE compounds. ***Materials and Methods:*** Balb/c or Swiss nude mice were engrafted with the SSTR2-positive xenografts NCI-H69 (SCLC model) or AR42J (pancreatic cancer model), respectively, and randomized based on tumour volume one day before treatment start. The therapeutic efficacy of 225Ac , 161Tb-, and 177Lu-labelled SSO110 was compared to 225Ac- and 161Tb-labelled DOTA-TATE using clinically relevant mouse-equivalent dose ranges. ***Results:*** In NCI-H69 SCLC model, single doses of 20 MBq 177Lu-SSO110 and 21 kBq 225Ac-SSO110 demonstrated significantly better efficacy with regards to tumour volume reduction and growth delay than a single dose of 42 kBq 225Ac-DOTA-TATE or 20 MBq 161Tb-DOTA-TATE. Most remarkably, a single dose of 30 kBq 225Ac-SSO110

reproducibly induced 100% complete tumour remission. In the same NCI-H69 model, administration of 20 MBq 161Tb-SSO110 was similarly effective as 42 kBq 225Ac-DOTA-TATE and less potent than 20 MBq 177Lu-SSO110 or a lower dose of 21 kBq 225Ac-SSO110. In the AR42J model, injection of 37 kBq 225Ac-SSO110 induced tumour growth control with tumour volume being stable immediately after treatment, while the vehicle group progressed rapidly, reaching a median survival of 11 days. The median survival of mice treated with 20 MBq 161Tb-SSO110 and 37 kBq 225Ac-DOTA-TATE was similar (36 vs 33 days). In contrast to the NCI-H69 model, 20 MBq 161Tb-SSO110 induced a stronger tumour growth delay than 20 MBq 177Lu-SSO110 (median survival 36 vs 30.5 days). All treatments were well-tolerated. ***Conclusion:*** Our results highlight that 225Ac-SSO110 shows the strongest anti-tumoral effect in vivo even at low, single doses when evaluating SSO110 and DOTA-TATE radiolabelled with different isotopes. The comparison of 161Tb-SSO110 to 177Lu-SSO110 in two models was inconclusive indicating that additional Auger emissions of 161Tb are not generally increasing the anti-tumour efficacy of 161Tb-SSO110 and further model-intrinsic mechanisms could be involved. Irrespective of the isotopes used, the superior pharmacokinetic profile of SSO110 translates into higher pre-clinical anti-tumour efficacy compared to DOTA-TATE. The assessment of radiolabelled SSO110 and DOTA-TATE will help guide clinical development of SSO110 across SSTR2-expressing indications.

OP-534

Development of an Innovative^{61}Cu/^{67}Cu Platform forTheranostic Solutions in Oncology: from Discovery to Clinical Trials

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Aim/Introduction: Although new radioisotopes have been introduced in nuclear medicine, the search for an ideal theranostic radionuclide pair continues. Factors such as demand, cost, and availability must be considered. The isotopes 61Cu (t1/2 = 3.3h, 61% β+-fraction, Eβ+mean = 800keV) for PET imaging and 67Cu (t1/2 = 61.8h, 100% β--fraction) for SPECT and PRRT represent a superior theranostic match compared to 68Ga/177Lu, as 61/67Cu-radiopharmaceuticals share the same chemical structure. 61Cu's physical properties offer advantages over current PET standards (18F, 68Ga, 64Cu), enabling broader distribution from production sites and delayed PET scans with enhanced resolution and sensitivity. 67Cu is a viable alternative to 177Lu, with its production potential by linear accelerator and a half-life that aligns with the pharmacokinetics of peptide ligands for effective treatment. This study aims to introduce our promising 61Cu/67Cu platform to overcome the limitations of standard treatments. ***Materials and Methods:*** 61Cu was produced via the cyclotron from 61Ni(p,n)61Cu reaction, with automated purification optimized using GE FASTlab2. In vitro and in vivo preclinical screenings were conducted to characterize combinations of oncological vectors and chelators, radiolabelling with 61Cu and 68Ga. Lead compounds, chosen for favorable biodistribution, were radiolabelled with 67Cu to assess safety and efficacy in vivo compared to 177Lu-radiopharmaceuticals. Translational steps included optimizing module-automated and kit-based radiolabelling, assessing radiopharmaceutical formulations for stability, and establishing QC methods and specifications. 61/67Cu-NODAGA-PSMA I&T was administered to patients for imaging in accordance with German regulations. ***Results:*** 61Cu production can be scaled up to 70 GBq per batch, with >90% recovery post-purification, radionuclidic purity ≥99.99%, and specific activity >1.3 GBq/μg. The screening process selected NODAGA-conjugated lead compounds as a theranostic for prostate cancer (NODAGA-PSMA-I&T), NETs (NODAGA-LM3) and TME (NODAGA-Kalios-02). The radiolabelling by module-automated or kit was quantitative within 5 minutes at room temperature and physiological pH, with stability ≥24h. The comparison with established radiopharmaceuticals showed enhanced biodistribution, with > 1.5 times tumor uptake and significantly improved tumor-to-background ratio at delayed time points. Preclinical tests with 67Cu-radiopharmaceuticals indicated no adverse effects, and survival rates similar to 177Lu-labelled competitors. First-in-human imaging with NODAGA-PSMA-I&T effectively identified multifocal metastatic prostate cancer. ***Conclusion:*** Our project explored the effectiveness of a 61Cu/67Cu platform in enhancing diagnostic accuracy and therapeutic outcomes, considering production efficiency, economic viability, and patient safety. Our approach addresses current radionuclides logistical and supply challenges. It eventually enables advanced dosimetry estimation for oncology patients, paving the way for personalized medicine. ***References:*** JNuclMed.2023Dec;64(12):1855-1857

OP-535

Preclinical Assessment of Lead-212 (212Pb) Radio-DARPin Therapeutic (RDT) Targeting Delta-like ligand 3 (DLL3) in Small Cell Lung Cancer (SCLC)

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Aim/Introduction: Radioligand therapy has shown strong clinical potential for treatment of certain neuroendocrine and prostate tumors. However, successful approaches in other cancer types are currently limited by the absence of suitable targeting agents for relevant tumor-associated antigens. DLL3 is one of these promising targets highly upregulated in SCLC and other high-grade neuroendocrine tumors. We present the first high-affinity DLL3-targeting RDT combining the advantages of a small protein-based delivery vector and the short-lived alpha particle-emitting radioisotope 212Pb. DARPins (Designed Ankyrin Repeat Proteins) are a versatile class of highly affine and specific binding proteins that can be generated against a broad range of tumor targets. Their intrinsic properties, including small size and robust architecture, make DARPins attractive vector candidates for radiopharmaceuticals to achieve efficient tumor uptake and penetration, while limiting exposure of healthy tissue. We previously showed that their accumulation in the kidneys, a key limitation observed for all small-size polypeptide vectors, can be overcome by engineering the DARPin scaffold surface in combination with half-life extension (HLE). 212Pb is a radioisotope with a short half-life of 11h and a favourable decay chain, allowing high energy deposition on tumor in a short time frame. By combining 212Pb with a HLE anti-DLL3 DARPin candidate, we aimed to generate a targeted RDT with high efficacy and safety. ***Materials and Methods:*** Potential clinical candidates for anti-DLL3 212Pb-RDT were identified by screening

combinations of HLE (using serum albumin binding moieties) and anti-DLL3-binding DARPins. 212Pb-labelled DARPin molecules were analysed for their in vivo biodistribution properties, and their antitumor activity/safety in different mouse xenograft tumor models. ***Results:*** In vivo biodistribution studies showed that 212Pb-DLL3-HLE DARPin constructs reached a tumor to kidney ratio >1 at 4h and 24h post injection in the MC38-hDLL3 tumor model (high DLL3 expression) and ≥1 at 24h in the NCI-H82 tumor model (low DLL3 expression). A range of different 212Pb-DLL3 DARPin constructs showed low kidney accumulation (<20% at 4h post injection) and high tumor uptake was observed in both models up to 24h. The best DARPins constructs were selected for further characterization. Strong tumor reduction was confirmed in a mouse efficacy study, while no major toxicity was observed in a dose-finding study up to 40µCi of injected 212Pb-RDT compound. ***Conclusion:*** These initial preclinical results support 212Pb based RDT against DLL3 as a promising treatment option for SCLC, with encouraging in vivo antitumor activity and a good safety profile for our first DLL3-targeting 212Pb-RDT candidate.

1205

Tuesday, October 22, 2024, 08:00 - 09:30
Hall Y4-Y9

Cutting Edge Science Track - TROP Session: Physics Committee: SPECT/CT Quantification

OP-536

Imaging Alpha's or: How I Learned to Stop Worrying and Love At-211

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Aim/Introduction: Alpha-emitting radionuclides have gained significant attention in targeted alpha therapy due to their high linear energy transfer and short range, offering promising therapeutic potential with minimal damage to surrounding healthy tissues. Among these, At-211 has emerged as a candidate with favourable properties. This study aims to evaluate the imaging capabilities of At-211 using a clinical SPECT/CT system. ***Materials and Methods:*** A point source and a flask containing a known concentration of 41.83kBq/mL of At-211 were imaged using a Siemens Symbia Intevo Bold SPECT/CT system to characterize the emission spectrum with and without collimators (LEHR) mounted on the detector heads. Subsequently, the spheres of a NEMA phantom were filled with 39.73kBq/mL of At-211 to simulate lesion uptake. ***Results:*** Based on Monte Carlo simulations[1] and confirmed by the measured spectrum, the energy windows were based on the characteristic X-ray production due to the At-211 EC Decay and were defined as 79±12keV for the main emission and 59±8keV for lower scatter. A supplemental window was placed at 245±24.5keV to evaluate the presence of co-produced contaminant At-210. Imaging was performed using a 128x128 matrix, LEHR collimator in non-circular step-and-shoot mode with 60 frames of 40s. The imaging experiments yielded excellent visualisations of the activity in all phantoms, even showing activity in the smallest sphere (10mm diameter) of the NEMA phantom, affirming its potential for targeted alpha therapy. Quantification was possible, as a calibration factor of 34.38±0.51cps/MBq was calculated using the large volume of the bottle. Quantification uncertainty for NEMA spheres is larger [3-6cps/MBq] for the three largest spheres. ***Conclusion:*** Our study demonstrates the successful imaging and quantification of At-211 using a clinical SPECT/CT system. Further optimisations using Monte Carlo simulations[2] are being performed to determine the contamination of the acquired At-211 spectrum as a consequence of photon interactions with the equipment (collimator,...) and its influence on image optimization and quantification. These findings support further research and development of At-211-based targeted alpha therapy for clinical applications and further imaging optimisations, paving the way for personalized and effective cancer treatment strategies. ***References:*** 1. Nakanishi, K., S. Yamamoto, and J. Kataoka, Monte Carlo approach to comparison of parallel-hole collimators of clinical scintillation camera system for imaging astatine-211 (At-211). Journal of Instrumentation, 2022. 17(10): p. T10007.2. Ljungberg, M. and S.E. Strand, A Monte Carlo program for the simulation of scintillation camera characteristics. Comput Methods Programs Biomed, 1989. 29(4): p. 257-72.

OP-537

An investigation of the accuracy of ^{177}Lu SPECT/CT bone marrow activity quantification using a 3D-printed ICRP phantom

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Aim/Introduction: Red marrow (RM) is a dose-limiting organ in many radiopharmaceutical therapies. Due to low bone marrow uptake of most radiopharmaceuticals, SPECT imaging reaches its limits with respect to quantification. In this work, the uncertainty in RM activity quantification was systematically investigated based on 177Lu SPECT/CT Monte-Carlo simulations and phantom measurements of a lumbar spine phantom with removable kidneys. ***Materials and Methods:*** The study was based on a 3D model of a lumbar spine (L1 to L5) and two removable kidneys as defined in ICRP145 [1]. To replicate attenuation in cortical bone, a high-density resin (HU: 813.2[2]) was selected for 3D printing a fillable lumbar spine phantom. To mimic attenuation in spongiosa (1.11g/cm3[1]), the vertebrae were filled with K2HPO4 dissolved in pentetic acid with 33kBq/ml of [177Lu]LuCl3. Kidney phantoms, produced using a lower-density resin (HU: 121.0[2]), were filled with 310kBq/ml [177Lu]LuCl3 dissolved in HCl. SPECT/CT imaging (MELP collimator, 20s-per-projection, 128x128 matrix, 4.8cm3 voxel size) was performed on a NEMA IEC phantom: Three repetitions with mounted lumbar vertebrae and kidneys; three repetitions without kidneys. SPECT simulations of lumbar spine with/without kidneys were performed using SIMIND[3]. 1,000 SPECT datasets with varying representations of Poisson noise were generated. Reconstructions were performed using PyTomography [4] (OSEM with resolution modelling, AC, TEW-SC, 20i4s). Activity quantification accuracy was evaluated by comparing SPECT-based (ICRP145 mask enlarged by 4-mm) and true activity. ***Results:*** Without kidneys, activity ratios between SPECT-based and true activity were similar across all vertebrae with mean(STD) of 1.11(0.01) [simulation] and 1.18(0.05) [measurement] across L1-L5. The positive bias might be explained by the low-count statistics (with a maximum of 7 counts per projection for all measurements), potentially resulting in activity overestimation for OSEM reconstructions[5]. The activity ratios changed considerably with kidney inserts, where vertebrae overlaid by the kidneys

showed significantly decreased activities (1.7/1.8-fold decrease in L1 compared with a 1.1/1.1-fold decrease in L5 [simulation/measurement]). ***Conclusion:*** A general overestimation of 177Lu SPECT/CT-based activities in the lumbar spine for realistic activity concentrations was found. In addition, our analysis revealed a strong dependence of the accuracy of activity quantification on the axial positioning of the lumbar spine. An overlap of the axial position of the kidneys with individual vertebrae leads to an underestimation of the activity in these vertebrae. ***References:*** [1] Kim et al., ICRP 49(3):2020:13-201 [2]Kalidindi et al., Micromachines 14(10):2023:1928 [3]Ljungberg et al., Comput Meth Prog Bio 29(4):1989:257-272 [4]Polson et al., arXiv:2309.01977, 2023 [5]Reilhac et al., NeuroImage 39(1);2008:359-368

OP-538

Evaluation of Medium and High Energy Collimators for ^{212}Pb SPECT/CT imaging using NEMA NU 1-23

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Aim/Introduction: Recent publications of 212Pb SPECT/CT imaging for isotope localisation and dosimetry estimates have used High Energy collimators (HEC). Publications of phantom data using Medium Energy Collimators (MEC) and HEC provide mixed recommendations. We investigate HEC and MEC SPECT performance using NEMA NU 1-23. ***Materials and Methods:*** System Planar Sensitivity (SPS) and Collimator Penetration, SPECT Reconstructed Spatial Resolution with Scatter and System Volume Sensitivity were assessed. Imaging used two simultaneous triple-energy windows 78 keV ± 20% (20% scatter) and 239 keV ± 10% (10% scatter). Planar assessment used scatter corrected images. SPECT scatter and attenuation corrected images for 78keV + 238 keV were combined to provided summed images (SI). ***Results:*** The MEC SI provided the highest Planar System Sensitivity and System Volume Sensitivity. 238 keV has the highest SPECT resolution and the HEC performs better. The SI resolution is marginally better than 78 keV. SI dual photo peak imaging improves sensitivity with a small reduction in resolution compared to 238 keV. 238 keV reconstructions provides higher resolution if required. Specifically. HEC SPS was 189, 100 and 273 c/s/MBq for 78, 238 keV and SI, respectively. MEC SPS was 377, 100 and 478 c/s/MBq for 78, 238 keV and SI. HEC Penetration factor was 0.22, -0.18 and 0.12 for 78, 238 keV and SI. MEC Penetration factor was 0.26, 0.04 and 0.19 for 78, 238 keV and SI. SPECT Reconstructed Spatial Resolution with Scatter. MEC FWHM 11.2, 8.4, 17 mm tangential, radial and central 78 keV. MEC FWHM 10.2, 7.8, 14.9 mm tangential, radial and central 238 keV. MEC FWHM 10.9, 8.4, 16.5 mm tangential, radial and central SI. HEC FWHM 10.0, 8.0, 15.9 mm for tangential, radial and central 78 keV. HEC FWHM 9.3, 7.6, 13.5 mm for tangential, radial and central 238 keV. HEC FWHM 9.5, 8.1, 15.8 mm for tangential, radial and central SI. System Volume Sensitivity. HEC 936, 743, 1679 (kcts/sec) / (MBq/cm^3) for 78, 238 keV and SI. MEC 1589, 1151, 2741 (kcts/sec) / (MBq/cm^3) for 78, 238 keV and SI. ***Conclusion:*** The MEC should be suitable, especially for larger lesions, with only a small reduction of resolution while achieving 1.22x increased sensitivity. MEC use could reduce acquisition time, enabling whole body imaging, or improve contrast through increased count studies. The HEC's better resolution is superior for imaging and quantitative dose assessment of smaller lesions.

OP-539

The potential of Ho-166 on a 3D CZT SPECT/CT

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Aim/Introduction: Transarterial radioembolization (TARE) is a minimally invasive procedure used to treat primary and secondary malignancies in the liver that are not amenable to curative resection. Next-generation SPECT/CT systems with swiveling CdZnTe (CZT) digital detectors in a ring-like setup are emerging in clinical routine. This study aims to investigate the potential of Ho-166 imaging on a 3D CZT SPECT/CT and a conventional SPECT/CT for post-therapy SPECT/CT imaging the day after treatment. ***Materials and Methods:*** The NEMA IQ phantom was adapted so that the smallest sphere of the standard NEMA phantom setup was replaced by a larger one, more suitable for SPECT image quality assessment and more corresponding to clinical lesion volumes. This resulted in inner sphere diameters of 13 mm, 17 mm, 22 mm, 28 mm, 37 mm and 60 mm. The NEMA IQ phantom was filled with an activity concentration of 1301 kBq/mL for the spheres and 270 kBq/mL for the background, resulting in a 4.8:1 contrast ratio. As such, a high-count scan was emulated, followed by scans with decreasing activity concentrations due to physical decay. The scans were performed on a conventional dual-head and a 3D CZT SPECT/CT system for comparison. ***Results:*** The average counts in the background of the reconstructed image are analyzed in relation to the activity concentration in the background. The dead time, measured as the deviation to a linear fit, was 20% for 90 kBq/mL for the conventional system (comparable with [1]) and 300 kBq/mL for the 3D CZT system. Noise (coefficient of variation in the background) was lower for the 3D CZT system (2.4 fold lower for the highest count scan but gradually leveling up for for the lower count scans). Recovery coefficients were generally higher for the conventional system while not all of the four largest spheres could be detected for all scans with the 3D CZT SPECT/CT. ***Conclusion:*** There is a large potential for Ho-166 imaging on a 3D CZT system with an improved sensitivity and reduced deadtime. However, further work must be done to optimize the reconstruction and scatter correction as this has a major impact on the sphere-to-backgroun ratio with respect to the noise for the CZT SPECT images. ***References:*** [1] Stella, M., Braat, A.J.A.T., Lam, M.G.E.H. et al. Gamma camera characterization at high holmium-166 activity in liver radioembolization. EJNMMI Phys 8, 22 (2021). https://doi.org/10.1186/s40658-021-00372-9

OP-540

Quantification Accuracy of SPECT Imaging with Low ^{212}Pb Activity Concentrations; Assessments by 3D-Printed Anthropomorphic Phantoms

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Aim/Introduction: 212Pb presents a promising alternative to beta emitters in targeted radiotherapy, but it can pose a challenge for imaging. To investigate the accuracy of SPECT imaging of 212Pb for patient geometries, we imaged anthropomorphic phantoms with 212Pb, and studied the deviations of activity

concentrations measured from SPECT images from gamma counter measurements. ***Materials and Methods:*** Phantom shells were generated for kidneys, liver, and five vertebrae (T11-L3) based on a patient's CT-image. The phantoms were 3D-printed using a modified Creality Ender-3 Pro and an UltiMaker S5. The vertebrae were printed with inner compartments in the vertebral body and vertebral arch, with a filament of enhanced attenuation. The posterior compartments were filled with a solution of water and 30% of dipotassium hydrogen phosphate by weight, and the vertebral body compartments were filled with radioactive water. The phantoms were imaged three times with a Siemens Symbia Intevo Bold SPECT/CT with a total of 4.4-4.9 MBq 212Pb (711-793 Bq/mL, 1110-1239 Bq/mL, 1095-1222 Bq/mL, 61-68 Bq/mL, and 59-65 Bq/mL in the left and right kidney, liver, vertebral bodies, and background respectively). The distribution was based on measurements from the modelled patient's 18F-PSMA PET. A 40% energy window centred at 79 keV, with scatter windows of 20%, was used. Images were acquired with 30 seconds per view, 60 views, 256x256 matrix, and high energy collimators. The images were reconstructed with 30 iterations and 1 subset, a 12 mm Gaussian filter, triple energy window scatter correction, and attenuation correction based on CT. Activity concentrations were estimated by placing spherical volumes of interest within the boundaries of the phantom compartments and using a calibration factor determined from imaging a uniform phantom with the same acquisition and reconstruction parameters. Well counter measurements of 1 mL samples from each phantom compartment were used as true activity concentrations. ***Results:*** Image derived activity concentrations deviated from well counter measurements by 12%±7%, 23%±13%, and -27%±9% for the liver, right kidney, and left kidney respectively. The image derived activity concentrations for the vertebra and background compartments deviated by 700%-1000%. ***Conclusion:*** Quantification of 212Pb SPECT images is promising for larger volumes like liver and kidneys with activity concentrations higher than 0.8 kBq/mL. Neither small vertebra volumes nor the large background volume with activity concentrations lower than 70 Bq/mL could be accurately quantified from the SPECT images.

OP-541

Evaluating the accuracy of planar scintigraphy LSF and SPECT/CT LSF estimations using Monte Carlo simulations with virtual 4D anthropomorphic phantoms.

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Aim/Introduction: Prior to 90Y selective internal radiation therapy (SIRT), planar 99mTc-MAA scintigraphy imaging is used to estimate the lung shunt fraction (LSF). The recommended method for LSF estimation, as per 90Y SIRT manufacturers, is through analysis of planar imaging, neglecting scatter radiation and respiratory motion. The method leads to significant LSF overestimations and, hence, affects dosimetric accuracy. LSFs calculated using SPECT/CT images are considered to be the most accurate. However, SPECT/CT and planar LSF comparisons and accuracy evaluations have been conducted with basic phantoms and in patient cohorts where the true LSF has been unavailable. An easily implementable scatter window based correction using planar images has previously been reported to significantly improve LSF estimation accuracy. The technique has been demonstrated for an average-sized anthropomorphic phantom and has yet to be established for relevant patient ranges. The objective of this study was to evaluate the accuracy of the scatter-corrected planar LSF estimation technique and that of SPECT/CT, for known LSFs, for a set of 4D virtual anthropomorphic phantoms, with a range of BMIs representative of a typical SIRT patient population. ***Materials and Methods:*** A GE 870 DR SPECT/CT system was used to acquire planar and SPECT/CT imaging datasets of an anthropomorphic Radiological Support Devices (RSD) Heart and Thorax phantom with LSFs of 2.8, 6.3 and 10.9%. SIMIND Monte Carlo (MC) simulations were validated for this experimental data. Further, planar and SPECT/CT imaging datasets of a range of 6 Extended Cardiac-Torso (XCAT) 4D digital anatomical phantoms were MC simulated for LSF quantification. These phantoms represented a BMI range of 21-38 kg.m-2 and included respiratory and cardiac motion. The accuracy of each LSF quantification approach was evaluated for a range of planar and SPECT/CT estimates, with and without scatter correction, and compared for significance ($p < 0.05$) using repeated measures ANOVA. ***Results:*** The planar LSF overestimated the true LSF by 69 ±25% while the scatter corrected planar LSF estimation led to a significantly improved accuracy ($p<0.05$) of within 24 ±14%. For SPECT/CT, with and without scatter correction, differences from the true values were found to be 25 ±8% and 22 ±20%, respectively. ***Conclusion:*** The use of MC simulations and voxel-based phantoms allowed for comparison between true and estimated LSFs for a range of virtual phantom sizes representative of the patient population. The study quantified the SPECT/CT and scatter-corrected planar LSF estimation techniques to be comparable to the true LSF values.

OP-542

Innovative renal phantom ready for 3D-Ring CZT dynamic imaging and first results.

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Aim/Introduction: Isotopic renography is pivotal for assessing upper urinary tract obstruction and provides renal functional parameters. New 3D-Ring CZT cameras offer innovative 3D protocols that need to be validated on phantoms. Current renal phantoms were often complex and suitable for 2D imaging. We propose a novel renal phantom design, adapted to 3D imaging which also offers a quarter split renal function. ***Materials and Methods:*** A 3D-printed renal phantom mimicking pediatric/adult kidneys with separation for upper/lower halves was designed. Each kidney subunit, connected to a bladder-bag, was programmably infused with 7.5 MBq of 99mTc to simulate reproductible normal nephrograms. An asymmetry of renal activity was also simulated using different activity ratios. The phantom underwent testing using a NaI conventional gamma camera and a 3D-Ring CZT gamma camera. ***Results:*** Normal kidney simulations displayed characteristic time-activity curves with mean Tmax at 3.14 +/- 0.31, T1/2 of 4.9 +/- 0.63 min, and 20-min/max count ratio of 17.0 +/- 3.27%. These results were all within the normal range for clinical practice. Ratios between subunits were consistent at 54.6/45.4%. Pathology simulations showed a good linear correlation ($r=0.951$, $p<0.001$) between activity and AUC, used for the split renal function evaluation. Results were similar on 3D-Ring CZT camera with dynamic protocol. ***Conclusion:*** The proposed 3D phantom offered a simple yet effective tool for the evaluation of renal scan protocols. Its use with dynamic protocol of new 3D-Ring CZT cameras holds promise for improved imaging protocols.

OP-543

Correlation of tracer uptake in sentinel lymph nodes as measured on SPECT/CT and during intra-operative gamma tracing with a drop in gamma probe: the UZ Leuven experience

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Aim/Introduction: This retrospective analysis aims to study the relationship between tracer uptake in sentinel lymph nodes (SLNs) as measured on SPECT/CT and during intra-operative gamma tracing with a drop-in gamma probe in patients who participated in the UZ Leuven cohort of a prospective multicentre clinical trial evaluating a drop-in gamma probe for minimally-invasive SLN biopsy (SLNB) in prostate cancer [1] Correlation of pre- and intraoperative imaging can allow for improved surgical planning, providing important information to guide intraoperative findings. ***Materials and Methods:*** Nine patients with histologically proven prostate cancer scheduled for radical prostatectomy (RP) with extended pelvic lymph node dissection (ePLND) were prospectively selected for preoperative lymphoscintigraphy with SPECT/CT the day before surgery after intra-prostatic injection of 240 MBq of 99mTc-nanocolloid under ultrasound guidance. SLNB was performed with the drop-in gamma probe during standard of care RP with ePLND. SLN detection and counts on SPECT/CT and in vivo and ex vivo probe measurements were compared. ***Results:*** Patient-based detection rate of at least one SLN was 100% on SPECT/CT and 100% intraoperatively with the drop-in gamma probe. In total, 29 SLNs were detected with the probe and 32 SLNs on SPECT/CT (table 1). In three patients, SLNs were identified on preoperative SPECT/CT imaging (4 SLNs in total) that were not resected due to localisation outside the ePLND template and related operative surgical risk. In one patient, two adjacent resection specimens could be matched to one preoperative imaging result. Seven of 29 SLNs identified by the drop-in gamma probe were located outside of the ePLND template. The correlation between SPECT/CT counts and in vivo and ex vivo probe measurements was significant but moderate (r=0.57, p=0.002 and r=0.64, p=0.0003, respectively). ***Conclusion:*** SPECT/CT and drop-in gamma probe had a detection rate of 100% for SLNs in prostate cancer. The counts measured in SLNs on SPECT/CT had a moderate concordance with uptake measured in vivo using the drop-in gamma probe for minimally invasive SLN dissection. The drop-in gamma probe thus constitutes a valuable tool in the intraoperative detection of SLNs, providing important information about the lymphatic drainage pattern of prostate cancer. SPECT/CT uptake values can be used as an estimate for in vivo detection of SLNs with the probe. ***References:*** 1. Everaerts W, Walz J, Abascal Junquera JM, et al. A Multicentre Clinical Trial Evaluating a Drop-in Gamma Probe for Minimally Invasive Sentinel Lymph Node Dissection in Prostate Cancer. Eur Urol Focus. 2023;24:S2405-4569(23)00174-8.

OP-544

SPECT/CT Calibration and Quantification with ^{161}Tb for Kidney Dosimetry

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Aim/Introduction: 161Tb has gained recognition as a promising candidate for targeted radionuclide therapy. However, its decay features yield a complex photon emission profile, potentially complicating image-based quantification. The aim of this study was to investigate the effects of employing different collimators, calibration factors, and quantification methods in 161Tb SPECT/CT-based kidney dosimetry. ***Materials and Methods:*** A GE Discovery NM/CT 670 Pro system (5/8") and one 75 keV±10% photopeak window were employed, using three collimators: low-energy high-resolution (LEHR), extended low-energy general-purpose (ELEGP), and medium-energy general-purpose (MEGP). Calibration measurements were performed using both a homogeneous cylinder phantom (V = 6.9 L) and a large hot sphere (V = 113 mL) in water. For the cylinder, three different volume-of-interest (VOI) geometries were employed to derive the calibration factor: a small cylinder (V = 940 mL), a large cylinder (V = 3.8 L), and a VOI matching the physical size of the phantom. For the sphere, the same two cylinder VOIs were employed, as well as one spherical VOI with a 1-cm margin (V = 268 mL). Imaging was performed using a realistic 3D-printed kidney insert (V = 158 mL). Quantification was carried out using the small VOI method with differently sized VOIs (0.6, 2, and 4 mL x 5 VOIs). A central 30-mL VOI was used as a reference for true activity. Reconstructions were performed with a clinical OSEM algorithm (Xeleris 4.0), including compensations of attenuation, scatter, and collimator-detector response with 20-200 updates. ***Results:*** The calibration factor was approximately two-fold higher with ELEGP compared to LEHR and MEGP (40.8, 20.2, and 19.1 cps/MBq, respectively). Source and VOI geometry significantly impacted the derived calibration factor. The highest calibration factor was obtained using the large cylinder VOI over the sphere (+20%, +17%, and +16% for ELEGP, LEHR, and MEGP). In kidney quantifications, the small VOI method generally underestimated the activity, with the underestimation increasing with updates. For MEGP and ELEGP, larger VOIs induced greater underestimations, whereas results were similar regardless of VOI size for LEHR. Generally, the best results were obtained at 40 updates with the 0.6-mL VOIs. ***Conclusion:*** Accurate SPECT-based kidney activity quantification appears feasible with 161Tb. Good results were obtained regardless of collimator; however, the low-energy collimators are associated with increased amounts of scatter. Consideration should be given to the source and VOI geometry used for determining the calibration factor, as these factors significantly impact the results, warranting further investigation.

1206

Tuesday, October 22, 2024, 08:00 - 09:30
Hall Z

Clinical Oncology Track - TROP Session: Oncology & Theranostics Committee: FAPI & Gastrointestinal

OP-545

Identifying Intra-abdominal Desmoid Tumors Mimicking GISTs: The Potential Role of [18F]FAPI-42 PET/CT

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Aim/Introduction: Intra-abdominal desmoid tumors (IADT) can mimic gastrointestinal stromal tumors (GISTs), particularly recurrence and metastases [1,2]. However, it is difficult to radiologically differentiate these two diseases [2,3]. This study aimed to investigate the clinical utility of fluorine 18 (18F)-labeled fibroblast activation protein inhibitor ([18F]FAPI-42) PET/CT for differentiating between IADT and GISTs by comparing to [18F] FDG PET/CT. ***Materials and Methods:*** This study retrospectively included a total of 24 patients (12 patients with IADT and 12 patients with recurrent/metastatic GISTs) who underwent both [18F]FAPI-42 and [18F]FDG PET/CT. The differences in the ratio of tumor SUVmax to liver SUVmean on [18F]FAPI-42 PET/CT (TLRFAPI) and [18F]FDG PET/CT (TLRFDG) and the ratio of TLRFAPI to TLRFDG (TLRFAPI/ TLRFDG) were compared between IADT and GISTs. AUC analysis was used to compare the discriminative performance of both tracers PET/CT for distinguishing IADT and GISTs. Immunohistochemistry was used to verify FAP expression of all IADT lesions and GISTs lesions. ***Results:*** TLRFAPI of IADT was significantly higher than that of GISTs [10.3 (3.3, 18.2) vs 5.0 (2.1, 19.6), P=0.024], while TLRFDG of IADT was significantly lower than that GISTs [1.2 (0.5, 3.0) vs 3.3 (0.7, 9.7), P=0.007]. TLRFAPI/ TLRFDG of IADT was significantly higher than that of GISTs [9.4 (2.8, 22.8) vs 1.9 (0.7, 23.2), P<0.001]. The discriminative performance of TLRFAPI/TLRFDG for distinguishing IADT and GISTs was best (AUC = 0.889), with 91.7% sensitivity, 83.8% specificity, and 87.5% accuracy. The expression of FAP in IADT was markedly higher compared to GISTs, with ten IADT lesions and one GISTs lesion showing a high level of expression, respectively [83.3% (10/12) vs 8.3% (1/12), P<0.001]. ***Conclusion:*** [18F]FAPI-42 PET/CT is a promising method for identifying IADT mimicking GISTs due to IADT showing higher FAP uptake and FAP expression than GISTs. Furthermore, combining [18F]FAPI-42 PET/CT and [18F]FDG PET/CT can help further differentiate IADT from GISTs. ***References:*** [1] Lee JC, Curtis D, Williamson JB, Ligato S. Gastric Desmoid Fibromatosis - Report of a Rare Mimic of Gastrointestinal Stromal Tumor. Cureus. 2021;13:e19614. doi:10.7759/cureus.19614.[2] Kim JH, Ryu MH, Park YS, Kim HJ, Park H, Kang YK. Intra-abdominal desmoid tumors mimicking gastrointestinal stromal tumors - 8 cases: A case report. World J Gastroenterol. 2019;25:2010-8. doi:10.3748/wjg.v25.i16.2010.[3] Riedel RF, Agulnik M. Evolving strategies for management of desmoid tumor. Cancer. 2022;128:3027-40. doi:10.1002/cncr.34332.

OP-546

Comparison of potential false-positive findings rate on 68Ga FAPI PET/CT in initial staging and post-surgery restaging of patients with gastric cancer.

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Aim/Introduction: To compare the rate of potential false-positive findings on 68Ga FAPI PET/CT in patients with surgery naïve gastric cancer (staging) and those that had prior surgery (restaging) ***Materials and Methods:*** A total of 38 patients with gastric cancer, referred for staging (endoscopic biopsy only, 13 patients/16 scans) or restaging after abdominal surgery (25 patients, 33 scans) were included. Only intraabdominal findings were analyzed, categorized as: Tumor related: Primary tumor, locoregional lymph nodes, obvious metastases. Tumor-related findings served as lesion-based exclusion criteria. Non-tumor related: FAPI positive lesions with a clear benign explanation (uterine fibroids etc.) Equivocal/ Surgery related: All sites that can be either benign or malignant: anastomoses, metal clips uptake, mesentery, peritoneum (FAPI uptake with no CT findings). Equivocal sites were followed up by imaging or histologically confirmed. Secondary primaries: Lesions with characteristics of another primary (histology confirmation) ***Results:*** Staging cohort: 13 patients (3 patients were rescanned after NACT and were also considered staging). Of those 7 patients (10 scans) showed no false positive findings (63%), 2 patients had uterine fibroids, 2 - pancreatic uptake, 1 - diffuse esophageal uptake, 1 patient - lung tumor (proven to be second primary). All findings were categorized as non-tumor related, one as secondary primary. None was categorized as equivocal. Restaging cohort: Of 25patients (32 scans) two were excluded because of extensive intraabdominal disease (dominant tumor-related lesions) Only two patients had no false positive findings (8%). 9 patients had diffuse pancreatic uptake, 2 - anastomosis uptake, 3- esophageal uptake, 2 - diffuse liver uptake/fibrosis, 1 - segmental liver uptake, 1 - portal vein thrombosis, 1 subphrenic abscess, 1 mesenteric uptake, 2 - surgery site/metal clips uptake, 3 - fibroids, 1 - diverticles, 1 - bowel wall uptake (ileus), 3 - laparotomy /abdominal wall. In one patient rectal cancer as secondary primary was detected (biopsy confirmed) Seven patients were categorized as equivocal. One patient with abdominal wall implant progressed locally, two patients progressed to an extend that the equivocal lesions were no more assessable, in 3 patients equivocal findings resolved, in one (subphrenic abscess) no change was noted on follow up. ***Conclusion:*** 68Ga FAPI PET CT shows high uptake in various benign conditions and especially surgery-related changes and should be used with caution in restaging patients with gastric cancer who underwent surgery. Contrary- in surgery-naïve patients it performs unequivocally and seems to be a reliable tool for staging gastric cancer.

OP-547

Diagnostic accuracy of ^{68}Ga-FAPI-46 PET/CT vs.^{18}F-FDG PET/CT vs. conventional CT imaging in patients with cancer of the upper gastrointestinal tract

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Aim/Introduction: Due to intestinal physiological activity of 18F-FDG and pitfalls of inflammation, cancers of the upper gastrointestinal tract are difficult to assess. The 68Ga-FAPI-46 PET/CT (FAPI-PET) has demonstrated a higher lesion detection rate and tumor-to-background ratio (TBR) than 18F-FDG PET/CT (FDG-PET) in many cancers. The aim of this study is to assess the accuracy of FAPI-PET compared with FDG-PET or CT for the detection of cancers of the upper gastrointestinal tract. ***Materials and Methods:*** Fifteen patients with cancer of the

esophagus, stomach or duodenum who underwent FAPI-PET were enrolled in a prospective observational trial (NCT04571086). They all additionally underwent FDG-PET and CT. The primary endpoint was the accuracy of FAPI-PET compared with FDG-PET or CT on a per-patient and per-region basis for tumor location (primary tumour, lymph node, distant metastasis) confirmed by histopathology, follow-up CT or clinical data. Secondary endpoints were detection rate, comparison on a per-region basis of SUVmax and TBR between FAPI-PET and FDG-PET (Wilcoxon), association between FAPI-PET uptake intensity and histopathological FAP expression (Spearman r), inter-reader reproducibility (Fleiss k) and change in management. The data set were interpreted by two masked readers. ***Results:*** The 15 patients had cancer of the esophagus (n=7, 46.7%), stomach (n=6, 40.0%) or duodenum (n=2, 13.3%). Patients had no disease (n=1, 6.7%), locoregional disease (n=3, 20.0%) or distant disease (n=11, 73.3%). FAPI-PET was equivalent in accuracy to FDG-PET or CT for primary tumours (86.7%, 86.7%, 93.3% respectively) and lymph nodes (93.3%, 86.7%, 86.7%). FAPI-PET was more accurate than FDG-PET or CT for distant metastases (86.7%, 66.7%, 66.7%). The detection rate was higher with FAPI-PET than FDG-PET or CT for primary tumours (73.3%, 73.3%, 66.7% respectively), lymph nodes (60.0%, 53.3%, 53.3%) and distant metastases (53.3%, 33.3%, 20.0%). There was no significant difference between FAPI-PET and FDG-PET uptakes for primary tumours (p=0.5), lymph nodes (p=0.3) and distant metastases (p=0.9). However, TBR (liver) was significantly higher for FAPI-PET than FDG-PET for primary tumours and lymph nodes (p<0.05). There was no positive correlation between uptake on FAPI-PET and FAP immunohistochemistry score (r=-0.03, p=0.94). After FAPI-PET, only 3 (20.0%) patients had a major change in management. ***Conclusion:*** In patients with cancer of the upper gastrointestinal tract, FAPI-PET showed equal accuracy for locoregional disease and greater accuracy for distant disease vs. FDG-PET, while providing better contrast for the detection of primary tumours and lymph nodes.

OP-548

Fibroblast activation protein α (FAPα) directed Imaging in Patients with Biliary Tract Cancer (BTC) - an Update of a Single-Center, Prospective, Observational Study (NCT04571086)

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Aim/Introduction: BTC has an unfavourable prognosis, and therapeutic options are limited. Therefore, accurate staging and development of new therapies is critically important. In previous studies, 68Ga-FAPI-46 PET/CT demonstrated promising results in BTC. Here, we aimed to investigate the detection efficacy (DE) of 68Ga-FAPI-46 PET in BTC patients and its impact on treatment management in an extended cohort, and to identify potential candidates for FAP-directed radioligand therapy (RLT). ***Materials and Methods:*** A retrospective review was performed on all BTC patients who had undergone 68Ga-FAPI-46 PET/CT for initial staging/restaging between 08/2020 and 03/2024 as part of our prospective observational study, and clinical 18F-FDG PET/CT. Clinical data and histopathological results were collected. To evaluate the DE, a region-based analysis of 68Ga-FAPI-46 PET, 18F-FDG PET and contrast-enhanced CT (ceCT) was performed by two independent nuclear medicine physicians. Follow-up and histopathology were used as reference standard. Interobserver reliability was assessed using Cohen's kappa. Region-based SUVmax and tumour-to-background ratios (TBR) of both ligands were compared using Wilcoxon test. Change in treatment management was assessed by pre- and post-imaging physician's questionnaires. Imaging criterion for potential FAP-RLT candidates was defined as SUVmax ≥10 in >50% of tumor manifestations on 68Ga-FAPI-46 PET. ***Results:*** N=37 BTC patients (median age: 57 years; range: 29-81 years) were analysed (n=27 intrahepatic/n=4 perihilar/n=5 distant cholangiocarcinoma/n=1 gallbladder cancer). Highest DE was observed for all regions on 68Ga-FAPI-46 PET, followed by 18F-FDG PET and ceCT (primary tumour: 100%/79%/76%, regional lymph node metastases (rLN): 86%/71%/50%, distant lymph nodes metastases (dLN): 86%/69%/69%, distant metastases: 96%/75%/75%, osseous metastases: 100%/78%/89%). The highest interobserver reliability was seen on 68Ga-FAPI-46 PET (68Ga-FAPI-46/18F-FDG/ceCT: primary (1/0.63/0.83), dLN (1/1/0.34), distant (0.65/0.64/0.57) and osseous metastases (1/0.18/-0.2). Region-based mean SUVmax values were significantly higher on 68Ga-FAPI-46 PET compared to 18F-FDG PET in primary tumours (mean±SD: 16.5±8.3 vs. 10.5±8.0; p<0.001) and distant metastases (12.6±12,6 vs. 10.6±8.2 p=0.042). In all investigated regions, TBRLiver was significantly higher on 68Ga-FAPI-46 PET vs. 18F-FDG PET (primary tumour: 13.3±7.0 vs. 4.9±3.9, p<0.001; rLN: 9.1±6.7 vs. 4.3±3.2; dLN: 12.1±11.8 vs. 4.5±2.8; distant metastases: 10.2±6.9 vs. 5.1±3.6; osseous metastases: 10.4±6.0 vs. 4.3±2.9; all p-values <0,05). Based on 68Ga-FAPI-46 PET, additional procedures, i.e. laparoscopy/biopsy, were performed/avoided in n=3/1 patients. Change in treatment was observed in one patient. 13 patients (35%) met the criterion for FAP-RLT. ***Conclusion:*** 68Ga-FAPI-46 PET demonstrates an improved detection rate and higher uptake in BTC patients compared to 18F-FDG PET and ceCT. One third of patients are potential candidates for RLT.

OP-549

Comparative Evaluation of 68Ga-FAPI PET/CT versus ^{18}F-FDG PET/CT in Gallbladder Carcinomas: A Prospective Head-to-Head Analysis

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Aim/Introduction: Recently developed radiolabelled FAPI (FAP inhibitors) have attracted researcher's attention in diagnosing various tumours due to its high specificity and better tumour to background ratio. The aim of this study is to evaluate the effectiveness of 18Ga-FAPI-PET/CT imaging for the evaluation of newly diagnosed and recurrent gall bladder carcinoma as well as its comparison with 18F-FDG PET/CT. ***Materials and Methods:*** This prospective analysis included 35 patients with pathologically confirmed gall bladder carcinoma who underwent simultaneous 68Ga-FAPI and 18F-FDG PET/CT scan on two different days (within a week) either for initial staging assessment or recurrence detection (re-staging). Images of both the scans were analysed based upon visual assessment, and semi-quantitative parameters (target-to-background ratio [TBR], maximum standard uptake

value [SUVmax]) for both primary tumours and metastases. ***Results:*** 35 patients (15 male, 20 female; mean age: 58.5 ± 12.3 SD; range: 41-84 years) with primary or recurrent gall bladder carcinoma were evaluated. The sensitivity rates were comparable in patients for both the modalities for primary and recurrent tumours (92.3% each), hepatic (100% each) and lung (100% each) metastases. However, sensitivity rates with 68Ga-FAPI PET/CT is more as compared to ^{18}F-FDG PET/CT in evaluation of positive lymph nodes (95.5% vs 77.3%), peritoneal metastases (100% vs 78.6%) and bone metastases (100% vs 66.6%). The mean SUVmax of 68Ga-FAPI PET/CT vs ^{18}F-FDG PET/CT for primary tumour (11.9 vs 10.4), recurrent tumours (12.6 vs 9.9), lymph nodal metastases (9.7 vs 8.4) and distant metastases (liver: 10.6 vs 8.7; peritoneal: 9.0 vs 7.4; bone: 6.6 vs 3.2) were higher. The mean TBRs on 68Ga-FAPI PET/CT vs ^{18}F-FDG PET/CT for primary tumour (9.4 vs 8.1), recurrent tumours (10.1 vs 7.7), lymph nodal metastases (7.9 vs 6.1) and distant metastases (liver: 7.7 vs 6.3; peritoneal: 6.9 vs 4.6; bone: 5.3 vs 1.6) were also higher. Statistically significant differences for both mean SUVmax (p value 0.004) and TBR (p value < 0.001) was seen in bone metastases. Lung metastases detected in only one patient with SUVmax (11.7 vs 4.8) and TBR (10.2 vs 3.2) values significantly higher with 68Ga-FAPI PET CT. ***Conclusion:*** 68Ga-FAPI PET/CT with its enhanced TBRs and sensitivity detection rates suggest complimentary role to ^{18}F-FDG PET/CT in assessment of gall bladder carcinoma, prompting further exploration with expanded cohorts.

OP-550

Relationship between Al^{18}F-NOTA-FAPI-04 SUVmax and clinicopathological features of primary lesions in gastric cancer

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Aim/Introduction: To investigate the relationship between Al18F-NOTA-FAPI-04 SUVmax of primary lesions and clinicopathological factors in patients with gastric cancer. ***Materials and Methods:*** Twenty-nine patients with histologically proven gastric cancer were prospectively recruited. Each patient underwent Al18F-NOTA-FAPI-04 PET/CT before surgery. Three patients with negative PET/CT imaging were excluded, resulting in a final inclusion of twenty-six patients (17 males, 9 females, age range 37-78 years). Mann-Whitney U test or Kruskal-Wallis rank sum test was employed to compare the differences in SUVmax of primary lesions among various clinicopathological factors. Additionally, Spearman rank correlation analysis was conducted to assess the correlation between different clinicopathological features and SUVmax of primary lesions. Factors with statistical significance in the univariate analysis were included in a multivariate linear regression analysis model for further multifactorial analysis. For parameters with statistical significance in the multifactorial analysis, receiver operating characteristic curves (ROC) were generated to determine the optimal parameters and diagnostic performance for discriminating between the two groups. ***Results:*** The sensitivity of Al18F-NOTA-FAPI-04 PET/CT in detecting primary lesions of gastric cancer was 89.7% (26/29). The sensitivity for T1 stage gastric cancer was 57.1% (4/7), with 50% sensitivity for T1a stage (2/4) and 66.7% for T1b stage (2/3). The sensitivity for T2-4 stage was 100% (22/22). The SUVmax of primary lesions in all gastric cancer patients was 8.7, where T1 stage SUVmax was significantly lower than T2-4 stage (3.3 vs. 9.2, P=0.004). Univariate analysis revealed that vascular and/or neural invasion (rs value: 0.502, P=0.009), pT stage (rs value: 0.575, P=0.002), pN stage (rs value: 0.582, P=0.002), and pTNM stage (rs value: 0.545, P=0.004) were positively correlated with SUVmax of primary lesions, while age, tumor location, pathological type, histological grade, and Lauren classification showed no correlation with SUVmax. Multivariate analysis indicated that only pT stage (β=2.284, t=3.649, P=0.001) was a significant independent predictor of SUVmax in primary lesions of gastric cancer. The optimized threshold of the Al18F-NOTA-FAPI-04 SUVmax for pT1 stage from pT2-4 stage was 5.0. The corresponding sensitivity, specificity, and area under the curve (AUC) of the ROC analysis were 86.4%, 100%, and 0.955, respectively. ***Conclusion:*** Vascular and/or neural invasion, pT stage, pN stage, and pTNM stage are associated with Al18F-NOTA-FAPI-04 SUVmax in primary lesions of gastric cancer, with pT stage being an independent factor influencing SUVmax.

OP-551

Diagnostic potential of static and dynamic ^{68}Ga-FAPI PET/CT for the differentiation of mass forming pancreatitis and pancreatic ductal adenocarcinomas

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Aim/Introduction: The differentiation of mass forming pancreatitis (MFP) and pancreatic ductal adenocarcinomas (PDAC) based on conventional imaging methods like ultrasound, CT and MRI is frequently not possible. Here, we applied static (60 minutes post injection) and dynamic PET/CT with 68Gallium-labelled Fibroblast Activated Protein Inhibitors (68Ga-FAPI-PET/CT) in 32 preoperative, treatment-naive patients with unclear pancreatic masses to evaluate the potential diagnostic value of this new imaging method for the differentiation of MFP and PDAC. ***Materials and Methods:*** 32 Patients with unclear pancreatic masses underwent static and dynamic 68 Ga-FAPI-PET/CT before surgical resection or biopsy of the pancreas and subsequent histological diagnoses. Static parameters (SUVmax and SUVmean) were generated from VOIs of pancreatic masses. Time activity curves and dynamic parameters including kinetic modeling were extracted from dynamic PET data using PMOD software. ***Results:*** Histology revealed PDAC in 13 patients and MFP in 19 patients. We observed a markedly higher 68Ga-FAPI-uptake in PDACs than in MFP (SUVmax: 17,43+/-4,79 versus 12,20+/-3,77 SUVmean: 10,41+/-2,82 versus 7,23+/-2,13). In dynamic PET-imaging, PDAC and MFP showed distinctive and characteristic time activity curves: While PDAC increased for 15+/-5 minutes followed by a plateau phase after the perfusion peak, MFP showed a steady decrease after a perfusion peak. The average time to peak was markedly longer for PDAC (19 minutes) than for MFP (4 minutes). PDAC showed higher K1and K2 values than MFP (K1:0,64+/-0,25 versus 0,33 +/-0,1, K2:0,77+/-0,63 versus 0,26+/-0,13). ***Conclusion:*** 68Ga-FAPI-PET/CT should be considered for patients where other imaging methods are not able to distinguish between malignant and inflammatory pancreatic masses. Overall, PDAC show higher 68Ga-FAPI-uptake than MFP. However, an overlap of PDAC and MFP-related uptake is possible. Dynamic time activity curves are distinctive for both PDAC and MFP, which underlines the additional value of dynamic 68Ga-FAPI-PET acquisition for the differentiation between malignancy-associated and inflammatory FAPI-uptake.

OP-552

[^{68}Ga]FAPI-46PET/CT for preoperative assessment of peritoneal carcinomatosis- Preliminary analysis of FAPeCa trial

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Aim/Introduction: Standard imaging modalities; CT, MRI, and FDG PET/CT face challenges in accurate preoperative staging of peritoneal metastases (PM) and often underestimate PM extent, leading to unexpected non-resectable disease during surgery. Preliminary reports suggest [68Ga]FAPI PET/CT, targeting fibroblast activation protein, may offer superior sensitivity for PM detection. This study aims to assess the potential of [68Ga]FAPI-46 PET/CT as a preoperative imaging tool for peritoneal carcinomatosis by correlating [68Ga]FAPI-46 PET findings with surgical outcomes and standard imaging modalities in colorectal and ovarian cancer patients. ***Materials and Methods:*** In this prospective study (NCT06061874), eligible patients with confirmed/suspected PM undergo [68Ga]FAPI-46PET/CT, [18F]FDG PET/CT, and abdominopelvic MRI within four weeks before scheduled cytoreductive surgery (CRS) and/or diagnostic laparoscopy (DL). Patients receiving neoadjuvant chemotherapy (NAC) undergo scans before and after NAC. The study targets the enrollment of eighty patients.The extent of PM was determined by the peritoneal cancer index (PCI) scoring system. Intraclass correlation coefficient (ICC) was used to assess the concordance between the PCI determined based on [68Ga]FAPI-46 PET/CT (FAPI-PCI), [18F]FDG PET/CT (FDG-PCI), MRI (MRI-PCI) and the PCI found during surgery (S-PCI). ***Results:*** Twenty-nine patients (six male, twenty-three female, mean age 63.8) were analyzed, including twenty-two ovarian and seven colorectal cancer patients. The mean PCI score at surgery (n=31; 22 based on CRS, 9 based on DL) was 15.7±8.9. The mean FAPI-PCI score (n=31, 13.7±8.9) was significantly higher than the mean MRI-PCI (n=18, 8.7±7.9, p=0.006) and FDG-PCI (n=31, 6.5±7.8, p<0.001). FAPI-PCI correlated very well with surgical PCI (ICC 0.80, 95% CI: 0.63-0.90). The ICC between S-PCI and FAPI-PCI was substantially higher than that between S-PCI and MRI-PCI (0.66, 95% CI: 0.28-0.86) and S-PCI and FDG-PCI (ICC 0.39, 95% CI: 0.05-0.65).The quantitative parameters; SUVmax (maximum standardized uptake value), TBR (target-to-background ratio) and PTV (total peritoneal tumour volumes) of [68Ga]FAPI-46 PET/CT for the PM lesions were significantly higher than those of [18F]FDG PET/CT (mean SUVmax: 12±6.8 vs. 7.5±7.9,p<0.001, mean TBR: 9.2±5.8 vs. 3.9±3.9,p<0.001, mean PTV: 151.3±296.4 ml vs. 90.4±271.8 ml,p=0.001, Wilcoxon signed-rank test). A case-by-case review of six patients receiving NAC revealed the accuracy of [68Ga]FAPI-46 PET in demonstrating the chemotherapy response of PM, correlating well with surgical findings. ***Conclusion:*** [68Ga]FAPI-46 PET-based PCI score evaluation demonstrated a very good correlation with PCI scores assessed during surgery in colorectal and ovarian cancer patients. [68Ga]FAPI-46 PET outperforms the current standard imaging modalities, MRI and [18F]FDG PET, making it a significant advancement for preoperative peritoneal disease assessment.

OP-553

First-in-Humans PET Imaging of ^{68}Ga-FT-FAPI and side-by-side comparison with ^{68}Ga-FAPI-04

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Aim/Introduction: Fibroblast activation protein (FAP) is a potential target for tumor theranostics. FT-FAPI, a novel FAP inhibitor with an organotrifluoroborate, was reported by Liu's team at Peking University and has been verified for the biological effect and stability preclinically. This study reported the dosimetry of 68Ga-FT-FAPI in healthy volunteers, and assessed diagnostic accuracy for gastrointestinal (GI) solid tumors comparing with 68Ga-FAPI-04 PET/CT side-by-side. ***Materials and Methods:*** Six healthy volunteers were included and divided into two groups to the 1 h dynamic and 2 and 3 h static PET imaging with 68Ga-FT-FAPI and 68Ga-FAPI-04, respectively. Blood samples were collected to perform the pharmacokinetic using the PKSlover program. The dosimetry was calculated based on the mean standardized uptake value (SUVmean) using OLINDA/EXM. Six patients with different GI cancers were included, underwent 68Ga-FAPI-04 PET/CT and 68Ga-FT-FAPI scans at 2 time points (1 h and 3 h), respectively. Based on the 68Ga-FAPI-04 and 68Ga-FT-FAPI images, SUVs and tumor-to-background ratio (TBR) were generated. ***Results:*** 68Ga-FT-FAPI was tolerated well, and no adverse events were found. The pharmacokinetic characteristics of FT-FAPI in humans best fit the two-compartment model. The clearance half-life (T1/2β) of 68Ga-FT-FAPI and 68Ga-FAPI-04 was similar (75.0 min vs. 77.2 min). The results indicated that its pharmacokinetic properties in vivo were ideal. 68Ga-FT-FAPI showed low radiation dose, the effective dose (ED) of 68Ga-FT-FAPI was 12.4 ± 1.51 μSv·MBq-1, slightly higher than 68Ga-FAPI-04 (9.99 ± 1.85 μSv·MBq-1). For GI cancers, the radiotracer uptake and TBR of primary for 68Ga-FT-FAPI were higher than those of 68Ga-FAPI-04 (primary tumors: SUVmax 27.04 ± 14.62 vs. 24.23 ± 15.44 [p = 0.777], and TBR, 20.80 ± 12.22 vs. 16.23 ± 7.58 [p = 0.234]). And the radiotracer uptake and TBR of metastatic lesions for 68Ga-FT-FAPI were significantly higher than those of 68Ga-FAPI-04 (metastases: SUVmax, 17.57±11.64 vs. 12.81±6.611 [p < 0.001], and TBR, 24.35±18.8 vs. 15.26±9.477 [p < 0.001]), revealed an improved lesion detection rate and tumor delineation. ***Conclusion:*** This study has shown that it was safe and feasible for diagnosis using 68Ga-FT-FAPI as a FAP-targeted probe for GI cancer. It will be valuable in providing more experimental evidence for advancing the clinical translation of FT-FAPI.

1207

Tuesday, October 22, 2024, 08:00 - 09:30
Hall Y10-Y12

TROP Session: Neuroimaging Committee: Neurodegeneration: FDG, Amyloid and other PET Tracers

OP-554

LATE like pattern in FDG-PET of MCI subjects: clinical characteristics, amyloid burden and conversion to AD-dementia.

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Aim/Introduction: Describe the incidence of medial temporal hypometabolism as a pattern of possible Limbic-Predominant Age-Related TDP-43 encephalopathy (LATE), as well as its clinical characteristics, amyloid load and conversion to Alzheimer Disease (AD) dementia in a cohort of patients with mild cognitive impairment (MCI). ***Materials and Methods:*** We studied 207 MCI patients (mean age 72±6.1; MMSE 27±2.6; 50.8% males) who underwent FDG and Amyloid PET scans at diagnosis, with a clinical follow-up (24±17.5 months). FDG-PET patterns of hypometabolism were visually evaluated using a voxel-based analysis against an age-adjusted normality database and classified as LATE-like (medial temporal), AD and Mixed (AD-LATE) (1). Differences between these three patterns were evaluated by statistical parametric analysis (SPM12) using our healthy subject population as a control group. Amyloid-PET using approved radiotracers were visually classified as positive/negative and processed using a commercially available solution to calculate composite standard uptake value ratios (SUVR) using tracer-specific 'target/reference' regions, and converted to the Centiloid scale using appropriate SUVR-to-Centiloid conversion equations. Differences in clinical characteristics, amyloid load and conversion to AD-dementia were explored using SPSS (CHI-squared test, one-way ANOVA and Cox-regression). ***Results:*** LATE-like pattern was present in 22 patients (10.6%), AD pattern in 57 patients (27.5%), and Mixed in 21 patients (10.1%). The remaining 107 patients (51.7%) presented non-AD defined patterns (FTLD, Dementia with Lewy bodies, among others) and were excluded from the analysis. SPM analysis confirmed significant higher medial-temporal hypometabolism in LATE-like group, while the hypometabolism of posterior cingulate and parieto-temporal cortex were more significant in the AD followed by Mixed group. LATE-like group exhibited higher MMSE scores, lower percentage of amyloid positivity and Centiloid values than in AD and Mixed groups ($p<0.01$; Table 1). However, LATE-like group was non-significantly older than AD and Mixed groups. Conversion to AD-dementia was slower in LATE-like group than AD (p=0.005; Hazard Ratio=0.26 [0.1-0.67]) and Mixed groups (p=0.02; HR=0.29 [0.11-0.83]). Although, non-significant statistical differences were observed between AD and Mixed groups (p=0.7; HR=0.88 [0.47-1.65]). ***Conclusion:*** LATE-like pattern in FDG brain PET is not uncommon and occur in cognitively less affected MCI subjects with a lower brain amyloid load. Interestingly, MCI patients with LATE-like pattern exhibit a longer time to conversion to AD-dementia than those with an typical AD or a Mixed (AD and LATE-like) patterns. ***References:*** 1. Grothe. M, Moscoso A, Silva-Rodríguez J, et al. Differential diagnosis of amnestic dementia patients based on an FDG-PET signature of autopsy-confirmed LATE-NC. Alzheimer´s Dement. 2023;19:1234-44.

OP-555

Blood-brain barrier P-glycoprotein function in Alzheimer's disease measured with [18F]MC225 and PET

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Aim/Introduction: Alzheimer's disease (AD) is the most common neurodegenerative disease and is characterized by the accumulation of amyloid-β (Aβ) plaques and neurofibrillary tangles in the brain. P-glycoprotein (P-gp), an essential efflux transporter at the blood-brain barrier (BBB) and plays a critical role in Aβ transport out of the brain, making it a potential therapeutic target [1]. Positron emission tomography (PET) imaging offers a unique quantitative approach to investigate the role of P-gp function at the BBB in vivo. In the past few years, several radiotracers have been developed and validated for PET imaging of the P-gp function. These radioligands are typically derivatives of avid P-gp substrates and therefore only suitable to measure decreases in P-gp function. [18F]MC225 is a novel weak P-gp substrate tracer that was developed to measure both increases and decreases in P-gp function. It has already been administered in both preclinical and clinical studies in healthy subjects [2,3]. The aim of this study is to assess BBB P-gp function in AD patients by quantitatively comparing [18F]MC225 kinetics with those in healthy volunteers. ***Materials and Methods:*** Thus far, fourteen healthy volunteers (HV; age 67±5y) and three AD patients (68±6y) were included. Subjects underwent a 60 minutes [18F]MC225 (200 MBq) dynamic PET scan with continuous arterial blood sampling and a cerebral T1weighted MRI scan as anatomical reference. Tissue time-activity curves, extracted using the Hammers maximum-probability atlas, were fitted to a reversible two-tissue compartment model to obtain the volume of distribution (VT), using the metabolite corrected plasma and uncorrected whole blood curves as input functions. ***Results:*** No significant differences were found in plasma curves, plasma/whole blood ratios and parent fractions between AD and HV groups. However, almost every brain region showed a significant difference in VT between AD and HV groups, except for thalamus and corpus callosum. The largest differences were found for globus pallidus and basal ganglia, with increases of 88 and 77%, respectively. For the whole brain grey matter region, VT increased by 52% (HV: VT=6.5±1.2 vs AD: VT=11.1±10.6; p= 0.021). ***Conclusion:*** This proof of concept study showed significant differences in P-gp function at the BBB between AD patients and HV. These findings support the further use [18F]MC225 PET in larger AD cohorts. It addition, it will be a potential in vivo tool to monitor response to disease modifying drugs. ***References:*** 1. Gil-Martins (2023) 2. Garcia-Varela (2021) 3. Mossel (2022).

OP-556

Multi-modal Multi-probe PET/MR Imaging in evaluation of the effect of CSUL surgery in AD patients

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Aim/Introduction: Recent studies have found that the glymphatic system plays an important role in clearing metabolic waste from the brain. Impairment of glymphatic system may underlie the pathological accumulation of proteins such as amyloid-β (Aβ) in Alzheimer's disease (AD) patients. Therefore, cervical shunting to unclog cerebral lymphatic systems (CSUL) surgery may promote the drainage of the glymphatic system and accelerate the clearance of harmful proteins. In this study, multi-modal multi-probe PET/MR Imaging, including 18F-AV45 and 18F-FDG, was used to analyze the changes of Aβ, glucose metabolism and diffusion tensor imaging (DTI) in the brain of AD patients before and after CSUL surgery. ***Materials and Methods:*** Three AD patients who underwent CSUL surgery were enrolled in this study. All participants underwent psychological testing, 18F-FDG PET, 18F-AV45 PET imaging, and 3.0 T brain multimodal MRI scans before and after surgery. With the cerebellar cortex as the reference area, SUVR of FDG and AV45 in each brain regions was analyzed. Whole-brain glymphatic activity was measured by diffusion tensor image analysis along the perivascular space (DTI-ALPS). ***Results:*** The index of DTI-ALPS increased in all three patients ($p<0.05$), indicating that surgery did improve the glymphatic drainage. Clinical evaluation after surgery showed a 2-3 point improvement in mini-mental status examination (MMSE) scores, indicating an improvement in cognitive function. Activity of daily living (ADL) scores decreased by 2-5 points, indicating increased mobility. AV45 PET showed an overall reduction of Aβ in the brain, demonstrating that surgery can promote the clearance of pathological proteins in the brain. FDG PET also showed improved overall glucose metabolism in the brain. However, unlike the decrease of AV45 uptake in almost all brain regions, FDG uptake in some brain regions such as superior parietal cortex, posterior medial temporal cortex, posterior cingulate cortex and primary visual cortex did not improve significantly, indicating that pathological protein clearance in some brain regions could not completely improve brain metabolism. ***Conclusion:*** Multi-modal multi-probe PET/MR preliminarily revealed the therapeutic effect and shortcomings of the newly developed CSUL surgery for AD patients, and provided a theoretical basis for improving the treatment regimen and subsequent surgical treatment for more AD patients.

OP-557

Sources of reading errors in the clinical assessment of Vizamyl™PET images and the potential benefits of quantification to support clinical reads

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Aim/Introduction: [18F]flutemetamol (trade name VizamylTM) was approved for amyloid brain PET based on the ability of amyloid-naive readers who completed a reader training program to identify significant levels of Aβ pathology (vs. autopsy as the truth standard). Post-approval, GE HealthCare conducted a European study involving 6 countries, 12 sites and 18 readers. The study aimed to assess real-world effectiveness of the VIZAMYL™ reader training programmes (in-person or electronic1) by estimating diagnostic accuracy, sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV), of the visual interpretation of VIZAMYL™ images obtained in clinical practice, and to identify likely reasons for false-positive and false-negative results. ***Materials and Methods:*** Routine clinical classifications of 209 VizamylTM PET images were independently assessed blindly by 5 expert readers, whose majority opinion was the gold standard classification. Agreement (Cohen's kappa)2 between each clinical classification and the majority opinion was calculated. A root-cause analysis examined the reasons for any disagreements. In a further post-hoc analysis, images were quantified on the centiloid (CL) scale and classified positive if uptake was ≥ 30 CL. Agreement between the clinical and expert readers' classifications and the quantitative classifications were compared. ***Results:*** The expert-majority and clinical-reader classifications agreement was 87% (kappa 0.66). The ratio of false positives to false negatives was 2.75 : 1. Sources of clinical reader errors were: incorrect alignments, wrong order of regional assessments, non-scrolled review, infrequent reviews (< 1/week), misplaced scrolling-plane, and time since reader training > 2 years. The expert-majority and quantitative classifications agreed with a kappa of 0.82 (near perfect agreement), while the clinical-reader and quantitative classifications agreed with a kappa of 0.62 (fair-to-good agreement). ***Conclusion:*** Insights from the study results and post-study interviews with clinical readers were captured in EMA-approved updated/refresher training materials with region-specific pitfall avoidance strategies. The post-hoc quantitative analysis showed near perfect agreement between expert majority and 30CL quantitative threshold. This strongly suggests that local clinical readers could use quantitation to assist their interpretation VizamylTM PET images (i.e. as a proxy for an expert read) and their reading accuracy would likely benefit from this adjunct. ***References:*** 1. Buckley CJ, Sherwin PF, Smith AP, Wolber J, Weick SM, Brooks DJ. Validation of an electronic image reader training programme for interpretation of [18F]flutemetamol β-amyloid PET brain images. Nucl Med Commun. 2017 Mar;38(3):234-241. 2. Cohen, Jacob (1960). A coefficient of agreement for nominal scales. Educational and Psychological Measurement. 20 (1): 37 46.

OP-558

Clinical characterization of a three-level Centiloid-based classification of amyloid distribution

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Aim/Introduction: β-amyloid (A) deposition is an Alzheimer's disease feature that can be studied in vivo with amyloid-PET. The images can be defined as positive or negative using visual assessment or semi-quantification, namely using the "Centiloid" unit, a tracer-independent scoring. The dichotomous nature of this classification is however limited by the presence of visually discordant cases and the use of different thresholds for the semi-quantitative index across studies. Our study aims to evaluate a three-level classification based on the Centiloid scale in a memory clinic population. ***Materials and Methods:*** We enrolled 580 subjects (70.4±7.8 years) ranging from cognitively unimpaired to mild cognitive impairment and dementia, who were evaluated at the Geneva Memory Center and underwent amyloid-PET scans using either [18F]florbetapir or [18F]flutemetamol. A subset of participants underwent [18F]Flortaucipir-PET (n=185) and CSF biomarkers (n=190) within a year. Amyloid status was visually assessed and Centiloid was calculated from amyloid-PET. Based on centiloid values, subjects were categorized into three categories: i) NEGATIVE: centiloid<12, ii) GRAY-ZONE: 12≤ centiloid ≤37, iii) POSITIVE: centiloid >37. Tau (T) status was evaluated both visually

and semi-quantitatively from tau-PET. Associations between amyloid categories and demographics, clinical diagnosis, tau status, cognitive function, and CSF biomarkers were assessed using Chi-squared and Kruskal-Wallis tests. Linear mixed-effects models were applied to test the prognostic values of amyloid categories. ***Results:*** NEGATIVE individuals were younger and had higher baseline MMSE scores compared to GRAY-ZONE and POSITIVE individuals (p<0.001). 99% of POSITIVE individuals were consistently visually identified as A+ and 97% of NEGATIVE individuals were visually classified as A-, while only 44% of GRAY-ZONE individuals were reported as A+. We found a systematic decrease of CSF-Aβ42 across the amyloid categories, significantly differing between the three levels (p<0.01). This decrease was most pronounced in POSITIVE individuals, followed by GRAY-ZONE subjects. Global tau also increased significantly across all three amyloid categories with POSITIVE individuals exhibiting the highest tau load (p<0.05). Linear mixed-effect models showed that both POSITIVE and GRAY-ZONE individuals exhibited a significantly faster cognitive decline compared to the NEGATIVE group (p<0.01) with GRAY-ZONE category showing intermediate cognitive decline (p<0.01). ***Conclusion:*** Our study shows distinct biomarker profiles in the proposed three-level Centiloid-based classification. Individuals classified as GRAY-ZONE exhibit different characteristics compared to both NEGATIVE and POSITIVE subjects, highlighting the need of identifying this population when establishing clinical management strategies. This is of the utmost importance considering that amyloid positivity is a requirement for the anti-amyloid monoclonal antibodies.

OP-559

Amyloid PET in individuals with subjective cognitive decline: differences in baseline signal on amyloid accumulators.

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Aim/Introduction: Positron emission tomography (PET) with [18F] florbetaben is an established tool for detection of brain amyloid-beta (Aβ) load. Changes of the Aβ load over time can be assessed using quantitative PET measurements such as standardised uptake value ratio (SUVR) for regional assessment or the Centiloid (CL) method for the global quantification of Aβ load. This study compared quantification of baseline Aβ negative (Aβ-) PET scans from individuals with subjective cognitive decline (SCD) that showed Aβ accumulation over time with those that presented stable levels of amyloid over several years. ***Materials and Methods:*** The Fundació ACE Healthy Brain Initiative (FACEHBI) study recruited 197 SCD individuals and performed at least two [18F]florbetaben PET scans (4.2±1.5 years apart) on them. A CL cutoff of 13.5 was used to identify the Aβ- scans at baseline [1]. Aβ annualised rate of change (ARC; CL/year) was assessed with a linear mixed effects model (LMM) and a cutoff point to identify individuals that accumulate Aβ was obtained using a 2-curve gaussian mixed model (GMM) applied to the ARC distribution from the LMM. A voxel-wise analysis using statistical parametric mapping (SPM) compared SUVR images (whole cerebellum as reference region) of Aβ- individuals that accumulated Aβ with those that did not. A minimum cluster size of 125 voxels (1mL) was considered significant at p<0.001. Finally, a post-hoc analysis was performed using the volume of interest defined by the SPM analysis. ***Results:*** 160 individuals were Aβ- on the baseline quantification. The distribution of ARC gave a cutoff to define accumulators at 1.5 CL/year based on 3 standard deviations above the mean of the lowest curve of the GMM. Given that, 129 ED individuals did not show accumulation (baseline CL=-2.8±5.6; ARC=0.2±0.5 CL/year) while 31 were Aβ accumulators (baseline CL=1.1±6.9; ARC=2.8±1.1 CL/year). SPM analysis identified a region within the precuneus (near the border with the cingulum and roughly symmetrical around the longitudinal fissure) with significantly higher baseline SUVR for accumulators. The ROI defined from this analysis showed an average SUVR of 1.00±0.10 for accumulators and 0.87±0.07 for non-accumulators (p=10-7). ***Conclusion:*** Baseline SUVR voxel-wise analysis was able to identify a region within the precuneus that showed higher signal in Aβ- SCD individuals that accumulated Aβ from those with stable amyloid load. This shows a promising method to identify pre-clinical AD in an SCD population. ***References:*** [1] Bullich, et al. Alzheimer's research & therapy 13 (2021)

OP-560

Quantification of demyelination in cerebral lesions in patients with multiple sclerosis: an [11C]MeDAS PET study

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Aim/Introduction: Multiple sclerosis (MS) is an demyelinating neurodegenerative disease, characterized by inflammatory lesions. Current treatments are aimed at inhibiting the inflammatory response, limiting the damage to myelin and neurons. However, damage that has already occurred is not repaired. Myelin repair treatments are in development but so far failed in clinical trials, probably due to the use of subjective clinical scores to determine their efficacy. Hence, there is a need for an objective biomarker that can quantify myelin density in MS lesions reliably. [11C]MeDAS PET appears promising for quantifying myelin density in MS lesions. However, to determine the efficacy of new myelin repair treatments, myelin imaging should be able to capture changes in myelin density in MS lesions. Since there is ongoing demyelination in MS lesions, this study aims to determine the sensitivity of [11C] MeDAS PET to detect changes in myelin density in MS lesions over time. ***Materials and Methods:*** Seven MS patients underwent two dynamic brain [11C]MeDAS PET scans with arterial blood sampling with a 1.4±0.5 year follow-up interval. A T1w MRI was acquired for anatomical reference and lesion detection. The [11C]MeDAS PET uptake in MS lesions were quantified using the 2T3k model. ***Results:*** In total 219 lesions with a diameter >3 mm were detected on MRI. In 54 of the 219 lesions, the Ki was estimated with a standard error >25% either at baseline or follow-up and hence omitted from further evaluation. Within the 165 lesions, an overall decrease in tracer uptake (T=3.71, p<0.001) was observed at follow-up (0.073±0.023) compared to baseline (0.083±0.023). No significant differences in [11C]MeDAS uptake over time were found for black holes (T=0.72, p=0.474, N=58) and remyelinated lesions (T=2.95, p=0.208, N=2). Significant decreases in [11C]MeDAS uptake at follow-up were found for demyelinated (T=2.93, p=0.005, N=58) and partial remyelinated lesions (T=2.19, p=0.033, N=47). ***Conclusion:*** [11C]MeDAS uptake was reduced in MS lesions over time, in particular in demyelinated lesions and partial demyelinated lesions. These findings correspond with the

demyelinating nature of MS pathology. Hence, [11C]MeDAS PET seems to be a sensitive myelin imaging tool to detect changes in myelin density in lesions over time, which is of particular interest for the development of myelin repair treatments.

OP-561

FDG PET as a systemic biomarker of Amyotrophic lateral sclerosis: brain-body connection, staging and subtyping

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Aim/Introduction: Amyotrophic lateral sclerosis (ALS) is a clinically diverse disease with underexplored metabolic changes and clinical manifestations. This study uses unsupervised learning to model ALS heterogeneity through metabolic changes on FDG-PET, alongside whole-body PET to explore the brain-body connection. ***Materials and Methods:*** We collected a total of 253 FDG-PET scans, consisting of 128 from clinically diagnosed healthy controls (HC) and 125 from ALS patients. All scans were spatially normalized (SPM8), and 15 groups of regions of interest (ROIs) were identified (AAL atlas) based on prior findings. These included the Frontal (FL), Parietal (PL), Occipital (OL), and Temporal (TL) lobes; Primary Motor(PM), Supplementary Motor(SPM), Sensory Motor(SM), Supplementary Sensory Motor (SSM), and Visual areas(VA); Basal Ganglia(BG), Thalamus (TH), Brainstem (BS); Limbic system(LB), Cingulum(CG); and the Cerebellum(CB). The standardized uptake value ratio (SUVr) was calculated for each ROI, normalized by the average value of the whole brain. Z-scores were derived after correcting for age and sex. An unsupervised machine-learning technique was utilized which identifies subtypes and stages simultaneously by combining clustering and data-driven disease progression modeling with a mixture of linear z-score models. Clinical manifestation presented by King's score and four key domains on the ALS Functional Rating Scale (ALSFRS) were compared between each subtype and stages. Survival analyses were conducted. Amongst ALS patients, 70 Whole-body (WB) scans were acquired, and the standard uptake value (SUV) was calculated within the organs and muscles (MOOSE V2). ***Results:*** Regions such as the TL, PM, SM, BG, TH, LB, AND CB exhibited hypometabolism concurrent with ALS progression. Two subtypes were identified: one with alterations in the motor cortex (subtype 1, 76%) and another associated with the brainstem (subtype2, 24%). ANOVA showed significant function disparities, such as swallowing and walking, between subtypes ($p < 0.05$). Subtype 1 showed greater difficulties with walking, while subtype 2 had more pronounced challenges with swallowing and salivation. Subtype 2 exhibited more hypometabolism in the kidney, stomach, and heart, and hypermetabolism in veins compared to subtype 1. It also indicated more severe clinical progression and shorter survival time. ***Conclusion:*** This study elucidates the metabolic patterns tied to ALS, presenting a novel stratification of disease progression that aligns with distinct clinical manifestations through FDG PET.

OP-562

Exploring Synaptic Density Patterns in Cerebral Small Vessel Disease: Insights from [18F]SynVesT-1 PET Imaging

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Aim/Introduction: Cognitive dysfunction caused by cerebral small vessel disease (CSVD) is the most common cause of VaD. [18F]SynVesT-1 is a promising PET tracer binding Synaptic vesicle glycoprotein 2A (SV2A) which is an potential biomarker for CSVD diagnosis. This study aimed to discern distinct synaptic density patterns associated with CSVD using [18F]SynVesT-1 PET and to elucidate the correlation between synaptic density and cognitive performance. ***Materials and Methods:*** Sixteen CSVD patients and ten age- and sex-matched healthy controls (HCs) underwent [18F] SynVesT-1 PET imaging to quantify synaptic density. Comparative analyses were conducted between CSVD and HCs and within different CSVD subgroups based on burden scores and cognitive status. Moreover, associations between regional synaptic density and neuropsychological assessment outcomes in CSVD patients were explored. ***Results:*** CSVD patients exhibited decreased [18F] SynVesT-1 uptake in the bilateral hippocampus-insula region and the left postcentral gyrus compared to HCs ($P<0.001$, cluster size>50). Neuropsychological performance correlated with regional standardized uptake values ($P<0.05$). Specifically, CSVD patients with burden scores of 0-1 demonstrated reduced synaptic density in the left insula and lingual gyrus compared to HCs. Conversely, patients with burden scores of 2-4 manifested diminished uptake in the bilateral insula, left parahippocampal gyrus, and right anterior cingulate and paracingulate gyri ($P<0.001$, cluster size>50). Moreover, CSVD patients without cognitive impairment exhibited decreased uptake in the left hippocampus-insula region relative to HCs, while those with cognitive impairment displayed synaptic loss in the bilateral insula, left hippocampus, and anterior cingulate and paracingulate gyri ($P<0.001$, cluster size>50). ***Conclusion:*** This study represents the first investigation of synaptic density in vivo in CSVD utilizing [18F]SynVesT-1 PET imaging. Our findings suggest the potential of synaptic density as a biomarker for diagnosing CSVD and assessing cognitive impairment and disease progression.

OP-563, 564 & 565 - please see Addendum at page 1026

1208

Tuesday, October 22, 2024, 08:00 - 09:30
Hall G2

Joint Symposium 6 - Radiation Protection Committee - Nuclear and Radiological Emergencies - Preparedness and Response

1209

Tuesday, October 22, 2024, 08:00 - 09:30
Hall F

e-Poster Presentations Session 9: Cardiovascular Committee: Nuclear Cardiology in all its States

EPS-169

Ventilation-perfusion mismatch correlates with hemodynamics in patients with Chronic Thromboembolic Pulmonary Hypertension: A quantitative analysis of Ventilation/Perfusion SPECT

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Aim/Introduction: Accurate diagnosis of chronic thromboembolic pulmonary hypertension (CTEPH) is crucial for individualizing treatment strategies, including pulmonary endarterectomy, balloon pulmonary angioplasty, medical therapy, or their combinations. Ventilation/perfusion (V/Q) single-photon emission computed tomography (SPECT) serves as the primary diagnostic imaging modality. While V/Q mismatch indicates thromboembolic disease, its precise quantification remains challenging due to high interobserver disagreement with semiquantitative methods. Here, we present a quantitative, observer-independent method to measure the extent of ventilation/perfusion mismatches. ***Materials and Methods:*** We retrospectively analyzed 23 patients clinically diagnosed with CTEPH according to the 2015 ESC/ERS guidelines on PH. Each patient underwent V/Q SPECT with 99mTc-Argongas inhalation for ventilation and injection of 99mTc albumin-aggregated for perfusion scan. Right heart catheterization was performed prior to treatment, within three months of the V/Q scan. Quantitative analysis of the V/Q scans involved the following: Ventilation scans were corrected for decay and for differences in acquisition time between V and Q (V(corr)). Remaining activity from V(corr) was subtracted from Q (Q(corr)). Lung boundaries were determined using a 10% threshold to the sum of V and Q(corr). Total counts within the lung were calculated for V and Q(corr) (CV and CQ). V was normalized to CQ (V(norm)=VxCQ/CV). The ratio of ventilation to perfusion was calculated as V/Q=V(norm)/Q(corr). The extent of a V/Q mismatch was determined as the fraction of lung volume with a V/Q above 2.5, 5 (V/QVol>5), and 10. V/Q heterogeneity was calculated using the log standard deviation of the V/Q distribution curve (logSD(V/Q)). Finally, statistical evaluation included a Pearson test for the relationship between V/Q mismatch and hemodynamic parameters as well as clinical scores. ***Results:*** Ventilation/perfusion mismatch (V/QVol>5) and its heterogeneity (logSD(V/Q) significantly correlated with pulmonary vascular resistance (r=0.55,p<0.01 and r=0.55,p<0.01 resp.), transpulmonary pressure gradient (r=0.52,p<0.05 and r=0.53,p<0.01 resp.), mean pulmonary arterial pressure (r=0.43,p<0.05 and r=0.48,p<0.05 resp.), and pulmonary arterial compliance (r=-0.51,p<0.05 and r=-0.64,p<0.01 resp.). Furthermore, right ventricular enddiastolic diameter, determined by echocardiography, significantly correlated with V/Q mismatches and heterogeneity (r=0.44,p<0.05 and r=0.68,p<0.01 resp.). ***Conclusion:*** For the first time in a cohort of patients with initial CTEPH diagnosis, we established an objective method to quantify V/Q mismatches in V/Q SPECT. The extent of V/Q mismatches significantly correlated with crucial hemodynamic parameters characterizing the severity of pulmonary hypertension. Objective V/Q analysis may therefore not only enhance diagnostic accuracy during the initial evaluation but may also be utilized in therapy assessment.

EPS-170

Quantitative analysis of SPECT/CT pulmonary perfusion imaging in the evaluation of postoperative effects of BPA in CTEPH patients

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Aim/Introduction: To investigate the value of SPECT/CT pulmonary perfusion imaging (Q-LDCT) quantitative analysis in the evaluation of balloon pulmonary angioplasty(BPA) after chronic thromboembolic pulmonary hypertension (CTEPH). ***Materials and Methods:*** A total of 262 lung segments were prospectively treated in 50 patients diagnosed with CTEPH and treated with BPA in China-Japan Hospital from January 2020 to February 2023. Q-LDCT imaging was performed again within one week before and after reexamination.The SUVmax and SUVmean values of 262 lung segments before and after operation were calculated by manually extracting ROI in the Siemens back office(Symbia Intevo 16 VB21A).By visual analysis (Q-LDCT) to determine whether pulmonary perfusion was improved in each lung segment after surgery, pulmonary angiography was used as the gold standard to compare the diagnostic efficacy of Q-LDCT, SUVmax and SUVmean at lung segment level. P<0.05 was considered statistically significant. ***Results:*** The AUC of Q-LDCT, SUVmax and SUVmean for diagnosing pulmonary perfusion improvement were 0.61, 0.73 and 0.69, respectively.There were statistical differences in sensitivity, accuracy and AUC between Q-LDCT visual analysis and SUVmax (P<0.01), but no statistical differences in specificity (P>0.05).There were statistical differences in sensitivity and AUC between Q-LDCT visual analysis and SUVmean (P<0.05), but no statistical differences in specificity and accuracy between Q-LDCT visual analysis and SUVmean visual analysis (P>0.05).The diagnostic results of these three methods were in high consistency with pulmonary angiography, and the kappa values were (0.671, 0.792, 0.721), respectively. ***Conclusion:*** Compared with visual analysis, quantitative indicators SUVmax and SUVmean at lung segment level were more effective in diagnosing the recovery of pulmonary perfusion after BPA surgery in CTEPH patients. Quantitative analysis of Q-LDCT imaging can be used to evaluate the postoperative efficacy of BPA in CTEPH patients.

EPS-171

Combination of CZT SPECT coronary flow reserve, stress myocardial blood flow and coronary artery calcium scoring in prediction of coronary artery disease

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Aim/Introduction: Coronary flow reserve (CFR) obtained during the dynamic SPECT examination is usable prognostic and diagnostic marker for coronary artery disease (CAD). However, the complexity of stress and rest study for CFR calculation (CFR = stress myocardial blood flow (stressMBF) / rest myocardial blood flow (restMBF)) is time consuming in clinical praxis and combination of two examination is related with higher radiation dose. Aim of this study is to assess the prognostic significance of stressMBF, CFR, and coronary artery calcium score (CACS). ***Materials and Methods:*** We analysed retrospectively 77 patients (29 men, 66±9 years) examined with rest-stress dynamic myocardial SPECT and CACS. The adverse cardiac event (CE) defined as sudden cardiac death, myocardial infarction, situationsrequiring coronary revascularization, and hospitalization for heart failure with reduced ejection fraction, were recorded. ***Results:*** During a mean follow-up of 12 months there were 15 (19.5%) CE recorded.

Patients with CE had significantly higher CACS (median 680 vs 31.5, P=0.0001), significantly lower stress MBF (1.89±1.03 vs 2.86±0.99 ml/min/g, P=0.0012) and a lower CFR (1.56±0.61 vs 2.48±0.87, P=0.0002). A cut-off value for the prediction of CE were: CACS 230,2 (sensitivity of 92 % and a specificity of 80 %, AUC = 0.84, HR 29.5), stressMBF 2.29 ml/min/g (sensitivity of 87 % and a specificity of 71 %, AUC = 0.80, HR 10.5), and CFR 1.94 (sensitivity of 73 % and a specificity of 77 %, AUC = 0.8, HR 7.0). CFR and stressMBF did not show different performance in the identification of CE (AUC = 0.80 vs. AUC = 0.80, P=0.679). No CE occurred in patients with the combination of stress MBF > 2.29 ml/min/g and CACS < 230.2. ***Conclusion:*** CE can be predicted by low stressMBF, low CFR and high CACS, whereas there is not superiority of CFR over stressMBF. Such resulting possible simplification of dynamic SPECT protocol (stress-first/stress-only) enables expansion of the MBF quantification for a larger number of patients. Supported by MH CZ - DRO (FNOl, 00098892). ***References:*** Kaminek M, Havel M, Kincl V, Henzlova L, Hudson L. The prognostic value of CZT SPECT stress myocardial blood flow (MBF) quantification-opportunity for stress-first/stress-only protocol. Eur J Nucl Med Mol Imaging. 2024 Jan;51(2):344-345. Havel M, Koranda P, Kincl V, Quinn L, Kamínek M. Additional value of the coronary artery calcium score in patients for whom myoca rdial perfusion imaging is challenging. Kardiol Pol. 2019;77(4):458-64.

EPS-172

Higher Precision and Processing Repeatability of Myocardial Blood Flow and Flow Reserve Calculated Using Net Retention Model Compared to One Compartment Model in ^{99m}Tc-MIBI CZT SPECT studies

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Aim/Introduction: The aim of this study is to assess the processing repeatability of myocardial blood flow (MBF) and myocardial flow reserve (MFR) values in dynamic SPECT studies calculated using two models - net retention (RET) and one compartment (1CM), in the latest version of Corridor 4DM software (v2024). ***Materials and Methods:*** Data of 107 patients with coronary artery disease referred for dynamic SPECT were analyzed retrospectively. 57 of these patients were previously assessed in older version of 4DM (v2015) [1], 50 were new. SPECT study was carried out using a two-day rest-stress (dipyridamole) protocol with 592 MBq of 99mTc-MIBI administered each day. Data was processed in 4DM v2024 twice by one operator and once by another operator. Repeatability of MBF and MFR values was compared between 4DM v2015 and v2024 in 1CM model (57 patients) and between 1CM and RET models (107 patients) in 4DM v2024. ***Results:*** Automatic heart image positioning during post-processing in 4DM v2024 was significantly improved compared to v2015, reducing the number of studies requiring significant manual corrections from 41% to 12%. This significantly improved interobserver processing repeatability of MFR values in RCA territory from r=0.67 to 0.85 (p = 0.0034) in 1CM model. Interobserver processing repeatability of MBF and MFR was significantly better in RET model compared to 1CM model. Also, in 4DM v2024, a measure of precision in form of standard deviation of percentage differences of MBF and MFR in both models is almost two times lower compared to results published in recent literature [2,3]. ***Conclusion:*** Repeatability of MBF and MFR values based on dynamic SPECT data calculated using RET model are better compared to 1CM model. Improved automatic positioning of heart images in 4DM v2024 significantly improved their processing repeatability. There is still a need for better standardization of dynamic SPECT MFR study processing methodology. ***References:*** [1] Cichocki P, Błaszczyk M, Cygulska K, et al. Inter- and Intraobserver Repeatability of Myocardial Flow Reserve Values Determined with SPECT Study Using a Discovery NM530c Camera and Corridor 4DM Software. Journal of Personalized Medicine. 2021;11:1164. [2] Bailly M, Thibault F, Metrard G, Courtehoux M, Angoulvant D, Ribeiro MJ. Precision of Myocardial Blood Flow and Flow Reserve Measurement During CZT SPECT Perfusion Imaging Processing: Intra- and Interobserver Variability. Journal of Nuclear Medicine. 2023;64:260-265. [3] Cuddy-Walsh SG, deKemp RA, Ruddy TD, Wells RG. Improved precision of SPECT myocardial blood flow using a net tracer retention model. Medical Physics. 2023;50:2009-2021.

EPS-173

Application exploration in prognosis evaluation of resynchronization therapy by dynamic change of mechanical contraction synchronization parameters in CZT-SPECT

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Aim/Introduction: Left ventricular mechanical systolic synchrony parameters was evaluated by GMPI phase analysis technique, and we analyze the predictive value of dynamic changes of mechanical systolic synchrony parameters for the prognosis of patients with chronic heart failure treated with resynchronization. ***Materials and Methods:*** A total of 15 patients with chronic heart failure prospectively enrolled, including 10 males and 5 females, with an average age (65.31±9.46) years old. Mechanical systolic synchronization parameters included PSD and PHB were evaluated by CZT-SPECT GMPI phase analysis technique before implantation, 1 week in the short term after implantation, and 6-12 months after implantation. The outcome was assessed according to the improvement of clinical symptoms and cardiac function parameters by CZT-SPECT. The relationship between mechanical synchrony parameters and cardiac function parameters was analyzed by using dynamic change curves. ***Results:*** During the follow-up of 15 patients. Finally, 12 patients were enrolled in the study for resynchronization therapy, 10 patients underwent CRT-D and 2 patients underwent CRT-P, including 7 patients with traditional CRT, 2 patients with left bundle branch region pacing, and 3 patients with LBBP-optimized CRT (LOT-CRT). According to the outcome criteria, all of the 12 patients were response, and 3 (25%) were sup-response. Preoperative relevant parameters of 12 patients are as follows: cardiac function parameters EDV and ESV respectively were (204.4±62.95) ml and (155.3±65.75) ml, and EF were (26.1±9.05)%. Synchronization parameters PSD and PHB respectively were (51.14±25.38) ° and (167.5±83.74) °. One week after resynchronization follow-up parameters: EDV and ESV respectively were (166.6±77.14) ml and (120.6±69.12) ml, and EF were (30.7±9.13)%. PSD and PHB were (33.87±13.98) ° and (104.2±46.02) °. Long-term follow-up (6-12 months) parameters: EDV and ESV were (137.2±77.33) ml and (86.9±67.30) ml, EF was (42.1±13.22)%. PSD and PHB were (32.69±17.60) ° and (101±57.92) °, respectively. The changes tend of synchronization parameters and left ventricular size and cardiac function were consistent according to the dynamic change trend curve of the short and long term the follow-up, it suggested that left ventricular size are reduced and left ventricular systolic function are improved with the improvement of left ventricular mechanical contraction

synchronization. ***Conclusion:*** The change trend of mechanical contraction synchronization may become a new way to predict the efficacy of resynchronization therapy in patients with heart failure.

EPS-174

Lung-to-Heart Ratio (LHR) on Myocardial Perfusion Imaging (MPI): A Potential Tool for Heart Failure Management?

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Aim/Introduction: Heart failure (HF) management remains challenging. Prior research suggests that SPECT Myocardial Perfusion Imaging (MPI) with AI-based algorithms improves HF hospitalization prediction [1]. Lung ultrasound, a non-invasive tool, diagnoses HF and predicts hospitalization based on comet tails, an indicator of lung fluid [2]. This study investigates the potential of the Lung-to-Heart Ratio (LHR) derived from MPI scans as a marker for lung fluid accumulation, aiming to improve HF management. ***Materials and Methods:*** We prospectively enrolled 21 patients (average age 62) undergoing both MPI (Rest 99mTc-sestamibi) and lung ultrasound on the same day. Patients with varying degrees of lung uptake were included. We quantified the number of comet tails per field of view on lung ultrasound images. LHR was measured on perfusion scans using a simplified method: the ratio of counts in a lung Region Of Interest (ROI) adjacent to the heart to the counts in the heart ROI (anterolateral wall). Both ROIs were rectangular and equal in size. ***Results:*** Eleven patients (nine with coronary disease) had high comet tail counts (≥3 per field) and high LHR (mean LHR value 0.67 ± 0.07, all ≥0.57). Ten patients (seven with coronary disease) had low comet tail counts (<3 per field) and low LHR (mean LHR value 0.42 ± 0.07, all <0.57). The Pearson correlation coefficient R=0.8026, p=.000012 (p<.01), indicating a positive correlation between lung fluid and LHR. ***Conclusion:*** Our initial findings suggest a link between lung fluid accumulation, as measured by lung ultrasound, and factors influencing LHR derived from MPI. LHR from MPI might offer a valuable, non-invasive assessment of lung congestion, potentially guiding HF management. However, further validation with a larger and more diverse patient population is needed. This study adds to the understanding of MPI's role in HF, potentially complementing the work by Feher, Attila et al. (2024) on MPI and HF hospitalization risk prediction [1]. Future research will determine if including LHR in MPI reports improves HF treatment strategies. ***References:*** 1: Feher, Attila, et al. "Artificial Intelligence Predicts Hospitalization for Acute Heart Failure Exacerbation in Patients Undergoing Myocardial Perfusion Imaging." Journal of Nuclear Medicine (2024). 2: Iwakura, Katsuomi, and Toshinari Onishi. "A practical guide to the lung ultrasound for the assessment of congestive heart failure." Journal of Echocardiography 19.4 (2021): 195-204.

EPS-175

Transient ischemic dilation ratio thresholds in patients undergoing vasodilator stress [^{13}N]-ammonia positron emission tomography myocardial perfusion imaging

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Aim/Introduction: Transient ischemic dilatation (TID) i.e. dilatation of the left ventricular cavity during vasodilator stress myocardial perfusion imaging (MPI) is a marker of extensive coronary artery disease (CAD) and adverse outcomes. TID has also been described in hypertrophic cardiomyopathy (HCM). While cut-off values are available for [82Rb]-PET MPI and single photon emission computed tomography, normal values have not been reported for [13N]-ammonia-PET. In the present study, we aim to describe TID cut-off values for [13N]-ammonia-PET in a patient cohort without CAD using two different commercially available software packages. ***Materials and Methods:*** We retrospectively included patients undergoing clinically indicated, adenosine or regadenoson [13N]-ammonia-PET MPI (08.2014-02.2023) without perfusion defects, normal hyperemic myocardial blood flow, normal myocardial blood flow reserve, and coronary artery calcium score (CACS) = 0. Patients with HCM and patients with severely depressed left ventricle ejection fraction (LVEF) were excluded. TID ratios were automatically generated using two different commercially available software tools with manual correction when indicated. Upper limits of normal TIDs were calculated using the mean +2 standard deviations. LV volumes and LVEF were derived from gated images. Patient demographics and cardiovascular risk factors were obtained from electronic medical records. ***Results:*** A total of 151 patients, 75 males (49.7%) and 76 females (50.3%) with a mean age of 54.9 ± 12.9 years and a median BMI of 24.8 kg/m2 (IQR 21.9 - 29.2) were included. Stress testing was performed using adenosine in 68 patients (45.0%) and regadenoson in 83 patients (55.0%). The mean TID for software 1 was 1.08±0.09 with the following upper normal limits: 1.23 in males and 1.25 in females using regadenoson and 1.26 in males and 1.31 in females using adenosine. The mean TID for software 2 was 1.01±0.08 with the following upper normal limits: 1.15 in males and 1.15 in females using regadenoson and 1.19 in males and 1.17 in females using adenosine. Cardiovascular risk factors included arterial hypertension (31.8%), dyslipidemia (27.2%), obesity (20.5%), smoking (13.9%), diabetes mellitus (12.6%) and a positive family history (11.9%). ***Conclusion:*** We report for the first time, TID cut-off values for [13N]-ammonia PET in a patient population without evidence of CAD. TID cut-off values vary based on the software, type of vasodilator, and gender. The TID cut-offs were found to be slightly higher than those established for [82Rb]-PET MPI using software 2 (1.13) in a healthy population defined by a low likelihood of CAD and normal MPI.

EPS-176

Simulation of a weight-based dose protocol for rubidium-82 cardiac PET: impact on clinical metrics and image quality

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Aim/Introduction: Rubidium-82 is the most widely used PET tracer for Myocardial Perfusion Imaging Positron Emission Tomography (MPI PET). Updated generator cart delivery systems facilitate individual patient weight-based dosing protocols as opposed to our existing standard 740 MBq for all comers. Currently all images are acquired on a SiPM PET-CT with 214 ps timing resolution and are deemed acceptable quality in our entire patient population. Our previous retrospective analysis of image quality in consecutive patients of varying weights led us to

look at a weight-based protocol in patients below 100 kg which forms nearly 80% of our referrals. This work simulates this protocol and assesses the impact of this protocol on clinical metrics and the visual interpretation of images. ***Materials and Methods:*** Event-by-event listmode resampling was performed to simulate a reduction in activity from fixed 740 MBq to 7.4 MBq/kg in 50 consecutive patients below 100 kg, which we have proposed from prior work to be appropriate for our patient population. Static relative perfusion and dynamic images were reconstructed with OSEM+TOF for original and resampled data. Total Perfusion Deficit (TPD) was derived from the static images and myocardial blood flow (MBF) and reserve (MBFR) were calculated from the dynamic data. A blinded visual assessment was performed by a nuclear medicine physician, on pairs of original and resampled patient images, viewed with both rest and stress in each case, with images ranked in terms of quality on a 5-point Likert scale. ***Results:*** No significant differences were observed in clinical metrics when comparing original and resampled data. TPD varied between -1 to +1 in 45 stress images and 40 rest images, with remaining changes of up to 4, that were not clinically significant. Mean and standard deviation in percentage difference for stress MBF, rest MBF and MBFR was +1.0%±4.1, -0.8%±4.4 and 1.9%±4.7, respectively, with all differences falling within the reported test-retest variability. For the visual assessment, all but three image pairs were scored equally on the Likert scale, with the remaining placed 1 rank apart. ***Conclusion:*** This work has confirmed that a weight-based protocol can be implemented in patients with weight less than 100kg undergoing MPI PET and achieve acceptable image quality and quantification. This would result in a dose reduction in the vast majority of our patients, achieving an effective dose for the test of between 1 and 2 mSv, for a rest-stress exam with a single CT for attenuation correction.

EPS-177

Effect of acute beta-blocker administration on myocardial blood flow as derived from quantitative 13N-ammonia PET myocardial perfusion imaging

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Aim/Introduction: The study aimed to evaluate the impact of acute intravenous beta-blocker administration on myocardial blood flow (MBF) during same-day hybrid coronary computed tomography angiography (CCTA) and positron emission tomography (PET) myocardial perfusion imaging (MPI) with 13N-ammonia. This investigation explores how beta-blockers, commonly used during CCTA for heart-rate control, might alter quantitative MBF measurements. Previous studies on the effects of discontinuing oral beta-blockers before MPI have yielded inconsistent and sometimes contradictory results. No studies have yet addressed this issue in the context of same-day hybrid imaging with intravenous beta-blocker administration. ***Materials and Methods:*** This retrospective, single-center study included patients who underwent same-day hybrid CCTA/13N-ammonia PET MPI for suspected chronic coronary syndromes. Patients received intravenous beta-blocker (metoprolol, up to 30 mg) as needed for heart-rate control prior to CCTA. We excluded all patients with coronary artery stenosis ≥50% on CCTA and/or regional perfusion abnormalities (i.e. ischemia and/or scar) on 13N-ammonia PET. Patients already on established oral beta-blocker therapy were also excluded. MBF was measured at rest (rMBF), during vasodilator-induced stress (sMBF), and the myocardial flow reserve (MFR) was calculated. ***Results:*** After excluding 281 patients who met the exclusion criteria, 154 remaining patients were used for propensity-score matching, resulting in a final cohort of 108 patients divided into two equal groups: those who had received beta-blockers prior to CCTA and those who had not. These groups did not differ in baseline characteristics. Among those who received beta-blockers, the median dose was 0.11 mg·kg-1 (IQR 0.07-0.20). The average time-interval between beta-blocker infusion and stress PET was 2.2±1.0 hours. The main finding was a significant reduction in sMBF (2.21 [IQR 1.72-2.78] versus 2.46 [2.08-2.99] ml·min-1·g-1, p=0.027) and consequently, as rMBF was highly comparable (0.65 [0.54-0.78] versus 0.64 [0.55-0.76] ml·min-1·g-1, p=0.931), a reduction of MFR (3.46 [2.70-4.05] versus 3.79 [3.22-4.46], p=0.030) in patients who received beta-blockers compared to those who did not. On average, sMBF and MFR were 10.2% and 8.7% lower, respectively. ***Conclusion:*** Acute administration of beta-blockers significantly influences MBF as measured by 13N-ammonia PET, leading to a significant reduction in sMBF and MFR. In contrast, rMBF appears unaffected, suggesting that beta-blockers primarily impact the coronary capacity to respond to vasodilators.

EPS-178

Routine clinical reproducibility of myocardial blood flow measurements with ^{15}O-water PET

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Aim/Introduction: Hyperemic myocardial blood flow (MBF) has been shown to provide the most accurate non-invasive diagnosis of hemodynamically significant CAD. A high reproducibility of hyperemic MBF measurements is important for accurate stratification of patients. Previous studies have shown that whole-myocardium hyperemic MBF measurement with 82Rb has a repeatability coefficient (RC) of 50% (1.3 mL/g/min) for a two-day test-retest using adenosine in healthy controls1 and 21% (0.51 mL/g/min) and 38% (0.90 mL/g/min) for a single-session and two-day test-retest using dipyridamole, respectively, in patients in clinical routine2. For 15O-water and adenosine, an RC of 25% (0.90 mL/g/min) has been reported in 1999 for healthy controls, whereas RC at the regional level was >50%3. The aim of the current work is to assess the reproducibility of hyperemic MBF measurements with 15O-water using state of the art technology. ***Materials and Methods:*** Sixteen patients referred for assessment of ischemia underwent a same day test-retest protocol consisting of 4-min dynamic rest and stress scans starting simultaneously with controlled bolus injection of 400 MBq 15O-water on a digital PET-CT scanner. Patients left the scanner between test and retest sessions and time between test and retest scan sessions was circa 1 h. Adenosine infusion at 140 µg/kg/min was started 2 min prior to each stress scan and continued during the entire scan. Images were analysed using fully automated software. RC (1.96 x SD of test-retest differences), mean relative test-retest difference and within-subject coefficient of variation (wCV) were calculated at the whole myocardium, regional and segmental levels. ***Results:*** Whole myocardium hyperemic MBF ranged from 1.3 to 4.6 mL/g/min. RC was 14% (0.38 mL/g/min), 21% (0.59) and 24% (0.71) at whole myocardium, regional and segmental levels, respectively. Mean test-retest difference was 6%, 9% and 10%, and wCV was 5.3%, 7.6% and 9.0%, respectively. Data from two subjects was excluded because of excessive motion and technical problems. ***Conclusion:*** Automated data analysis and use of modern PET scanners results in a large improvement of reproducibility of

hyperemic MBF measurements with 15O-water. Reproducibility of hyperemic MBF with 15O-water is superior to previously published values for 82Rb. ***References:*** 1 Byrne et al, J Nucl Cardiol 2020; 2 Kitkungvan et al, JACC cardiovasc imag 2017; 3 Kaufmann et al, J Nucl Med 1999.

EPS-179

Feasibility of right ventricular imaging with F^{18} Flurpiridaz positron emission tomography

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Aim/Introduction: F^{18} Flurpiridaz is a novel PET perfusion tracer with nearly linear myocardial extraction, providing superior image quality for the assessment of left ventricular (LV) perfusion, flow and function. Here, we sought to evaluate the feasibility for right ventricular (RV) imaging. ***Materials and Methods:*** Thirteen patients (4w, 9m) underwent routine one-day rest and regadenoson stress F^{18} Flurpiridaz PET for the workup of suspected or known coronary artery disease (injected dose: 121 MBq (IQR: 108-130) for rest, 227 MBq (IQR: 201-260) for stress). Disease involving the right coronary artery (RCA) was present in 5/13. None had evidence of congenital heart defects, shunts or right ventricular hypertrophy. Static, gated and dynamic images were generated for visual, semi-quantitative and quantitative analysis using commercially available software. ***Results:*** LV analysis revealed static perfusion defects in 5/13 subjects (2 rest and 5 stress exams; 4 involving RCA territory). Gated analysis showed a median LVEF of 64% (IQR: 61-71) at rest and 65% (IQR: 60-70) at stress, while median LV stroke volume was 89 ml (IQR: 78-100) at rest and 89 (IQR: 80-94) ml at stress. Global myocardial flow reserve was 3.1 (IQR: 2.2-4.3). RV analysis revealed good contrast for visualization of the myocardium. Median RV myocardium-to-cavity ratio was 6.5 at stress (IQR: 4.5-7.4) and 3.2 at rest (IQR: 3.0-3.5), which was lower than for LV (stress: 9.1, IQR: 7.8-12.8 / rest: 7.8, IQR: 5.7-10.7). RV was not visually discernible in two rest studies. In the remaining 24 studies (including 4 of 4 patients with RCA disease), regional RV perfusion was generally heterogeneous and clearcut perfusion defects were not readily discernible. For gated RV analysis, automated contouring was limited. We included 7 stress and matching 3 rest exams that had segmentations with only minor issues for a further analysis. Here, median RVEF was 72% (IQR: 64-75) at rest and 78% (IQR: 68-79) at stress. RV stroke volume was 76 ml (IQR: 70-89) at rest and 90 ml (IQR: 78-91) at rest. Pairwise comparison of LV and RV SV showed no significant difference in these subjects, providing internal validation (rest: p=0.25; stress: p=0.29). ***Conclusion:*** RV analysis seems feasible with F^{18} Flurpidaz PET perfusion imaging, but should be tested in larger patient cohorts using independent validation and optimized acquisition and analysis techniques.

EPS-180

Assessment of Cardiac FDG PET/MRI in Predicting Functional Recovery After AMI PCI: A Retrospective Study

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Aim/Introduction: Late gadolinium enhancement (LGE) in cardiac magnetic resonance imaging (MRI) has been identified as an accurate diagnostic tool for detecting non-viable myocardium. However, the role of F^{18} fluorodeoxyglucose (FDG) positron emission tomography (PET)/MRI in detecting viable myocardium has not been fully investigated. The aim of this study is to evaluate the diagnostic efficacy of cardiac FDG PET/MRI in detecting functional recovery of non-viable myocardium, which is identified by cardiac MRI following successful percutaneous coronary intervention (PCI) for patients with acute myocardial infarction (AMI). ***Materials and Methods:*** We retrospectively reviewed a total of 42 patients with AMI who underwent PET/MRI within 7 days after AMI PCI. Among the study population, 28 patients (66.67%) were identified as having non-viable myocardium, defined as ≥50% transmurality of LGE. We categorized these patients based on FDG uptake: group A (perserved FDG uptake, n=14) and group B (decreased FDG uptake, n=14). We analyzed infarct-related regional wall motion recovery at 9 months after PCI. ***Results:*** Clinical and angiographic findings were similar between the two groups. Peak troponin-I levels were also not significantly different between the two groups (34.29±31.76 ng/mL vs. 49.06±37.38 ng/mL, p=0.100). Baseline echocardiographic findings also showed similar results, including left ventricular ejection fraction (49.0±10.34% vs. 42.07±9.25%, p=0.268) and regional wall motion index (1.46±0.40 vs. 1.55±0.30, p=0.473). At 9 months after PCI, infarct-related regional wall motion index recovery was significantly more pronounced in group A (Initial: 1.98±0.57, follow up: 1.70±0.68, p=0.008) compared to group B (Initial: 2.23±0.50, follow up: 2.06±0.69, p=0.108). ***Conclusion:*** Although MRI findings indicated non-viable myocardium, FDG uptake could serve as a predictor for functional recovery after AMI PCI.

EPS-181

Development and validation of a novel prognostic model for predicting MACE based on ^{18}F-FDG PET myocardial ischemic memory imaging in patients with suspected UA: results from an observational cohort study in China

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Aim/Introduction: ^{18}F-FDG PET myocardial ischemic memory imaging can be used to diagnose myocardial ischemia. Our previously unpublished study found that ^{18}F-FDG PET myocardial ischemic memory imaging can serve as a novel prognostic marker for predicting major adverse cardiovascular events (MACE) in suspected unstable angina (UA) patients presenting with chest pain, exhibiting significantly incremental prognostic value. This study aims to develop and validate a nomogram model for predicting the risk of MACE in suspected UA patients. ***Materials and Methods:*** Conducted as a post-hoc analysis of prospective research, the study enrolled 240 patients who presented with chest pain, normal initial electrocardiogram (ECG), and initial negative cardiac biomarkers but still had clinical suspicion for UA. All patients underwent rest ^{18}F-FDG PET myocardial ischemic memory imaging, and coronary angiography was performed within one week. "Focal" or "focal on diffuse" myocardial ^{18}F-FDG uptake was defined as ^{18}F-FDG positive (myocardial ischemia). The primary endpoint was MACE, defined as the composite of cardiovascular death, rehospitalization for UA, acute myocardial infarction, heart failure, unplanned coronary revascularization, or stroke. With a median follow-up duration of 26 months, 50 cases (20.8%) of MACE were recorded. Patients were randomly divided into training (n = 168) and internal validation (n = 72) group at a

7:3 ratio. The influencing factors of MACE were selected using least absolute shrinkage and selection operator (Lasso) regression and multivariate COX regression, and a nomogram prediction model was established. Discrimination, calibration, and clinical validity of the nomogram model were evaluated using area under the receiver operating characteristic curve (AUC), calibration curves, and decision curve analysis (DCA), respectively. ***Results:*** The final nomogram model included six predictive factors: male, previous myocardial infarction, hypertension, abdominal circumference, GRACE score, and ^{18}F-FDG positive. At a median follow-up of 26 months, the AUC demonstrated excellent discriminative ability, with values of 0.876 (95% CI 0.811-0.943) for the training group and 0.769 (95% CI 0.708-0.860) for the validation group. Calibration curves for both groups exhibited strong agreement with the ideal model. DCA and clinical impact of Kaplan-Meier survival analysis underscored the favorable clinical utility of the nomogram prediction model. ***Conclusion:*** The nomogram model developed in this study effectively identifies high-risk populations among suspected UA patients presenting with chest pain, offering specific predictive value for MACE occurrence. Larger-scale, multicenter prospective studies are warranted to validate and refine these findings.

EPS-182

Immune-checkpoint inhibition does not affect arterial [18F]FDG uptake in cancer sequential PET/CTs

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Aim/Introduction: There is increasing evidence that immune checkpoint inhibition (ICI) may accelerate atherosclerosis, leading to increased incidence of cardiovascular events. However, evidence is conflicting as to whether ICI increases short-term arterial inflammation, which may be measured by [18F]FDG uptake. Furthermore, long-term trajectories have not been evaluated. Aim of the present study was to analyse arterial uptake over time in cancer patients. ***Materials and Methods:*** Inclusion criteria were presence of a tumor eligible for ICI treatment, age >65 years, initial PET/CT upfront ICI use, and follow-up with at least 3 PET/CTs over 36 months. We quantified the vascular target-to-background ratio (vTBR) of six vascular regions: both carotid bifurcations, aortic arch and abdomen, aortic bifurcation, left renal and femoral artery. Mixed-effects linear and logistic regression models were used for baseline and follow-up analyses for continuous and dichotomized outcomes, including regional measurements. All models were adjusted for a number of potential confounders, and the time-dependent model was adjusted for the time since the first PET/CT. ***Results:*** Inclusion criteria were met in 156 patients (81 melanoma, 23 non-small cell lung cancer, 18 small cell lung cancer, 12 lymphoma and 22 with other cancers). 51 patients were treated with ICI. Statin use (25.0%), hypertension (67.3%), pre-existing coronary heart disease (17.3%), stroke (12.2%), current or former smoking (18.6%), chronic kidney disease (17.9%) and diabetes (23.1%) were similar between ICI and control groups. Baseline vTBR did not differ significantly between groups. Predictors of higher vTBR at baseline were male sex (odds ratio [OR] 3.30, 95% confidence interval [CI] 1.77, 6.16, p<0.001) and BMI (OR 2.30, CI 1.26, 4.20, p=0.007). Statin use (OR 0.64, CI 0.31, 1.32, p=0.226), smoking (OR 1.36, CI 0.61, 3.02, p=0.452) and age (OR 1.31, CI 0.72, 2.38, p=0.374) were not significantly associated with higher vTBR at baseline. Follow-up vTBR values were analysed over a median of 725 days (IQR 658, 770). Statin use correlated negatively (p=0.003) and BMI correlated positively (p=0.014) with vTBR over time. No association (regression coefficient [RC] -0.006 [CI -0.015, 0.004], p=0.229) was found between ICI therapy and vTBR. ***Conclusion:*** In cancer patients with cardiovascular comorbidities, ICI was not associated with long-term arterial uptake trajectories assessed by routine [18F]FDG PET/CTs. The sensitivity to inflammatory modifiers is supported by the inverse associations with BMI and statin use found in our study. Conversely, the lack of association with ICI suggests that [18F]FDG may not adequately reflect ICI-induced low-grade arterial inflammation.

EPS-183

Evaluation of ^{11}C-PIB PET/CT and ^{99m}Tc-DPD scintigraphy in the subtype diagnosis and survival prediction of cardiac amyloidosis

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Aim/Introduction: This study sought to evaluate the application of combined 11C-Pittsburgh compound B (PiB) positron emission tomography (PET) /computed tomography (CT) and 99mTc-diphosphono-1,2-propanodicarboxylic acid (99mTc-DPD) scintigraphy in diagnosing subtypes of cardiac amyloidosis (CA) i.e. immunoglobulin light-chain (AL), transthyretin (ATTR) amyloidosis and predicting patient survival time. ***Materials and Methods:*** The cohort consisted of 50 patients, including 12 with AL-type CA,15 with ATTR-type CA, and 23 with non-CA. All patients underwent 11C-PIB PET/CT and 99mTc-DPD scintigraphy, and clinical features, pathological results, serological indicators (proBNP, Tn, kappa, lambda), cardiac MRI, echocardiography and follow-up data were collected. Quantitative assessment of 11C-PIB activity was performed using the SUVmax and SUVmean of the left ventricular myocardium and paraspinal muscle and calculation of target-to-background SUV ratio. CAM of 99mTc-DPD scintigraphy was performed using deep-leaning. Furthermore, this study developed 1-year, 3-year, and 5-year survival prediction models, using survival analysis techniques for model evaluation. ***Results:*** Preliminary results indicate that the combined 11C-PIB PET/CT and 99mTc-DPD imaging demonstrates high sensitivity and specificity in differentiating between AL and ATTR types of cardiac amyloidosis. Additionally, the survival prediction models integrating clinical features and imaging parameters showed good accuracy in predicting both short-term and long-term patient survival rates. ***Conclusion:*** These findings suggest that 11C-PIB PET/CT and 99mTc-DPD scintigraphy not only serve as accurate diagnostic tools for the subtypes of cardiac amyloidosis but also provide valuable prognostic assessment capabilities.

EPS-184

Multigene panel analysis had limited additional value compared to transthyretin gene analysis only for patients with suspected cardiac amyloidosis with Perugini grade 2-3 on bone scintigraphy

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Aim/Introduction: Gillmore et al., introduced a diagnostic algorithm for cardiac amyloidosis where bone scintigraphy is pivotal. For Perugini grade 2-3 cardiac bone tracer uptake, only transthyretin (TTR) genotyping is recommended to distinguish between wildtype transthyretin (ATTRwt) amyloidosis and hereditary transthyretin (ATTRv) amyloidosis after excluding immunoglobulin light chain amyloidosis. For Perugini grade 0-1 cardiac bone tracer uptake and persistent suspicion of cardiac amyloidosis, the amyloid type should be identified through histologic tests. Several cases of rare hereditary forms of cardiac amyloidosis have been reported with cardiac bone tracer uptake, that would have been diagnosed with ATTRwt amyloidosis by following the Gillmore algorithm. While typically considered rare, they can be more common than thought and therefore misdiagnosed as ATTRwt cardiomyopathy. Therefore, addition of multigene panel analysis to bone scintigraphy may enhance the accuracy of identifying patients with cardiac amyloidosis and establishing the correct type of amyloidosis (ATTRv amyloidosis, ATTRwt amyloidosis or a rare hereditary type of amyloidosis). Distinguishing between hereditary and non-hereditary types of cardiac amyloidosis based on genetic analysis has treatment implications and is relevant for family members. This study aims to evaluate the diagnostic yield of multigene panel analysis in patients with suspected cardiac amyloidosis based on bone scintigraphy. ***Materials and Methods:*** All consecutive patients with suspected cardiac amyloidosis without a known family history of hereditary amyloidosis referred to the University Medical Center Groningen between 2017-2023 were enrolled. Patients underwent genetic analysis using the multigene panel Amyloidosis (twelve genes). The results of genetic analysis were related to findings on bone scintigraphy. Perugini grade 2-3 indicates cardiac transthyretin amyloidosis (ATTR-CM). ***Results:*** In total, 246 unrelated patients were included, of whom fourteen (5.7%) had a pathogenic gene variant. Ten patients with a TTR-gene variant had Perugini grade 2-3, indicating ATTR-CM. One patient with Perugini grade 1 had an APOAI-gene variant consistent with AApoAI-amyloid in fat tissuse biopsy. One patient with an OSMR-gene variant had Perugini grade 0 but this variant was not associated with the cardiomyopathy. Two other patients with Perugini grade 3 had pathogenic variants unrelated to the cardiomyopathy. ***Conclusion:*** The yield of multigene panel analysis was 4.5%. In patients with Perugini grade 0-1, multigene panel analysis might provide additional value to identify rare hereditary types of amyloidosis beyond what TTR-genotyping only and bone scintigraphy can reveal. However, in those with Perugini grade 2-3, multigene panel analysis does not provide additional value compared to bone scintigraphy and TTR-genotyping only.

EPS-185

Census of Cardiac Uptake on Routine Bone Scintigraphy, a Methodology to Assess the Prevalence of the TTr Cardiac Amyloidosis

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Aim/Introduction: Transthyretin cardiac amyloidosis (TTrCA) is a rapidly progressive restrictive cardiomyopathy remaining underdiagnosed. Diagnosis is challenging and cannot be based on ultrasound and MRI findings alone because they lack sufficient accuracy. It requires invasive test of myocardial or fat pad biopsies. The non-invasive scintigraphic technique using bone-seeking radiopharmaceuticals has become a cornerstone in the workup revealing a myocardial uptake. Our work consists of a single institution retrospective study aiming to look of myocardial uptake on bone scintigraphies, and to estimate the prevalence of TTrCA. ***Materials and Methods:*** A total of 2211 consecutive cases of bone scintigraphy realized mostly for oncologic purposes between 2009 and 2020 in patients ranging between 31- and 95-y-old (mean age = 61.40 ± 15.42) were included in this study, 1261 are females (57%) and 950 are males (43%). The visual analysis of scintigraphic images classifies the cardiac uptake into 4 Perugini grades and evokes the diagnosis of TTrCA in high grades 2 and 3. The medical records of high grades patients were reviewed to exclude other pathologies that could be a cause of myocardial uptake. Patients with positive uptake underwent echocardiography to demonstrate restrictive cardiomyopathy. ***Results:*** Grades 1, 2 and 3 myocardial uptakes, were observed in 1.72% of all patients. Prevalence of uptakes, was 0.37% in the 50th, increased dramatically at the 60th, (2.49%), and reached 4% above the age of 80. Low grade 1 cases are the majority of positive cases, constituting 86.4%. Cases of high grades 2 and 3 were identified in 0.23% of overall patients (5 cases) ranging between 56- and 91-y-old. ***Conclusion:*** Our results agree with the trend of disease increases with age, and the low percentage of true positive cases is in concordance with the rarity of disease, as shown in other published series. The careful analysis of the bone scintigraphy of all incoming adult patients should allow to make the diagnosis of the TTRrCA at a preclinical stage and establish the effective treatments. Special cardiac care must be given to patients aged over 60 with cardiac uptake, even those of grade 1, due to the high prevalence of TTrCA in this age group. Our results provide an estimate of the number of patients that could be diagnosed and improve the awareness of the prevalence of disease. In this way, multicentric studies should be implemented by enrolling large cohorts of bone scintigraphy cases.

EPS-186

Clinical management of patients with Perugini grade 1 on [^{99}mTc]-HDP cardiac scintigraphy

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Aim/Introduction: Perugini grades 2 or 3 on cardiac scintigraphy with [99mTc]-HDP (CS) offer a non-invasive diagnostic criterion of cardiac transthyretin amyloidosis (ATTR) in the setting of typical echocardiographic/cardiac magnetic resonance (CMR) findings when clonal dyscrasia is excluded. However, confirmatory endomyocardial biopsy is needed for CS with Perugini grade 1. Our objective was to assess the proportion of patients with Perugini grade 1 on CS who finally undergo endomyocardial biopsy in the clinical practice in our centre. ***Materials and Methods:*** This is a single-centre retrospective observational study. From 2015 to 2024, 292 patients underwent CS. There were 32 patients with Perugini grade 1 whose clinical records were assessed in search of histological confirmation or any additional testing supporting the diagnosis of cardiac ATTR. The pre-CS clinical suspicion of cardiac ATTR was assessed according to the presence of red flags, considering high suspicion >1 red flag and low suspicion ≤1 red flag. ***Results:*** Twelve patients (37.5%) underwent additional examinations after CS (mainly cardiac MR) but only 4 patients (12.5%) underwent endomyocardial biopsy, having 3 of them

high suspicion of cardiac ATTR and one of them low suspicion. Of the remaining 8 patients, only 2 patients had high suspicion of cardiac ATTR but no histological confirmation due to high-risk comorbidities; the other 6 patients had CMR not suggestive of infiltrative cardiomyopathy (n=4) or died during the diagnostic process (n=2). Twenty patients (62.5%) did not undergo additional diagnostic testing. Only 3 (15%) of these patients had high suspicion of cardiac ATTR but also had high-risk comorbidities that precluded endomyocardial biopsy. In the remaining 17 patients, 12 patients had alternative cardiological diagnosis, 3 patients had very low suspicion of cardiac ATTR (0 red flags), one patient rejected additional testing and another patient lacked follow-up. ***Conclusion:*** In our routine clinical practice, many patients with Perugini grade 1 on CS do not undergo additional diagnostic testing and only a minority have endomyocardial biopsy, mainly due to associated comorbidities and low clinical suspicion of cardiac ATTR.

EPS-187

Multimodal Imaging in Cardiac Amyloidosis: Correlation between ^{99m}Tc-PYP SPECT/CT, Echocardiography, and Cardiac Magnetic Resonance: A Case Series

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Aim/Introduction: Cardiac amyloidosis (CA) is an infiltrative cardiomyopathy marked by deposition of amyloid in the myocardial tissue. 99mTc-pyrophosphate (99mTc-PYP) is a non-invasive imaging technique that allows the diagnosis of transthyretin type (ATTR) of CA. The study aims to compare the scintigraphic findings with echocardiography (ECHO) and cardiac magnetic resonance (CMR) in patients with clinical suspicion of CA. ***Materials and Methods:*** Our study involved 21 patients (mean age: 63, range: 42-75 years) with suspected cardiac amyloidosis (CA), who underwent 99mTc-PYP scintigraphy and SPECT-CT. Two experienced nuclear physicians analyzed planar and SPECT-CT images obtained 1-3 hours post-injection. We employed visual and quantitative analysis, calculating the C/CL ratio (counts of a region of interest over the heart vs. contralateral hemithorax). A ratio >1.5 with myocardial 99mTc-PYP uptake on tomographic images indicated ATTR positivity. Data from previous echocardiography (ECHO) and cardiac magnetic resonance (CMR) studies, including ventricular wall thickening, ejection fraction (EF), and late gadolinium enhancement, were also collected. ***Results:*** Myocardial 99mTc-PYP uptake was identified in the left ventricle in 10 patients and in the right ventricle in 6 patients. In these cases, the C/CL ratio was > 1.5. In the remaining 11 patients, myocardial uptake was ruled out with SPECT/CT images, and the C/CL ratio was <1.5, except in one patient. Vascular pool activity was identified in the tomographic images of 8 patients. All patients showed on ECHO an increase in the thickness of the left ventricular wall (>12mm), right ventricular wall thickening (>5mm) (n=6), interatrial septum thickening (>5 mm) (n=5), biauricular enlargement (n=10), preserved EF (n=12) and 9 patients showed reduced EF with globally reduced longitudinal strain (absolute value less than -15%). On the other hand, the finding evaluated with CMR were thickening of the left ventricle (n=14), right ventricular wall thickening (n=6), interatrial septum thickening (n=5), biauricular enlargement (n=12), preserved EF (n=9), reduced EF (n=5) were observed. In the late gadolinium enhancement (LGE) images the pattern was diffuse (n=11) and subendocardial (n=2). In only one case was it not possible to null the myocardial signal with different inversion times. Also LGE was evident in the left ventricle (n=13), right ventricle (n=6), and interatrial septum (n=5). ***Conclusion:*** This study highlights the significance of 99mTc-PYP scintigraphy and SPECT-CT in diagnosing cardiac amyloidosis (CA), especially in determining the subtype (ATTR). Our findings were consistent with abnormalities detected in echocardiography (ECHO) and cardiac magnetic resonance (CMR).

EPS-188

The Value of Na$^{[18F]}$F Imaging in the Early Assessment of Aortic Valve Degeneration Following Transcatheter Aortic Valve Implantation (TAVI)

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Aim/Introduction: Transcatheter aortic valve implantation (TAVI) is a standard, minimally invasive treatment of severe symptomatic aortic stenosis associated with aging. Patomechanism of the degenerative process on the biological valve leaflets in elderly is rather known, but the process of TAVI degeneration, limiting their durability, is not fully elucidated. We aimed to investigate the utility of Na$^{[18F]}$ PET/CT in assessment of an TAVI microcalcification and its influence to potential TAVI degeneration. ***Materials and Methods:*** Seventy-one TAVI patients underwent transthoracic echocardiography (TTE), transesophageal echocardiography (TEE), biochemical assessment of calcification and inflammation parameters and PET/CT with Na$^{[18F]}$F. According to the protocol TTE, TEE and PET/CT were planded at baseline and after 6 month follow up. Biochemical assays were performed as baseline and at 3, 6, 12 and 24 months. Of these, 30 patients had follow-up examinations, while the rest were lost to mortality and the COVID pandemic. In all patients included to the analysis TAVI valve morphology and function were assessed using TTE and TEE. SUVmax, SUVmean and tissue-to-background (TBR) of Na$^{[18F]}$F in the projection of the aortic valve were measured. Na$^{[18F]}$F uptakes were compared between baseline and follow-up PET/CT scans, performed 18.2 (±11.3) and 19.8 (±12.7) months after baseline. ***Results:*** Na$^{[18F]}$F PET/CT, as well as echocardiographic and biochemical data, were analyzed in 30 patients after TAVI (M11, F19), all of whom underwent follow-up PET/CT. The median age of the patients was 84.0 (IQR 80.0-87.0) years. After TAVI implantation, significant improvement in valve function was observed in all patients. The mean SUVmax of Na$^{[18F]}$F uptake on TAVI was 2.07 (IQR 1.67; 2.46). A positive correlation was found between changes in SUVmax values and selected echocardiographic parameters such as changes in maximal and mean transvalvular gradient, R=0,68, p=0,034 and R=0,3362, P=0,045, respectively. Among all biochemical assessments, a significant correlation was found between PET/CT results and baseline ox-LDL (R=0.3067, p=0.051) and osteoprotegerin (R=-0, 3024, p=0.0249), as well as control concentrations of osteopontin (R= -0.3903, p=0.0363), Lp(a) (R= 0.4026, p=0.0568) and matrix metalloproteinase-3 (R= -0.4844, p=0.009). ***Conclusion:*** Na$^{[18F]}$F

PET/CT appears to be an interesting new imaging modality for the evaluation of TAVI valve microcalcifications, which correlates with selected echographic parameters and biochemical markers. However, the possible use of PET/CT imaging for prediction of degenerative process on TAVI, as well as understanding of the pathomechanism of their destruction requires further research.

1210

Tuesday, October 22, 2024, 08:00 - 09:30
Hall G1

CTE 6 - Technologists Committee - Artificial Intelligence and Radiomics

OP-567
Briefly introduction to Radiomics and AI in Nuclear Medicine
D. Visvikis;
Director of Research INSERM, Brest, FRANCE.

OP-568
Artificial intelligence, deep learning and radiomics in nuclear medicine applications
R. Madru;
Medical Physicist, Skane University Hospital, Department of Medical Radiation Physics, Lund, SWEDEN.

OP-569
Exploring Radiographers' Engagement with Artificial Intelligence: the state of the art
L. Bernabucci;
Fondazione Policlinico Universitario A. Gemelli IRCCS, Radiotherapy Department , Rome, ITALY.

1211

Tuesday, October 22, 2024, 08:00 - 09:30
Hall Y1-Y3

Theranostics Track - TROP Session: : Oncology & Theranostics Committee: Prostate Cancer Therapy I

OP-570
Genetic biomarkers for response prediction to PSMA RLT treatment in mCRPC Patients
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Aim/Introduction: Radioligand treatment (RLT) with Lutetium-177(177Lu)-labeled ligands to the prostate-specific membrane antigen (PSMA) is becoming increasingly important in the treatment of progressive metastatic castration-resistant prostate cancer (mCRPC). However, there is still a substantial number of patients without treatment response and progression under RLT, likely due to the complex genetic portrait of prostate cancer and commonly altered DNA damage response genes that confer resistance to radiation. The aim of this study was to investigate the association between response to 177Lu-PSMA-based RLT and tumor mutations in genes involved in DNA repair pathways. ***Materials and Methods:*** We analysed a total of 32 patients who received RLT between January 2021 and March 2024 and in whom prior genetical testing for at least the following genes was available: ATM, BARD1, BRCA1, BRCA2, BRIP1, CDK12, CHEK1, CHEK2, FANCA, FANCL, NBN, PALB2, RAD51B, RAD51C, RAD51D, RAD54L, TP53, FANCC, FANCG, FANCD2, MSH2, MSH6, MLH1, PMS2, and EPCAM. For response assessment, we used radiologic assessment including [68Ga]Ga-PSMA PET/CT and $^{[18F]}$F-FDG PET/CT as well as prostate-specific antigen (PSA) levels before and after two administered therapy cycles according to the Prostate Cancer Working Group 3 (PCWG3) criteria. ***Results:*** In this cohort of patients, we identified 21/32 patients (66 %) harbouring pathogenic mutations in the following genes: T53 (n= 14, 67%), ATM (n=2, 10%), BRCA2 (n=2, 10%) NBN (n=2, 10%) and CHEK2 (n=1, 5%). The group of mutation carriers had a median baseline PSA of 160 ng/ml, whereas in patients without mutations in predefined genes, the median baseline PSA level was 15 ng/ml (p=0.21). Interestingly, the cohort of mutation carriers had also a shorter median time from the initial diagnosis to PSMA-RLT (4 years) as compared to the control group with an interval of 6 years (p<0.05). Regarding the number of administered RLT cycles, the group with DNA repair pathway mutations received a median of 4 cycles (range, 1-6) compared to the group without mutations with a median of 5 cycles (range, 2-8; p<0.05). In the 24 patients in whom treatment response assessment was available, 90% (9/10) of subjects without DNA repair pathway mutations achieved a partial response/stable disease while 10 % (1/10) showed disease progression. In contrast, 50% (7/14) of patients carrying mutations suffered from disease progression. Interestingly, no statistical difference (p=0.67) was found between the two groups regarding biochemical response. ***Conclusion:*** Genetic testing prior to PSMA-RLT could predict treatment response and thereby improve patient selection and treatment tailoring.

OP-571
Dynamic change in tumour PSMA expression between baseline and day 15 after commencing enzalutamide in poor-risk, metastatic, castration-resistant prostate cancer (mCRPC): Findings from the randomised, phase 2, ENZA-p trial (ANZUP 1901)
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Aim/Introduction: Prostate-specific membrane antigen (PSMA) receptor expression changes with androgen receptor blockade in prostate cancer. The combination of enzalutamide (ENZA) and lutetium-177-PSMA-617 (LuPSMA) improved PSA progression-free survival (PFS) over ENZA alone in mCRPC in the ENZA-p trial. It is unknown whether this is due to complementary effects on heterogenous cell populations or synergistic effect with PSMA upregulation due to ENZA in clonal subpopulations. In this ENZA-p substudy, we evaluate the frequency, magnitude, and significance of change in PSMA PET/CT quantitative parameters between baseline and day 15 after commencing ENZA. ***Materials and Methods:*** Participants (pts) had mCRPC not previously treated with chemotherapy or AR antagonist (abiraterone permitted), 68Ga-PSMA-avid disease, and at least two risk factors associated with early progression on ENZA. Pts were randomised (1:1) to either ENZA 160 mg daily (ENZA-alone), or ENZA 160 mg daily plus adaptive- dosed LuPSMA 7.5 GBq (2 or 4 doses) dependent on persistent PSMA-avid disease on interim 68Ga-PSMA PET. All patients underwent a 68Ga-PSMA PET/CT at baseline and day 15 after commencing ENZA, with LuPSMA administered on day 16 in the experimental arm. All 68Ga-PSMA PET/CT were quantified (MIM Encore) to derive total tumour volume (TTV), SUVmean, and SUVmax. Change in TTV, SUVmax, and SUVmean were calculated using the baseline and day 15 PSMA PET/CT. PSA-PFS outcomes associated with these parameters were assessed using Kaplan Meier analysis. ***Results:*** We randomised 162 pts from Aug 2020 to Jul 2022: median age 71 (range 45-96), prior docetaxel in 54%, and prior abiraterone in 13%. All patients underwent baseline imaging and 149 had day 15 PSMA PET/CT available for quantification. A rise in SUVmax of any magnitude was recorded in 105/149 pts (70%), with the median SUVmax rise in these pts being 29.7% (IQR 10.9-48.3). 103 (69%) had a rise in SUVmean and 102 (69%) a rise in TTV. In those with increased SUVmax, 16/105 (15%) had a discordant fall in SUVmean. Associations between change in baseline and day 15 imaging parameters and PSA-PFS will be calculated for both the ENZA and ENZA+LuPSMA arms (results will be available at presentation). ***Conclusion:*** A majority of pts in the ENZA-p trial demonstrated increased PSMA SUVmax between baseline and day 15 PSMA PET/CT after commencing ENZA for mCRPC. This [was/was not] associated with PSA PFS in patients on ENZA and combination treatment.

OP-572

Investigation of Variations in DNA Repair Genes on [177Lu]Lu PSMA Treatment Response in Patients with Prostate Cancer

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Aim/Introduction: The aim of this study was to investigate the relationship between ERCC2 gene variants, [177Lu]Lu PSMA treatment, and miRNA-182 and miRNA-187 expression levels. ***Materials and Methods:*** Seven prostate cancer patients participated in this study, receiving varying doses of [177Lu]Lu PSMA: 150 mCi, 200 mCi, and 250 mCi. The study employed high-performance liquid chromatography (HPLC) to verify radiochemical purity before administration, and Sanger sequencing was used to assess the relationship between ERCC2 gene variants and miRNA expression levels. ***Results:*** Post-treatment observations showed a significant increase in miRNA-182 and miRNA-187 levels, particularly in patients receiving higher doses (200 mCi and 250 mCi). The ERCC2 gene variations exhibited a discernible correlation with the altered miRNA expressions, indicating genetic modulation of treatment responsiveness. Patients who received treatment, including [177Lu]Lu PSMA, had significantly higher levels of miRNA-182 ($p<0.001$) and miRNA-187 ($p=0.000$) than patients who received no treatment. A significant relationship was found between the post-treatment expression level of miRNA-182 and the change in post-treatment DNA concentration ($p=0.028$). The ERCC2 gene variants of prostate cancer patients who received and did not receive [177Lu]Lu PSMA treatment were investigated. The rs13181 variant was found in heterozygous mutant and wild-type genotypes in both patients who received treatment and those who did not. For the rs1799793 variant, patients who received treatment had wild-type and homozygous mutant genotypes, while patients who did not receive treatment had homozygous mutant and heterozygous mutant genotypes. A post-treatment analysis revealed that 50% of patients who responded to PSA treatment had the heterozygous mutant variant of the ERCC2 rs13181 gene, while 66.66% of patients who did not respond to treatment had the wild-type genotype. For ERCC2 rs1799793, 100% of patients who had a PSA response had the heterozygous mutant genotype, while 50% of patients who did not have a PSA response had the wild type genotype and 50% had the homozygous mutant genotype. Additionally, it was found that patients who had high levels of miRNA-182 after treatment were more likely to have the ERCC2 rs13181 heterozygous mutant genotype ($p=0.028$). ***Conclusion:*** The results emphasize the importance of genetic and molecular diagnostics in optimizing treatment strategies for prostate cancer. By evaluating miRNA levels and DNA repair gene variations, the effectiveness of Lu-177 PSMA therapy can be enhanced, facilitating more personalized and effective treatment approaches. This study contributes to the growing field of precision medicine in oncology, advocating for targeted treatment strategies based on genetic profiles.

OP-573

Tumour dosimetry across 6 cycles of [^{177}Lu]Lu-PSMA-617 in patients with metastatic castration-resistant prostate cancer: results from the VISION sub-study

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Aim/Introduction: In VISION, [177Lu]Lu-PSMA-617 (177Lu-PSMA-617) plus protocol-permitted standard of care (SoC) significantly improved overall survival and radiographic progression-free survival in patients with PSMA-positive metastatic castration-resistant prostate cancer. In the VISION dosimetry sub-study, 177Lu-PSMA-617 had a good safety profile with low radiotoxicity in at-risk organs. Here, we present the tumour dosimetry for 177Lu-PSMA-617 across cycles 1-6. ***Materials and Methods:*** Dosimetry was assessed in a separate cohort of 29 non-randomized patients. Participants received 177Lu-PSMA-617 (7.4 GBq/6 weeks, ≤6 cycles) plus SoC. Participants underwent SPECT/CT scans during cycle 1 at approximately 2, 26, 48 and 168 hours after 177Lu-PSMA-617 injection, and in subsequent cycles at 36-48 hours post-injection. Region of interest/volume of interest construction was performed on PET/CT images (cycle 1) and SPECT/CT images (cycles 2-6) to determine tumour volumes and morphology, with kinetic data derived from SPECT images. The present analysis included patients with at least one evaluable tumour in cycles 2-6 following selection of up to 5 tumours per patient in cycle 1. The normalized number of disintegrations were calculated assuming consistent uptake and retention half-times across cycles, with variations occurring solely in the magnitude of activity uptake. The ratio of individual tumour activities in each cycle to cycle 1 was utilized to scale the normalized disintegrations from cycle 1 to subsequent cycles. Tumour dosimetry parameters were estimated using the standard Medical Internal Radiation Dose/Radiation Dose Assessment Resource method. ***Results:*** In total, 60 unique, delineated prostate cancer tumours were analysed across cycles 1-6, in 18 patients who had evaluable tumours in cycles 2-6. The mean radiation-absorbed dose for all tumours declined from 7.9 Gy/GBq (SD 10; range 0.17-55) in cycle 1 (60 tumours) to 1.6 Gy/GBq (SD 1.7; range 0.11-7.5) in cycle 6 (20 tumours). For tumours in bone, the mean absorbed dose was 6.4 Gy/GBq (SD 7.3; range 0.17-45) in cycle 1 (46 tumours) and 1.3 Gy/GBq (SD 0.95; range 0.11-3.9) in cycle 6 (17 tumours). For tumours in lymphatic tissue, the mean absorbed dose was 11 Gy/GBq (SD 15; range 0.99-55) in cycle 1 (12 tumours) and 3.2 Gy/GBq (SD 3.8; range 0.14-7.5) in cycle 6 (3 tumours). Based on these data, patients received a median 6-cycle cumulative absorbed dose of approximately 100 Gy. ***Conclusion:*** Declining radiation-absorbed doses across cycles 1-6 in this dosimetry sub-study were consistent with the anti-tumour efficacy of 177Lu-PSMA-617 observed in VISION.

OP-574

Real-life data on [177Lu]Lu-PSMA-617 : Descriptive analysis on the largest RLT metastatic castration-resistant prostate cancer (mCRPC) cohort treated in France.

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Aim/Introduction: VISION study showed that [177Lu]Lu-PSMA-617 added to BSoC prolonged imaging-based progression-free survival and overall survival in patients with PSMA-positive mCRPC. French Health Authorities has granted a "cohort" early access for [177Lu]Lu-PSMA-617 in this indication. ***Materials and Methods:*** PSMA positive mCRPC patients pretreated with at least 1 taxane-based chemotherapy regimen and ≥1 androgen receptor pathway inhibitor (ARPI) were included. [177Lu]Lu-PSMA-617 (7.4 GBq) was administered up to 6 cycles every 6 weeks. Patients' characteristics and safety data are described for the entire population, it's evolving and reflects the care of mCRPC and eligibility for these treatments in real life in France. Efficacy was analyzed within a sub population with 6 months follow-up min after 1st [177Lu]Lu-PSMA-617 injection. Adverse events (AE) grading was not evaluated. ***Results:*** From 12/1/2021 to 1/31/2024, 1626 patients were included, and 790 patients were analyzed for efficacy from 12/1/2021 to 4/30/2023. At data cut-off, 728 were still under treatment, and 909 stopped treatment due to disease progression (48.0%), AE (8.6%) or death (6.3%). 284 patients (31.2%) completed all 6 injections. Patients baseline characteristics: median age 73.3 (37-92) years; ECOG 0-1: 87.2%; median PSA level 58.0 (0-6972) ng/ml; metastatic sites: bone 93.5%, lymph node 60.0%, liver 9.2%; previous taxane regimen: 97.8% of which 53.8% have received 2; prior ARPI treatment: 100% and 60.8% received 2 or more (median: 2). Concomitant treatment with ARPI was observed in 25.3%. In terms of efficacy results, the imaging PFS is 7.3 months. Median time to clinical symptoms progression was 7.9 months. 69.4% patients had a decrease in PSA level at any time point. Median time to PSA decrease was 1.18 (0.0-8.6) months. 12.3% (n= 201) of patients experienced >1 treatment-related (TR) AE, including 161 patients with ≥1 serious AE. 5 fatal cases related to treatment have been reported. The most reported TRAEs were thrombocytopenia (4.4% of patients) and anemia (4.2% of patients). ***Conclusion:*** In this large real-life cohort of mCRPC treated with [177Lu] Lu-PSMA-617 patients profile is evolving from heavily pretreated to standardized patient profile. In the global cohort they received less concomitant ARPI treatment and higher incidence of 2 prior taxane regimens compared to VISION study. Safety profile of [177Lu]Lu-PSMA-617 remains favorable. Since the cohort is still ongoing, updated results will be presented at EANM congress, including longer follow-up period and higher number of patients who completed treatment.

OP-575

GRPr antagonist [^{177}Lu]Lu-AMTG for treatment of in prostate cancer patients: first in-human biodistribution, in vivo stability, and dosimetry

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Aim/Introduction: Gastrin-releasing peptide receptor (GRPr) could be an alternative molecular target for theranostic approach in prostate cancer patients with insufficient PSMA expression. Recently, a new GRPr ligand AMTG has been introduced and clinically used as a 68Ga-labelled PET/CT-diagnostic. This ligand is expected to show higher in vivo stability, suggesting higher tumor doses when labeled with a therapeutic radio-metal.

Therefore, this study focused on evaluating biodistribution, in vivo stability, and absorbed doses (AD) to organs at risk (OAR) and tumor lesions for [177Lu]Lu-AMTG in mCRPC patients with insufficient PSMA expression. ***Materials and Methods:*** 4 patients without treatment options for approved therapies who showed sufficient uptake in GRPr-PET/CT were recruited for [177Lu]Lu-AMTG-therapy. Mean activity administered was 7.5 ± 0.2 GBq. 2 patients received 2 or 3 treatment cycles. Therapies were carried out as individual treatments under the German Medicines Act (AMG, §13[2b]). AD in kidneys, pancreas, liver, spleen, bone marrow, and 34 tumor lesions were calculated according to the MIRD dosimetry scheme and EANM dosimetry guidelines. For this purpose, quantitative SPECT/CT scans were performed at approx. 1, 24, 48, and 72 h p.i. and blood samples were taken. To assess in vivo stability, blood samples were centrifuged, the supernatant collected, and the plasma proteins precipitated by treatment with MeCN and subsequent centrifugation. Serum samples were analyzed using radio-RP-HPLC. ***Results:*** [177Lu]Lu-AMTG-therapy was well tolerated and no treatment-related side effects were observed. Rapid uptake was observed in the tumor lesions and the pancreas within the first hour after injection. In contrast to rapid washout from the OAR, binding in tumor tissue was more stable. This was reflected by effective half-lives of 45.5 and 62.8 hours in soft tissue and bone metastases, respectively. Table 1 summarises AD and dose rates in OAR and tumor lesions. [177Lu]Lu-AMTG also showed high stability in vivo in human serum (see Table 2). In blood samples taken later than 6 hours p.i., no significant activity could be detected. ***Conclusion:*** [177Lu]Lu-AMTG has advantageous properties in terms of biodistribution, in vivo stability, and dosimetry, which predestine it for therapeutic use. Its rapid washout from the pancreas, which is considered the main OAR, and the resulting low dose exposure distinguish it from its parent peptide RM2. It binds significantly longer in tumor tissue and therapeutically relevant doses can be achieved. This advantageous profile also allows the application of higher activities or more biologically effective radionuclides to increase tumor control probability.

OP-576

SatisfACtion: a phase 1/2 study of [^{225}Ac]Ac-PSMA-R2 in patients with PSMA-positive metastatic castration-resistant prostate cancer with or without previous [^{177}Lu]Lu-PSMA radioligand therapy

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Aim/Introduction: The PSMA-targeted radioligand therapy (RLT) [177Lu]Lu-PSMA-617 prolonged overall survival (OS) and radiographic progression-free survival (rPFS) when added to standard of care (SoC) in patients with metastatic castration-resistant prostate cancer (mCRPC) in the VISION study. The α-emitter 225Ac mainly causes double-strand DNA breaks, whereas the β-emitter 177Lu mainly causes single-strand breaks. Radiolabelled PSMA-R2, a PSMA-targeting ligand, has been associated with low radiation-absorbed doses in at-risk organs. SatisfACtion is an ongoing study of [225Ac]Ac-PSMA-R2 (225Ac-PSMA-R2) in patients with PSMA-positive mCRPC. ***Materials and Methods:*** SatisfACtion (NCT05983198) is an open-label, multicentre, phase 1/2 study of 225Ac-PSMA-R2. Participants with and without previous exposure to 177Lu-PSMA RLT are assigned to separate parallel groups. Eligible patients are adults with progressive PSMA-positive mCRPC confirmed by [68Ga]Ga-PSMA-targeted PET/CT, who have adequate organ function, and have previously received androgen-receptor pathway inhibitor and taxane therapy. Patients who have received systemic anti-cancer therapy ≤28 days before Cycle 1 are ineligible. The study has two phases: dose escalation (phase 1; ongoing) and dose expansion (phase 2). In both phases, participants in each group receive intravenous 225Ac-PSMA-R2 plus SoC once every 6 (±1) weeks for a ≤6 cycles. Patients attend a safety follow-up visit approximately 41 days after the final dose then enter long-term follow-up (assessments every ~12 weeks). The ongoing dose-escalation phase aims to evaluate the safety and tolerability of 225Ac-PSMA-R2 and determine the recommended dose for expansion (RDE). Dose escalation will proceed in each group using independent Bayesian logistic regression models following the escalation with overdose control (EWOC) principle. A starting dose of 7 MBq may be increased to 10, 12 or 14 MBq providing the EWOC criteria are met, and safety and tolerability are acceptable. Approximately 18-22 participants per group are being enrolled (3-6 per dose cohort; ≥6 receiving the RDE). The primary endpoints are the incidence and severity of dose-limiting toxicities, adverse events (AEs) and serious AEs, and dose intensity and treatment modifications. The dose-expansion phase will enrol approximately 80 participants per group to evaluate further the anti-tumour activity of 225Ac-PSMA-R2 at the RDE. The primary endpoints are objective response rate and PSA50 response rate. Secondary endpoints in both phases include response rates, rPFS, PFS, OS, time to symptomatic skeletal event, PSA response, change in alkaline phosphatase and lactate dehydrogenase levels, pharmacokinetics and health-related quality of life. Exploratory endpoints include analysis of PSMA PET parameters and associations between molecular biomarkers and clinical efficacy.

OP-577

Harmonisation of Serial ^{177}Lu-PSMA SPECT/CT Images in Patients with Metastatic Castrate-Resistant Prostate Cancer Treated with ^{177}Lu-PSMA-617: A Prospective Multicentre ^{177}Lu-PSMA SPECT/CT harmonisation (ENZA-p).

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Aim/Introduction: Prostate-specific membrane antigen (PSMA) therapy and imaging have advanced the management of prostate cancer, particularly metastatic castrate-resistant prostate cancer (mCRPC). Despite advancements, mCRPC remains incurable.

Identifying biomarkers to better personalise PSMA-targeted radionuclide therapy is crucial. 177Lu-PSMA SPECT/CT imaging may be valuable in assessing dynamic changes in tumour volume and PSMA avidity. Achieving consistency in qualitative and quantitative parameters across different centres necessitates harmonisation efforts. This study aimed to standardise series of 177Lu-PSMA SPECT/CT images acquired from various centres. ***Materials and Methods:*** Serial 177Lu-PSMA SPECT/CT images obtained from 15 centres participating in the phase II clinical trials ENZAp (NCT004419402), were included. Each centre received three phantoms to allow for derivation of CT-based attenuation correction, SPECT sensitivity, and confirmation of quantitative accuracy (IEC body phantom). Data were centrally analysed in MIM software using the SPECTRA licence and a consistent approach to reconstruction (3D OSEM with 6i21s, double energy window scatter correction, CT based attenuation correction, and geometry-based resolution recovery). Raw clinical SPECT projection and CT data were transferred to a cloud-based server for quantitative reconstruction using derived sensitivity factors and consistent analysis. The SPECT/CT series were harmonised by applying camera-specific sensitivity factors and centrally reconstructed. ***Results:*** A total of 81 patients from the experimental arm of ENZAp receiving 2 to 4 doses of 177Lu-PSMA therapy were included in this study. Sensitivity factors were achieved in 12 out of 15 centres, ranging from 5.02 to 10.29 cps/MBq. Harmonisation was unsuccessful in one centre due to non-compliance with acquisition guidelines, while two centres failed initial phantom site assessment. Serial SPECT/CT images from 80 patients were successfully harmonised and centrally reconstructed to provide comparable clinical data. ***Conclusion:*** Harmonisation of 177Lu-PSMA SPECT/CT images is key for standardising both visual and quantitative parameters, enabling multisite trial evaluation of disease progression on 177Lu-PSMA therapy.

OP-578

Single Time Point Whole-Body Tumour Dosimetry as an Independent Prognostic Biomarker for Treatment Outcome in Patients with Metastatic Castration-Resistant Prostate Cancer Receiving Lutetium-177 [^{177}Lu]Lu-PSMA-617

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Aim/Introduction: Whole-body tumour dosimetry was previously correlated with prostate-specific antigen (PSA) response in patients with metastatic castration-resistant prostate cancer (mCRPC) treated with Lutetium-177 [177Lu]Lu-PSMA-617 [1]. We aim to validate post-cycle 1 (C1) single time point whole-body tumour dosimetry (WBTD) as an independent prognostic biomarker. ***Materials and Methods:*** This prospective, single-centre analysis included patients with progressive mCRPC who were treated with at least one cycle of [177Lu]Lu-PSMA-617 in the ProsTIC Registry (NCT04769817). Eligible patients completed post-C1 quantitative SPECT/CT and weren't treated on prior trials with [177Lu]Lu-PSMA-617. WBTD was performed using single time point, voxel-level analysis, with automated tumour segmentation using open-source AI models and reviewed by experienced nuclear medicine physicians. Association between WBTD and 12-week PSA response was analysed. Logistic regression, adjusted for conventional prognostic factors and imaging parameters, evaluated the association between WBTD and PSA reduction of ≥50% or ≥90% from baseline (PSA-50/90). Overall survival (OS) was analysed using Kaplan-Meier methods with the previously identified 10Gy threshold [1]. ***Results:*** Between May 1st 2021 and March 30th 2023, 181 of 195 patients were eligible, with a median (IQR) age of 74 (68-78) years and PSA of 73 (18-220) ng/mL. Previous treatments included docetaxel in 148 (82%), cabazitaxel in 63 (35%), enzalutamide in 116 (64%) and abiraterone in 77 (43%). Median (IQR) radiation absorbed dose was 8.9 (7.0-13.7) Gy. Of the 181 patients, 111 (61%) and 49 (27%) achieved PSA-50 and PSA-90 by 180 days post-C1, respectively. WBTD was significantly prognostic of PSA-50 (odds ratio [OR] per 1Gy: 1.16 [95%CI 1.06-1.26]; p=0.001) and PSA-90 (OR: 1.18 [1.08-1.27]; p<0.001), independent of ECOG (0 vs ≥1), alkaline phosphatase, haemoglobin, bone and/or liver metastasis. After adjusting for [18F] FDG PET metabolic tumour volume (MTV) and PSMA PET mean standardised uptake value (SUVmean), the PSA-90 association with WBTD remained independently prognostic (OR: 1.22 [95%CI 1.08-1.38]; p=0.001). Patients with ≥10Gy radiation absorbed dose had a significantly longer median OS of 15.2 (12.1-21.1) months vs 11.4 (9.9-14.9) months for <10Gy (p=0.009). ***Conclusion:*** Single-time point whole-body tumour dosimetry at cycle 1 of [177Lu] Lu-PSMA-617 is an independent biomarker for PSA response. Higher radiation absorbed dose is prognostic for favourable PSA responses and overall survival. ***References:*** Violet J, Jackson P, Ferdinandus J, Sandhu S, Akhurst T, Iravani A, et al. Dosimetry of 177Lu-PSMA-617 in Metastatic Castration-Resistant Prostate Cancer: Correlations Between Pretherapeutic Imaging and Whole-Body Tumor Dosimetry with Treatment Outcomes. J Nucl Med. 2019;60:517-23.

1301

Tuesday, October 22, 2024, 09:45 - 11:15

Hall 1

CME 10 - Oncology & Theranostics Committee - Joint EANM-SNMMI Guideline on the Role of 2-[18F]FDG PET/CT in no Special Type Breast Cancer

OP-579

FDG-PET/CT in staging

D. Groheux;

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OP-580

FDG-PET/CT in assessing treatment response

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OP-581
FDG-PET/CT in assessing recurrence
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Nuclear Medicine - Radiopharmacology, Champalimaud Clinical Center - Champalimaud Foundation, Lisbon, PORTUGAL.

OP-582
Other developments and future applications of FDG-PET
L. de Geus;
Department of Radiology, Leiden University Medical Center, Leiden, NETHERLANDS.

1302

Tuesday, October 22, 2024, 09:45 - 11:15
Hall 4

Special Track 10 - What is/could be the contribution of radiobiology to clinical practice?

OP-583
Point of View: Life is linear or linear quadratic
K. Sjögreen;
Gleisner Medical Radiation Physics, Lund University, Lund, SWEDEN

OP-584
Point of View: Clinical response is more than tumor absorbed dose; dosimetry guided TRT needs to be based on sound clinical evidence
S. Fanti;
Nuclear Medicine Division, IRCCS Azienda Ospedaliero-Universitaria Di Bologna, Policlinico S.Orsola, Bologna, ITALY.

1303

Tuesday, October 22, 2024, 09:45 - 11:15
Hall X9-X12

LIPS Session 10 - Physics, Neuroimaging, Oncology & Theranostics and Dosimetry Committee - More you need to know about Kinetic Modelling

OP-585
Radiobiology is the missing link between dosimetry and treatment response: Biological parameters need to be considered in order to envisage the most effective therapeutic strategies and combinations and hope to achieve a complete response
K. Lückerath;
University of Duisburg-Essen-University Hospital Essen, Essen, GERMANY.

OP-586
Fundamentals of kinetic modelling
M. Lubberink;
Uppsala University, Department of Surgical Sciences, Molecular imaging and medical physics, Uppsala, SWEDEN.

OP-587
Use of kinetic modelling in neuroimaging
S. Golla;
Amsterdam UMC, VUmc, Radiology and Nuclear Medicine Department, Amsterdam, NETHERLANDS.

OP-588
Use of kinetic modelling in oncological imaging
A. Dimitrakopoulou-Strauss;
German Cancer Research Center (DKFZ), CCU Nuclear Medicine, Heidelberg, GERMANY.

OP-589
Use of kinetic modelling in dosimetry
E. Yousefzadeh-Nowshahr;
University Hospital Ulm, Nuclear Medicine, Ulm, GERMANY.

1304

Tuesday, October 22, 2024, 9:45 - 11:15
Hall X1-X4

M2M Track - TROP Session: Radiopharmaceutical Sciences + Translational Molecular Imaging & Therapy Committee: Molecular Imaging in Cardiology

OP-590
Open label, single arm, adaptive study assessing Safety and Accuracy of ^{18}F-SYN2 - a novel PET myocardial perfusion tracER in patients with suspected functionally significant coronary stenoses - SAFER phase 2 clinical trial
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Aim/Introduction: [18F]SYN2 (18F labeled acridinium derivative) is a novel radiotracer for PET myocardial perfusion imaging. The primary objective was to assess safety and tolerability of [18F]SYN2 in patients with suspected CAD and referral to invasive coronary angiography (ICA). The secondary objective was to assess the diagnostic ability of [18F]SYN2 in the detection of coronary stenosis using ICA with FFR as the reference standard. ***Materials and Methods:*** Out 57 patients screened - 40 pts were enrolled. 21 (52%) were female and 19 (48%) were male. The mean age was 63.2 ± 10.5. The mean BMI was 30.69 ± 4.83 kg/m2. Six subjects (15%) had a history of angina, and none had a history of acute coronary event. Other comorbidities : arterial hypertension (n = 29, 72.5%), diabetes (n = 12, 30%), dyslipidemia (n = 24, 60%), atrial fibrillation (n = 6, 15%). Patients were screened within 28 days prior to first dosing day. First dosing and PET scan (resting

baseline - 250 MBq ±10%). The second dosing and stress PET scan (during regadenosone vasodilation) was performed 1 day - 7 days after - 250 MBq ±10%. Safety visit was 5 ± 2 days after the last dosing. During the follow-up period the ICA was performed for all patients. All subjects also received follow-up call 30 ± 7 days after the last PET examination. ***Results:*** 4 adverse events (AE) (12%) were possibly related (diarrhea, musculoskeletal pain, palpitations) to the study drug administration. AEs of the highest incidence were general disorders and administration site conditions (5 cases in 5 (12.5%) patients), cardiac disorders (6 cases in 4 (10.0%) patients), and nervous system disorders (6 cases in 4 (10.0%) patients). The most common AE was headache (n = 4, 12%).In the intention to treat (ITT) population, sensitivity, specificity, accuracy, positive predictive value and negative predictive value of [18F]SYN2 PET-CT MPI (results provided by independent panel) in comparison to ICA with FFR in diagnosis of CAD were 80.0%, 75.0%, 76.7%, 61.5% and 88.2%, respectively. In the per protocol (PP) population these values were as follows: 80.0%, 73.7%, 75.9%, 61.5% and 87.5%. ***Conclusion:*** [18F]SYN2 tracer administration for PET/CT imaging in subjects with coronary artery disease suspicion was feasible and safe. The good diagnostic ability in the phase 2 study entitle to conduct the assessment of the SYN2 tracer in phase 3 trial.

OP-591

Dual PET/MRI arterial input function determination in an extracorporeal shunt setup for mouse scans with accurate dispersion correction

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Aim/Introduction: Accurate determination of individual arterial input functions (AIF) for pharmacokinetic modelling of dynamic PET and MRI data is exceedingly difficult in mice. We here present an approach for dual PET/MRI AIF measurements using an extracorporeal shunt setup and a novel catheter dispersion correction. ***Materials and Methods:*** Our setup includes an extracorporeal shunt design based on our proposed MRI AIF determination design comprising two reservoirs (1 mm inner diameter) within the shunt, placed inside the MRI field-of-view [1]. We additionally incorporated a flow-through radioactivity detector into the setup (time resolution: 1 s). Shunt flow was maintained by mouse blood pressure alone. Catheter dispersion effects were modelled as a convolution of unknown gamma variate dispersion kernels with the true AIF, both for the MR image-derived reservoir AIF and the radiotracer AIF [2]. As deconvolution with an unknown kernel is an ill-posed problem, we incorporated population-averaged AIF peak information derived from intra-aortal positron-sensitive microprobe measurements into the iterative semi-blind deconvolution process [2], resulting in deconvolved AIF solutions for the reservoir and radioactivity detector curves. We tested this approach in six mice co-injected with 10 - 80 MBq [18F]PSMA-1007 and 35 mM gadobutrol in 0.1 mL at 1 mL/min in a 9.4 T small animal MRI system. MRI involved T1 mapping and a 3D-flash sequence for dynamic imaging (time resolution: 4 s). We compared the resulting MRI AIF to those calculated from deconvolutions with a fixed kernel derived from reservoir-to-reservoir comparisons as in [1] and an image-derived MRI AIF from a small region in the venous sinus sagittalis. ***Results:*** Incorporation of microprobe-derived average AIF peak information numerically stabilized the iterative deconvolution process for both MRI as well as PET AIF, as evidenced by convergence to identical solutions from different initial trial input functions. All three MRI AIF exhibited highly similar curve shapes. However, the sinus-based AIF clearly demonstrated underestimation of absolute contrast agent concentrations, as evidenced by AIF peak heights (2.3±0.5 mM, 2.0±0.7 mM, 1.1±0.5 mM for semi-blind deconvolution, fixed kernel deconvolution, and the sinus AIF, respectively). This might be due to partial volume effects or uncertainties in calculating in vivo Gd concentrations in contrast-enhanced MRI. ***Conclusion:*** Our proposed shunt setup, in combination with the novel dispersion correction approach, was successfully able to record dual PET/MRI AIF in mice. ***References:*** [1] Backhaus P et al. Magn Reson Med. 2020;84:1404-1415. [2] Cufe J et al. EJNMMI Res. 2023;13:86.

OP-592

Monitoring of Pulmonary Hypertension Progression and Therapy Response by Using a novel serotonin transporter targeted agent - [18F]FPBM2 and PET/CT

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Aim/Introduction: Pulmonary hypertension (PH) is characterized by progressive pulmonary vascular remodeling leading to right heart failure and mortality. The serotonin hypothesis proposes that serotonin contributes to PH pathogenesis by inducing vasoconstriction and stimulating proliferation and hypertrophy of pulmonary arterial smooth muscle cells, thereby promoting arterial remodeling and increased pulmonary arterial pressure. Here, we utilized a novel 18F-labeled serotonin transporter (SERT) targeting agent ([18F]FPBM2) in conjunction with PET imaging to dynamically monitor PH and its response to anrisentan therapy. ***Materials and Methods:*** [18F]FPBM2 was synthesized by an automated radiosynthesis module (BIBD-F) with solid-phase extraction (SPE) purification for producing desired high purity doses. Monocrotaline (MCT)-induced pulmonary hypertension (PH) was established in rats, followed by three weeks of oral anrisentan therapy (10mg/kg/daily). Weekly [18F]FPBM2 PET/CT imaging was conducted in MCT rats, and 3 weeks post-MCT induction, right heart (RV) catheterization, histological staining, and SERT immunofluorescence were evaluated. ***Results:*** [18F]FPBM2 synthesis was completed in 45 minutes with high radiochemical purity (>95%) and yields of 10-15% (n = 10, decay corrected), with chemical impurities lower than 100 μg per batch. Ex vivo stability testing showed 74% activity retention in rat lungs were [18F]FPBM2 compared to 25% in blood at 60 minutes post-injection. [18F]FPBM2 showed specific SERT binding to pulmonary arterial smooth muscle cells. In MCT rats standardized uptake value ratio (SUVR) of whole lungs was significantly increased from baseline (1.5) to week-3 (4.0) ($P < 0.01$). Anrisentan-treated rats exhibited minimal SUVR changes compared to baseline. RV pressure was significantly elevated in MCT rats versus anrisentan-treated and healthy controls (48 vs 40 vs 31 mmHg). Histological analysis revealed lung vessel thickening in MCT rats, with a measurable higher SERT expression (IHC score: 76% vs 67% vs 54%, $P < 0.01$) as compared to anrisentan-treated and healthy controls. While RV pressure serves as the gold standard for PH evaluation, it lacks insight into small blood vessel changes in the lung. By noninvasively mapping SERT levels in pulmonary artery smooth muscle cells and directly measuring vascular remodeling, this study offers a promising approach for PH assessment. ***Conclusion:*** This study demonstrated the potential of [18F]FPBM2 PET/CT imaging for assessing and monitoring progression of pulmonary hypertension and response to anrisentan therapy. It is reasonable

to conclude that results of this study provide physiological basis in testing the serotonin hypothesis and highlighting its potential utility as a promising imaging biomarker in clinical settings.

OP-593

Granzyme B PET imaging for non-invasive early diagnosis of acute heart allograft rejection

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Aim/Introduction: Cardiac transplantation remains the single most effective treatment for end-stage heart failure. Despite the routine use of anti-rejection drugs in clinical practice, approximately 40% of cardiac transplant patients still experience unavoidable rejection. Timely diagnosis of early acute rejection (AR) is essential to prevent further tissue damage through effective immunosuppressive therapy. Transplant rejection and graft damage is primarily mediated by recipient cytotoxic CD8+ T cells, which attack allografts by releasing perforin and granzyme B (GzmB). This study aimed to evaluate whether GzmB-targeted positron emission tomography (PET) imaging agent (68Ga-grazytracer) can characterize T lymphocyte infiltration in acute cellular rejection. ***Materials and Methods:*** The mouse cervical heterotopic heart transplantation model was established. Mice were subjected to GzmB-targeted PET/CT on post-operative days 3, 5, and 7. Autoradiography, Masson staining, immunohistochemistry, and flow cytometry were performed to verify the inflammatory infiltration and graft damage after AR in vitro. Allograft-bearing mice were intraperitoneally administered with tacrolimus (2 mg kg−1) daily from operative day to post-operative day (POD) 7. The immune status assessment of treatment group was measured using the above method. ***Results:*** The uptake of 68Ga-grazytracer was observed increased with the extension of rejection time compared with syngeneic mouse heart transplantation (SUVmax:0.54 ± 0.07 vs. 0.19 ± 0.05 at POD 7 days, P<0.001). To assess 68Ga-grazytracer sensitivity and specificity between isograft and allograft groups, POD 7 PET/CT imaging were analyzed for their catalytic activities by receiver-operating-characteristic (ROC) analysis (AUC=0.93, 95% CI = 0.8143-1). Hematoxylin and eosin staining of the myocardium indicated massive inflammatory cell infiltration and disruption of the myocardial integrity in the allograft myocardium. Immunohistochemistry and flow cytometry showed significantly high expression of GzmB and CD8, in line with the PET/CT imaging results. Autoradiography revealed 68Ga-grazytracer accumulation in the transplanted heart. The 68Ga-grazytracer uptake of treated mice was significantly reduced compared with that in the allograft group (SUVmax: 0.262±0.05% vs. 0.54 ± 0.07 at POD 7 days; P<0.001). Daily treatment with tacrolimus improved heart allograft outcome and graft survival curves revealed complete rejections of the allograft within POD 15 ± 3 days. ***Conclusion:*** This study demonstrated the potential of 68Ga-grazytracer imaging to delineate early non-invasive diagnosis of heart allograft rejection. This study provides an entirely imaging-based method for monitoring allograft status. In the future, the development of imaging of GzmB may be more readily translated into clinical applications.

OP-594

Targeting of Liver Fibrosis with ^{89}Zr-labeled SP02SP26-ABD, a Pan-Fibrosis Theranostic Vector Directed Against PDGFRb on Activated Myofibroblasts

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Aim/Introduction: As the prevalences of obesity and type 2 diabetes mellitus are rapidly rising, so is the prevalence of liver fibrosis. Unfortunately, reliable options to detect and treat active fibrosis are lacking. Hepatic fibrosis develops as a response to chronic liver injury, resulting in the formation of fibrous scars and liver failure. This process is fueled by collagen-producing activated myofibroblasts, the common driver cells across different fibrotic diseases in different organs, which reportedly express high levels of platelet derived growth factor receptor-β (PDGFRβ). We developed SP02SP26-ABD, a PDGFRβ-specific biparatopic VHH-construct, as a pan-fibrotic theranostic targeting vector. SP02SP26-ABD is equipped with an albumin binding domain (ABD), increasing bio-availability by decreasing renal excretion, and a cysteine in the C-terminal region allowing site-specific conjugation of diagnostic or therapeutic payloads. Here, we assessed SP02SP26-ABD for its fibrosis-targeting potential in the specific setting of liver fibrosis. ***Materials and Methods:*** Binding characteristics and cellular uptake of SP02SP26-ABD were assessed in vitro using human-, mouse-, and rat PDGFRβ ectodomains and PDGFRβ-expressing cells. Intracellular payload delivery was evaluated in vitro using SP02SP26-ABD conjugated to the cytotoxic payload auristatinF. Validity of PDGFRβ as a marker of active (liver-) fibrosis was assessed by immunohistochemistry and RT-PCR in human liver samples and 3 different mouse models of liver fibrosis (DDC, CCl4, CDA-HFD). After synthesis of SP02SP26-ABD-DFO*-Zr[89Zr], it's targeting ability was assessed in healthy mice and mice with liver fibrosis by PET-CT imaging, ex vivo biodistribution and autoradiography. ***Results:*** SP02SP26-ABD displayed similar nanomolar affinity for human-, mouse-, and rat PDGFRβ, facilitating clinical translation. Specific intracellular payload delivery was evident as AuristatinF-conjugated SP02SP26-ABD exerted subnanomolar cytotoxicity only in PDGFRβ-expressing cells. Immunohistochemistry of human- and mouse fibrotic livers confirmed co-localization of PDGFRβ with markers of active fibrosis. In all three mouse models, PET-CT imaging and radionuclide counting revealed increased uptake of SP02SP26-ABD-DFO*-Zr[89Zr] in fibrotic livers. Uptake in DDC-, CCl4-, and CDA-HFD-induced fibrotic livers, upon injection of 15 nmol/kg, was 20.93±4.35, 13.27±1.70, and 12.29±1.29%ID/g, respectively, compared to 7.56±0.85 %ID/g in healthy livers. Autoradiography revealed preferential uptake in PDGFRβ-expressing fibrotic areas. ***Conclusion:*** SP02SP26-ABD selectively and efficiently targets PDGFRβ-expressing activated myofibroblasts in liver fibrosis.

Based on these results, and preliminary results obtained in kidney- and lung fibrosis models, it qualifies as a theranostic vector. Clinical PET-CT studies with SP02SP26-ABD-DFO*-Zr[89Zr] will be initiated in different fibrotic indications.

OP-595

Preclinical and First-in-human Study of a Novel SPECT Myocardial Perfusion Imaging Agent with Rapid and Stable Heart Uptake: ^{99m}Tc-4BOH

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Aim/Introduction: An ideal myocardial perfusion radiotracer with high first-pass extraction fraction (EF) and stable heart retention is necessary for accurate myocardial blood flow (MBF) quantitation. Popular 99mTc-Sestamibi suffers from low K1 value (K1=MBF*EF). Meanwhile, the fast myocardial washout of 99mTc-Teboroxime makes it hard to acquire high quality images. This study evaluated a novel SPECT perfusion agent in swine, 99mTc-4BOH, and compared it with 99mTc-Sestamibi and 99mTc-Teboroxime. Furthermore, patient volunteers were enrolled to compare 99mTc-4BOH and 99mTc-Sestamibi head-to-head. ***Materials and Methods:*** Fifteen swine were divided into three groups and injected with 99mTc-4BOH, 99mTc-Sestamibi or 99mTc-Teboroxime separately. Fifteen patients were eligible for myocardial perfusion imaging with 99mTc-4BOH and 99mTc-Sestamibi. Dynamic scans were obtained on GE 530c CZT camera. K1 and k2 were estimated by fitting one-compartment model in an inhouse software. The heart uptake, liver uptake and heart/liver ratio were assessed using ImageJ. ***Results:*** Firstly, the comparison of kinetic parameters from swine demonstrated that both rest and stress K1 values of 99mTc-4BOH were prominently higher than those of 99mTc-Sestamibi (rest: 0.81±0.03 vs 0.43±0.09 mL·min-1·g-1, P<0.05; stress: 1.19±0.26 vs. 0.50±0.10 mL·min-1·g-1, P<0.05), indicating higher first-pass extraction fraction. k2 values were significantly lower than those of 99mTc-Teboroxime (rest: 0.18±0.03 vs. 0.26±0.01 min-1, P<0.05; stress: 0.26±0.04 vs. 0.38±0.08 min-1, P<0.05), suggesting more stable heart retention of 99mTc-4BOH. High K1 and low k2 values derived 99mTc-4BOH superior kinetic properties for MBF quantification and an excellent candidate for further clinical translation. Thirteen volunteers finished the head-to-head comparison between 99mTc-4BOH and 99mTc-Sestamibi. K1 values of 99mTc-4BOH were prominently greater than those of 99mTc-Sestamibi (rest: 0.71±0.14 vs 0.38±0.06 mL·min-1·g-1, P<0.05; stress: 1.47±0.24 vs. 0.59±0.08 mL·min-1·g-1, P<0.05). K1 values of 99mTc-4BOH demonstrated a near-linear uptake, whereas 99mTc-Sestamibi plateaued especially during stress. Higher K1 values equipped 99mTc-4BOH better clinical potential for MBF quantification than 99mTc-Sestamibi. Consistently, heart uptake of 99mTc-4BOH in patients was much higher than that of 99mTc-Sestamibi. Moreover, heart/liver ratios of 99mTc-4BOH were higher than that of 99mTc-Sestamibi during the first 8 minutes post injection, which may contribute to excellent quality SPECT images of 99mTc-4BOH. ***Conclusion:*** 99mTc-4BOH exhibited not only faster heart uptake and higher K1 values than 99mTc-Sestamibi, but also more stable myocardial retention than 99mTc-Teboroxime. The primary clinical trial further demonstrated that 99mTc-4BOH is a promising radiotracer for MBF quantification for future clinical translation.

OP-596

Unlocking the potential of imaging the low-density lipoprotein receptors in glioblastoma

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Aim/Introduction: Overexpression of the low-density lipoprotein receptors (LDLR) in solid tumors has been linked to the poor prognosis of cancer. LDLRs mediate the transport of the endogenous ligands across the blood-brain barrier (BBB). We selected a library of radiolabeled peptide-conjugates, RMX-VH, with affinity to LDLR. These conjugates can serve as isotope delivery vectors capable of crossing the BBB in GBM. To improve the PK properties of RMX-VH, we have incorporated an albumin binder PIBA (4-p-iodophenyl) butyryl acid) to the conjugate. This study aimed to assess the potential of optimized 203Pb-DOTAM-peptide, RMX-VH-PIB, as a novel SPECT imaging agent of glioblastoma. ***Materials and Methods:*** The 203Pb-RMX-VH-PIB was labeled manually in 0.4M NH4OAC buffer pH=6.0. Ascorbate was used as a scavenger at 40mg/ml concentration. 203Pb was produced by UAB Cyclotron Facility, UA, in Birmingham. The radiochemical/ purity was analyzed using iTLC and radio/UV HPLC. SPECT images were captured using a gamma-eye camera (Bioemtech, Greece) at different times (1h, 2h, 3h, 24h, and 48h post-injection), followed by biodistribution studies. ***Results:*** Radiolabeling was carried out with RCY>98%. 203Pb-RMX-VH-PIB showed high radiolytic stability as monitored up to 24hours post-synthesis. SPECT studies indicated selective accumulation of the agent in U87MG xenografts as early as 1 h post-injection. 203Pb-RMX-VH-PIB demonstrated longer blood exposition. The optimal time for tumor accumulation was 24hours post-injection. The addition of the albumin-binding motif, PIBA, significantly increased blood circulation time and tumor accumulation compared to RMX-VH. The bioD studies demonstrated 6.2±1.8%ID/g tumor retention of the agent at 1h, which remained almost the same (5.8±0.3%ID/g) at the 3h and was reduced to 3.3±0.2%ID/g at the 24h. Liver accumulation remained at a similar level at all time points (6.6±0.7%ID/g at 1 hour, 8.2±1.3%ID/g, 2h, and almost unchanged at the 24h. The initial high blood pool of activity at 1h (8.7±0.7%ID/g) was reduced to 1.1±0.1%ID/g at the 24h. The bone marrow uptake was 1.2±0.7%ID/g at the early time point and reduced three-fold at 24hours, suggesting stable coordination of 203Pb. The renal retention of the agent was lower than that observed for RMX-VH without the albumin-binding motif. The tumor retention of radiolabeled RMX-VH-PIB was higher than RMX_VH conjugates with shorter blood circulation time, showing the advantages of structural modification with an albumin binding linker. ***Conclusion:*** Structural modification by incorporating PIBA (203Pb-RMX-VH-PIB) improved the LDLR-targeting properties of the conjugate. eIND study will include 68Ga/203Pb-RMX-VH with albumin binding linker for selecting LDLR(+) solid tumors (GBM and PDAC).

OP-597

Effects of remote ischemic conditioning on pigs with myocardial ischemic reperfusion injury evaluated by serially multi-target PET/CT molecular imaging and the underlying mechanisms

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Aim/Introduction: This study aims to dynamically to assess the effects and mechanisms of remote ischemic conditioning (RIC) on the myocardial ischemic reperfusion (MIR) porcine model through multi-target molecular imaging (myocardial perfusion, metabolism, inflammation, and fibroblast activation). ***Materials and Methods:*** MIR was established in 14 pigs (7 males; age: 6-8 months) and they were randomly divided into RIC group (n=7) and non-RIC group. RIC was performed in pigs by blood pressure inflation on the upper and lower limbs for 5 min period and 4 cycles immediately after MIR. A series of 99mTc-MIBI D-SPECT myocardial perfusion imaging, fasting 18F-FDG myocardial inflammatory imaging, and 18F-AlF-NOTA-FAPI imaging were performed longitudinally at the 3rd, 14th, 28th, 56th day after MIR. At the same time, biomarkers were serially tested.P value<0.05 was considered statistically significant. The correlation between imaging parameters and cardiac outcomes was analyzed. ***Results:*** Compared with the non-RIC group, RIC group exhibited significantly reduced infarct size (P<0.05). The RIC group also showed a significant increase in ΔLVEF and a significant decrease in ΔESV (P<0.05). At the acute phase, RIC group had significantly lower FAPI uptake intensity in the peri-infarct region [SUVmax: (5.39±1.55) vs. (8.26±2.26), P=0.014]; at the subacute phase, RIC group had significantly lower FDG uptake extent and intensity in the FDG+ area, infarct region, and peri-infarct compared with the non-RIC group (P<0.05). At both acute and subacute phases, bone marrow uptake in the RIC group was lower(P<0.05). Moreover, ΔIL-1β2w-3d in the RIC group was lower , while ΔIL-102w-3d was higher than that in the non-RIC group (P<0.05). Additionally,The extent and intensity of FAPI and FDG uptake at the acute phase were negatively correlated with cardiac function in the chronic phase and positively correlated with LV remodeling (P<0.05). Furthermore, we found that the changes of FAPI uptake intensity from 3 day to 2 week was positively correlated with ΔLVEF and negatively correlated with ΔESV at subacute and chronic phases, whereas the changes of FDG uptake intensity from 3 day to 2 week was negatively correlated with ΔLVEF and positively correlated with ΔESV at subacute and chronic phases (all P<0.05). ***Conclusion:*** RIC could reduce systemic inflammation at acute and subacute phase, attenuate fibrosis in the peri-infarct region at the acute phase, and cardiac inflammation in both infarct and peri-infarct region, ultimately resulting in a reduction in infarct size, improvement in cardiac function and reverse remodeling, which may provide a new therapeutic approach for MIRI.

OP-598

Molecular imaging of fibroblast activation protein in response to cardiac injury using [^{68}Ga]GaDATA^{5m}.SA.FAPi

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Aim/Introduction: The fibroblast activation protein (FAP) has gained tremendous traction as a target for tumor imaging and cancer treatment, but is also involved in fibrosis. Increased FAP expression has been demonstrated in myofibroblasts during fibrogenesis, which predicts the quality of cardiac remodeling after myocardial infarction or other entities of heart failure. The aim of this study was to evaluate [68Ga]GaDATA5m.SA.FAPi for PET imaging in regards to replacement or interstitial fibrosis due to myocardial infarction (MI) and pressure overload-induced hypertrophy in mice (TAC), respectively. ***Materials and Methods:*** [68Ga]GaDATA5m.SA.FAPi was manually produced. Myocardial infarction was induced by a permanent ligation of the left anterior descending coronary artery in male adult C57BL/6 mice (MI group). For pressure overload-induced cardiac remodeling, mice underwent a surgery for constriction of the transverse aorta (TAC group). Sham-operated animals served as controls. One, two, six and 12 weeks after surgery, [68Ga]GaDATA5m.SA.FAPi was injected i.v. into the anesthetized mice and after 45 min of tracer distribution (under isoflurane anesthesia) a static PET/CT scan (10 min PET+5 min CT) was conducted. Subsequently, mice were sacrificed and hearts were harvested for assessment of total radioactivity followed by ex vivo autoradiography and immunohistochemistry (IHC). Hypertrophy simulating cell uptake was assessed in isolated human ventricular cardiac fibroblasts cell culture experiments (high-stretched 18-20%/low-stretched 2-3%). ***Results:*** Cardiac uptake was highly significantly (p=0.002) increased two weeks after MI induction (MI: 2.1±0.2%ID/g (n=7) vs. SHAM: 1.1±0.2%ID/g (n=5)), also confirmed by ex vivo autoradiography. This confirms the replacement fibrosis within the infarcted area in the sub-acute phase of adverse post MI remodeling. No significant difference in [68Ga]GaDATA5m.SA.FAPi uptake was found at six weeks after surgery (MI: 1.1±0.1%ID/g (n=4) vs. SHAM: 0.8±0.0%ID/g (n=3)), indicating the completion of infarct healing. In contrast, cardiac uptake increased significantly (p=0.0110) in the TAC vs. SHAM mice after 6 weeks (TAC: 1.8±0.2%ID/g (n=6)) due to progressive hypertrophy and fibrosis. In line with that, high-stretched cardiac fibroblasts showed a higher uptake compared to low-stretched conditioned ones. IHC confirmed the expression of FAP in cardiac tissue in both models. ***Conclusion:*** This study for the first time demonstrated the efficacy of [68Ga]GaDATA5m.SA.FAPi for longitudinal imaging of cardiac fibrosis in response to different injury in mice. In vivo imaging of FAP during cardiac remodeling might be a promising target for diagnosis and prognosis of disease progression and could aid clinical management of patients.

1305

Tuesday, October 22, 2024, 09:45 - 11:15
Hall Y4-Y9

Cutting Edge Science Track - TROP Session: Physics Committee: Innovative Instrumentation and Measurements

OP-599

Image guided robotics: Hybrid sensory enrichment as means to extend surgical workflows with robotic-SPECT and - Fluorescence Molecular Tomography

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Aim/Introduction: Accurate assessment of the surgical environment and the targets therein sets the stage for precision surgery. Target visualization can be facilitated via intraoperative molecular imaging e.g. making use of surgery dedicated hybrid tracers that combine radioactive and fluorescent emissions. The emergence of such tracers during minimally invasive robotic surgery has created a need for matching sensory hardware, so-called 'smart' instruments. By converting the steerable surgical

instruments to sensory devices themselves, it becomes possible to employ the robots dexterity for the enhancement of the environmental perception. Here, we present a hybrid detector, that put both radioactive- (99mTc) and fluorescent- (ICG) sensing at the surgeons 'fingertips'. ***Materials and Methods:*** To transfer hybrid sensory experiences to the ProGrasp robotic forceps, a hybrid Click-On detector was designed. The prototype, which includes markers for video-tracking, was build using 3D printing and precision multi-axis machining (3-axis turning methodologies). Using custom computer-vision algorithms the two sensory read-outs were coupled to the probe positions. When combined with a look-up table and Maximum-Likelihood Expectation-Maximization (MLEM) reconstruction methods this allowed for the creation of 3D SPECT and fluorescence molecular tomography (FMT) scans. Following initial sensitivity evaluations in the lab, the prototype was used to evaluate 17 tissue specimens (lymph nodes and prostate) from 7 prostate cancer patients undergoing ICG-99mTc-nanoscan guided prostatectomy and lymph node dissections. Handheld gamma probe tracing and laparoscopic fluorescence imaging were used as reference. ***Results:*** The Click-On functionalized ProGrasp instrument preserves the instruments grasping function while complementing it with autonomous, 6-degree-of-freedom, bi-modal molecular sensing at the robotic instrument tip. Sensitivity of the newly developed hybrid modality allowed for detection of 99mTc- (>10^-4 MBq) and ICG-emissions (>10^-6 mg/mL). Analysis of surgical specimens confirmed both readouts were compatible with real-life ICG-99mTc-nanoscan signal intensities. Robotic-SPECT and -FMT scans helped convert the sensory readouts to a visible image. These images and could in turn be used to augment the laparoscopic view. The findings of the new 'robotic imaging' techniques aligned well with the reference measurements of handheld obtained using the gamma probe and fluorescence endoscope. ***Conclusion:*** With the new Click-On modality, a first step towards 'fingertip' radio- and fluorescence-sensing by surgical instruments has been realized. Hereby the sensory read-out sets the stage for unique new robotic tomographic molecular imaging solutions, that help enhance the surgical experience.

OP-600

First Measurements with On-Chip PET Detectors

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Aim/Introduction: We previously introduced a dedicated On-Chip PET scanner designed for functional imaging of Organs-on-Chips (OOCs). OOCs aim to provide an alternative to conventional in vitro and animal models for drug development, disease modeling, and toxicity testing. Up to now, we have enhanced the system design using Monte-Carlo simulations and implemented a deep learning-based positron range correction algorithm. This study presents the initial real-world measurements using the On-Chip PET scanner. ***Materials and Methods:*** The first version of the On-Chip PET system comprises two detectors, each consisting of a monolithic LYSO crystal measuring 50 mm x 50 mm x 15 mm. The back surface of each crystal is optically coupled to four Hamamatsu S14161 3 mm 8 x 8 SiPM arrays. The readout electronics utilize PETsys Electronics' SiPM readout system, which includes four front-end modules each connected to two SiPM arrays, and one FEB/D board that processes a total of 512 channels. The assembly of the two detectors and the front-end modules is secured within custom 3D-printed housings, positioned on top of each other with an adjustable gap of currently 10 mm between them. A Na-22 370 kBq point source was placed between the two detectors during data acquisition. Additionally, we developed a 3D-printable phantom, modeled on a commercially available OOC device with multiple compartments connected by microfluidic channels. This OOC phantom allows for comparison of Monte Carlo simulation results with actual measurements. ***Results:*** After completing the ASIC calibration, which included adjusting discriminators, time-to-digital converters, and charge integrators, we conducted several data acquisitions with the point source positioned in the middle and at the four corners of the field of view of the detector for 60 seconds each. Each data acquisition recorded approximately 25 million single events. Analysis of constructed flood maps and energy spectra from these single events revealed distributions consistent with expected variations based on the source's positioning. ***Conclusion:*** These preliminary measurements using the dedicated On-Chip PET scanner confirm the functionality of the design and mark the first step towards enabling functional imaging for OOCs. Next steps will focus on measurements using the OOC phantom, prior to imaging actual OOC devices.

OP-601

First in human validation of a DROP-IN β-probe during robotic PSMA-guided Surgery

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Aim/Introduction: Within the diagnostic molecular imaging setting, PET/CT is widely considered to be the leading imaging modality. Not only because of its superior sensitivity and resolution, but also because of the availability of dedicated radiopharmaceuticals. When PET/CT roadmaps are used to identify patients with local disease that will benefit from surgery, ideally such surgery targets the exact same lesion. Despite the many ongoing efforts with regards to low-energy (<150keV) γ-emission or fluorescence guided surgery, detecting the beta-emitting radiopharmaceutical directly seemingly provided the most direct readout method. In this contribution we present the first in-vivo use of robotic 68Ga-PSMA surgical guidance using a DROP-IN beta probe with dedicated signal interpretation algorithm. ***Materials and Methods:*** A sterilizable DROP-IN beta probe has been developed, compatible with the daVinci robotic platform.The core of the β detector consists of a cylindrical mono-crystalline para-terphenyl. Scintillation light conversion was performed by a 3x3 mm2 silicon photomultiplier (SiPM Hamamatsu S13360-3050PE) powered and read-out by a custom microcontroller, connected to the device with a biocompatible and sterilizable latex-free cable. The prototype was evaluated during robotic resections in 8 primary prostate cancer patients that had at least 1 lymph node metastases visible on their PSMA-PET roadmap. At the beginning of surgery, patients were injected with 1.1 MBq/kg of [^{68}Ga]Ga-PSMA. The DROP-IN β probe was used

to trace PSMA-expressing lymph nodes in vivo during the pelvic lymph node dissection. To support the surgeon in discriminating between probe signals coming from tumor and healthy tissue, a statistical software algorithm was developed and optimized on this dataset, and will be presented in this contribution ***Results:*** During robotic surgery, the DROP-IN β probe helped provide the surgeon with an efficient means to detect PSMA-avid lesions. A total of 76 samples (i.e., lymph nodes specimens) were analyzed in vivo, of which 37 (49%) were found to be malignant (21 being PET positive). Using our dedicated detection algorithm, we found a probe detection rate of 80% of the PSMA-PET-positive samples (n = 17/21), yielding a sensitivity of 80% and specificity of 85%, as compared to pathologic evaluation ***Conclusion:*** This study is the first-in-human validation of a DROP-IN β probe, supporting β radio guidance during robotic surgery.Opening the way for the widespread surgical use of beta-emitting radiopharmaceuticals. The obtained sensitivity and specificity values for nodal metastases were found to be competitive to values obtained for other RGS strategies.

OP-602

Investigation of a Nuclear Medicine Compton Camera for low dose imaging using Timepix3 technology

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Aim/Introduction: Current nuclear medicine gamma camera technology relies on the use of collimators to determine the positional information of gamma ray photons emitted from radiopharmaceuticals. However, collimators typically attenuate >95% of incident photons. A Compton camera is an imaging device that can determine the direction of photons based on the kinematics of Compton scattering. The development of a Compton camera would negate the need for collimators and, thus, lead to a significant reduction in the required radioactivity administered to patients, or reduce the scanning time needed. The purpose of this study was to investigate the use of Timepix3 technology as a Compton camera for Nuclear Medicine imaging. ***Materials and Methods:*** A high spatial, high contrast resolution Timepix3 (55 µm pixel pitch, 1.56 ns timing resolution, energy resolution of 9% at 140 keV) device with a Cadmium Telluride (CdTe, 1mm thick) sensor layer was used to acquire 2D image datasets for 99mTc,131I and 137Cs test objects. Analysis pipelines for identifying appropriate interaction events and clusters were established. Compton cone data were subsequently reconstructed onto single and multiple planes using maximum likelihood expectation maximization (MLEM) techniques. Monte Carlo (MC) simulations of the Timepix3 detector Compton camera were developed using EGSnrc MC software and reconstructed similarly. Images of anthropomorphic thyroid phantoms acquired on conventional gamma cameras and the Timepix3 were compared in terms of sensitivity and spatial resolution. ***Results:*** The MC model of the Timepix3 Compton camera was validated using the experimentally acquired data, accounting for Doppler broadening, energy and spatial resolution effects. The spatial resolution, as measured by the full width half maximum (FWHM) of 99mTc and 137Cs point sources was found to be 7.3 and 5 mm, respectively, which is of the order of conventional gamma cameras. The Compton camera sensitivity was approximately 15-20 times that of conventional gamma cameras, demonstrating potential to significantly reduce the required nuclear medicine patient radiation dose or reduce the required scanning time. Further work is needed to optimise the detection and reconstruction techniques for improved spatial resolution in the case of anthropomorphic phantoms. ***Conclusion:*** Timepix3 technology has been investigated for use as a nuclear medicine Compton camera, with experimental and simulated data demonstrating its potential for Compton imaging applications. Future work will look to optimise the use of the Timepix3 detector for more complex nuclear medicine imaging applications, to investigate the technology's potential to significantly reduce administered patient activities or increase throughput.

OP-603

Preclinical and First-in-Human Evaluation of a Novel Brain-Dedicated PET System

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Aim/Introduction: With the recent introduction of concepts defining neurodegenerative disorders on biological grounds, and with the advent of disease-modifying drugs in Alzheimer's disease, there is growing interest in brain-dedicated PET systems. The NeuroLF system (Positrigo, Zurich, Switzerland) consisting of a LYSO-SiPM detector ring placed around the head of a patient sitting on an armchair was developed as a compact, versatile and cost-effective option. The aim of this study is to evaluate the performance of this system according to NEMA specifications and in a first-in-human scenario. ***Materials and Methods:*** The spatial resolution and sensitivity of the system was determined according to the NEMA (NU2-2018) standard using FBP and OSEM reconstructions. Hoffman brain phantom images were acquired on the NeuroLF system and compared with those obtained on Siemens Quadra and GE Discovery MI systems. In addition, by now, eight patients (5 female, age 61±10yrs) were enrolled into a first-in-human study. After undergoing exams on a standard of truth (SoT) PET system (Biograph Vision Quadra, Siemens) with $^{[18F]}$FDG (n=3; ~300MBq; for whole-body staging to exclude malignancy), $^{[18F]}$florbetaben beta-amyloid (n=3; ~300MBq; suspected Alzheimer's disease) or $^{[18F]}$PI-2620 tau (n=2; ~200MBq; suspected progressive supranuclear palsy), patients underwent 15 min brain PET imaging on the NeuroLF system at 114±8min p.i., 145±13min p.i., or 62±26min p.i., respectively. To investigate the non-inferiority hypothesis of the NeuroLF system, the PET scans acquired with NeuroLF are compared to those obtained with the SoT clinical PET system. All brain scans are analysed using tracer-specific standardized visual and semi-quantitative approaches. Additionally, the level of comfort for both patients and technologists when using the new system is scored. ***Results:*** FWHM resolution was determined as 2.2mm (radial), 3.5mm (tangential), and 2.5mm (axial) using FBP reconstruction at 10mm offset from the scanner axis. The sensitivity of the system was measured at 4.8cps/kBq. The Hoffman brain phantom images demonstrated similar quality compared to those acquired with the reference systems. The first human PET images were deemed to be of good quality, suitable for deriving a clinical diagnosis. This far, the PET findings obtained with NeuroLF have not differed from those acquired with the SoT system in any patient. ***Conclusion:*** The data analysis of the first-in-human study is currently ongoing. More patients, including patients scanned with other brain

PET tracers, will be enrolled. However, the NEMA results and preliminary clinical data indicate the suitability of the novel brain-dedicated PET system for providing valuable clinical information.

OP-604

Development of a Fluidics Phantom for Dynamic PET Imaging

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Aim/Introduction: Positron emission tomography (PET) imaging is used in oncology for diagnosis and staging of cancer. Standardized uptake values (SUV) and other quantifiable PET imaging metrics facilitate the comparison of various disease presentations, enhancing treatment planning. Phantoms are the gold-standard for validating these quantities, as they provide a controlled environment that mimics the properties of a human subject with a well-defined ground truth. However, few anthropomorphic phantoms exist which capture the time-dependent radiopharmaceutical distribution observed in dynamic PET imaging. In this work, we aimed to develop a novel fluidics phantom to accurately mimic the pharmacokinetics of prostate-specific membrane antigen (PSMA) radiotracers, enabling the precise measurement of dynamic ground truth. ***Materials and Methods:*** The devised dynamic PET phantom consists of resin 3D printed fluidics chambers. Spherical lesion chambers (17mm, 22mm, and 28mm) and anthropomorphic kidney chambers (~115mL) were created due to the high kidney uptake of PSMA tracers. Fluidic port locations were optimized through computational fluid dynamics to prevent stagnation. These chambers are supplied with a mixture of water and 18F-fluorodeoxyglucose (18FDG) as an analog to 18F-DCFPyL. The variable mixing of water and 18FDG using diaphragm pumps allows the system to dynamically follow a moving set point along an input time activity curve (TAC). NaCl is added to the 18FDG solution to allow for indirect activity concentration measurements with a conductivity sensor. The flow rates of the diaphragm pumps are regulated by a proportional-integral-derivative (PID) controller responding to conductivity sensor feedback. Three spherical chambers are connected in series in one fluidics loop, while the kidneys are connected in series in another loop. All the chambers are mounted in an anthropomorphic Probe-IQ phantom with other static organ chambers. ***Results:*** Non-radioactive tests have shown that the system is capable of following simulated activity curves with a maximum of 9.2% transient state error and negligible steady-state error. A settling time of less than 4 seconds was achieved for TACs. Further dynamic activity validation with PET imaging is planned. ***Conclusion:*** In this work, we developed a novel fluidic system to model time-dependent radiopharmaceutical distributions characterized by dynamic PET imaging. The system has a settling time of less than 4 seconds, allowing it to replicate in vivo tracer dynamics with rapid transit times. Integrated with additional organ chambers, this technology has the capability to be used as a validation tool for new image acquisition methods and dosimetry workflows.

OP-605

Walk-Through Flat-Panel Total Body PET: system design simulations, deep learning, and prototype measurements.

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Aim/Introduction: Long axial field-of-view (LAFOV) PET offers heightened sensitivity compared to standard AFOV PET, enabling quicker and/or lower-dose imaging. However, patient positioning on the bed constrains effective patient throughput for LAFOV, and high system costs make it hard to justify for routine imaging. We propose a novel approach: a dual flat-panel Walk-Through (WT) PET designed for scanning patients in standing position, eliminating time for positioning on the bed[1]. Our solution entails a patient-centric design based on high resolution monolithic detectors with depth-of-interaction (DOI). An optional sequential rectangular shaped spectral multi-source standing CT aims for high quality anatomical images. ***Materials and Methods:*** The system design dimensions are based on patient size measurements. Two large flat panels (with a 50 cm gap) 70 cm wide and 106 cm high accommodate whole-body (pelvic to head) PET. Further cost reduction is obtained by axial gaps between each row. Deep learning is implemented to compensate for the reduced count statistics from sparse WT-PET. The system spatial resolution is estimated from Monte Carlo simulations and a measured detector model. The full system has been modeled in Gate, XCAT simulations have been reconstructed and compared to a model of the Siemens Vision Quadra system. A mockup has been constructed to evaluate patient experience and first prototype measurements are being acquired. Energy based scatter correction and deep learning derived attenuation maps from emission data enable quantitative standalone PET. ***Results:*** The large opening angle, TOF and DOI reduces the expected limited angle artefacts (only visible close to the detectors). Despite a much less detectors (2-4 x), the proximity leads to comparable sensitivity as LAFOV systems. Excellent system spatial resolution (< 2mm throughout the FOV) is obtained due to DOI-capable monolithic detectors. Good image quality is obtained at standard dose (3MBq/kg) for XCAT simulations of 30 sec, further enhanced by deep learning noise reduction. Infrared based motion tracking show that rigid head and body motion in 30 sec was limited (<2mm) for free-breathing and breath-hold conditions to be reduced by motion compensation methods. ***Conclusion:*** The WT-PET reduces cost (2-3 x) approaching that of a SAFOV system, while maintaining LAFOV coverage. and image quality. Higher throughput is achieved by simplifying patient positioning, with the aim to significantly accelerate routine PET torso scans. ***References:*** [1] Vandenberghe, S.,et al (2023). Walk-through flat panel TB pet: a patient-centered design for high throughput imaging at lower cost using doi-capable high-resolution monolithic detectors. EJNMMI 50(12), 3558-3571.

OP-606

First in vivo positronium lifetime measurement with a commercial long axial field-of-view PET/CT

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Aim/Introduction: While the lifetime of the triplet state of positronium (oPs) in vacuum is about 142 ns, it shortens significantly and becomes dependent on the surrounding material with which the oPs can interact. Measuring oPs lifetimes in patients therefore carries the potential for obtaining additional information about the molecular structure of the surrounding tissue [1]. First promising ex-vivo [2] and in-vivo [3] positronium images were recently reported with the modular J-PET system prototype. We report the first in vivo positronium lifetime measurements with a commercial long axial field-of-view (LAFOV) PET/CT scanner. ***Materials and Methods:*** Three subjects (m 58y, f 39y, m 39y) received a standard dose of [68Ga]Ga-PSMA-11, [68Ga]Ga-DOTATOC and [82Rb]Cl and were scanned for 40, 20 and 10 minutes using a special acquisition mode which saves the single-crystal interactions on a commercial LAFOV PET/CT system in addition to the standard PET scan. Triple events were selected from the listmode data based on energy, time and spatial selection criteria. We performed a Bayesian fit to the measured time difference distributions (TDD) with an appropriate prior for the branching fractions of the direct, singlet and triplet annihilation in order to determine the oPs lifetime at the organ level. ***Results:*** We describe histoimages of triple events for the three patients and the resulting oPs lifetime spectra for several organs. The left and right heart chambers, i.e. collecting triple events from the atria and ventricles, of the subject receiving [82Rb]Cl show a distinct oPs lifetime: the 68% credible intervals of the oPs lifetime's posterior distribution are [1.25, 1.48] ns (left) and [1.51, 1.79] ns (right) with mean values 1.38 and 1.66 ns, respectively. This might signal the different oxygenation levels of the blood in the two heart chambers. Challenges for oPs lifetime measurements remain. Several examples of these challenges include the statistics of triple events (e.g. a peak-to-background ratio of ~1.25 in the TDD from 68Ga in the kidneys, liver and pancreas), correction for random triple events and the energy selection for the prompt photon of 68Ga and 82Rb. ***Conclusion:*** In vivo oPs lifetime measurements in patients on a commercial LAFOV PET/CT system are feasible and have the potential to provide additional physiological information presently unavailable in coincidence PET/CT imaging.

References: [1] P. Moskal et al. Nature Reviews Physics 1.9 (2019): 527-529.[2] P. Moskal et al. Science Advances 7.42 (2021): eabh4394. [3] P. Moskal et al. medRxiv (2024): 2024-02.

OP-607

Novel hybrid ultrasound/gamma probe: First clinical experience

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Aim/Introduction: Hybrid nuclear medicine modalities such as SPECT/CT, PET/CT and PET/MR have revolutionized functional imaging, but practical solutions for integrating radionuclide imaging with high-resolution ultrasound are lacking. ***Materials and Methods:*** We constructed a novel hybrid ultrasound/gamma probe by 3D printing a snap-on adapter to attach standard gamma probe for sentinel lymph node surgery to a high-resolution "hockey" probe connected to our clinical ultrasound system. To test clinical feasibility, we performed high-resolution ultrasound in 10 consecutive patients (60 % female, age 55 ± 19 years, mean standard ± deviation) undergoing posttherapeutic imaging incl. SPECT/CT following thyroid ablation for differentiated thyroid cancer (DTC) 72 hours after oral application of 1.1 and 3 GBq [131I]NaI (n = 5 each), respectively. ***Results:*** SPECT/CT revealed an iodine avid pyramidal lobe in 8 out of 10 patients. Only in 1 out of 8 patients, a pyramidal lobe measuring 8 x 6 x 11 mm (260 mm3) could be localized using standard ultrasound probes in the knowledge of the SPECT/CT findings. In the remaining 7 patients, the iodine-avid pyramidal lobe could not be visualized using conventional ultrasound by the same experienced observer, but only using the novel hybrid probe. The lesions had a maximum diameter of 7 ± 2 mm and a volume of 54 ± 24 mm3 ($p < 0.001$) at a maximum count rate of 1500 ± 800 s-1. ***Conclusion:*** Our novel hybrid ultrasound/gamma probe allows the identifcation of small radiotracer-avid lesions with superior sensitivity and precision, thus aiding surgical managment of thyroid cancer and other conditions such hyperparathyroidism.

1306

Tuesday, October 22, 2024, 09:45 - 11:15
Hall Z

Clinical Oncology Track - TROP Session: Oncology & Theranostics Committee: Neuro-endocrine

OP-608

Assess the Added Value of Al^{18}F-NOTA-LM3 Compared to^{68}Ga-DOTATATE and^{68}Ga-NODAGA-LM3 in Patients with Well-differentiated Neuroendocrine Tumors

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Aim/Introduction: 18F-labelled somatostatin receptor (SSTR) analogs present multiple advantages over 68Ga, including improved yield, cost-effectiveness, enhanced spatial resolution, and a higher detection rate. This study aims to evaluate the diagnostic efficacy and the impact on clinical management of Al18F-NOTA-LM3 in comparison with 68Ga-DOTATATE and 68Ga-NODAGA-LM3 in patients with well-differentiated neuroendocrine tumors (NETs). ***Materials and Methods:*** Patients with histologically confirmed well-differentiated NETs (G1 and G2) were prospectively recruited and randomized into two arms: Arm A, where patients underwent Al18F-NOTA-LM3 and 68Ga-DOTATATE PET/CT within a week, and Arm B, where patients underwent Al18F-NOTA-LM3 and 68Ga-NODAGA-LM3 PET/CT within a week. In both arms, the interval between the two scans was set to be at least 24h to avoid interference. Lesion numbers, lesion uptake, and tumor-to-background ratio (TBR) were compared. The impact on clinical management was evaluated. ***Results:*** A total of 50 patients were enrolled in this study, 30 in arm A, and 20 in arm B. On a per-patient basis, Al18F-NOTA-LM3 had a higher detection rate for liver and lymph node lesions than either 68Ga-DOTATATE or 68Ga-NODAGA-LM3. On a per-lesion basis, Al18F-NOTA-LM3 detected significantly more liver metastases (503 vs. 331, P=0.003) and lymph node metastases (33 vs. 24, P=0.007) than 68Ga-DOTATATE. Al18F-NOTA-LM3 identified significantly more liver metastases (375 vs. 261, P=0.008) than 68Ga-NODAGA-LM3. Compared to 68Ga-DOTATATE, Al18F-NOTA-LM3 showed comparable lesion uptake but significantly higher TBR of primary lesions, liver lesions, and bone lesions. Compared to 68Ga-NODAGA-LM3, Al18F-NOTA-LM3 showed lower uptake but higher TBR of liver lesions. Al18F-NOTA-LM3 led to a change in clinical management in 16.7%

(5/30) of the cases in arm A, and 10% (2/20) of the cases in arm B, primarily due to the identification of new, unexpected findings. ***Conclusion:*** AI18F-NOTA-LM3 demonstrated superior diagnostic efficacy compared to 68Ga-DOTATATE and 68Ga-NODAGA-LM3 in patients with well-differentiated NETs, thus providing additional value and impacting clinical management decisions.

OP-609

Assessment of inter- and intraobserver agreement in [^{68}Ga]Ga-DOTA-SSA PET/CT and [^{18F}]AlF-NOTA-octreotide PET/CT imaging

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Aim/Introduction: [18F]AlF-NOTA-octreotide ([18F]AlF-OC) is an alternative for [68Ga]Ga-DOTA-somatostatin analogues (SSAs) in PET imaging of the somatostatin receptor (SSTR) in neuroendocrine tumor (NET) patients. Our aim is to compare inter- and intraobserver agreement in [68Ga]Ga-DOTA-SSA PET/CT and [18F]AlF-OC PET/CT imaging. ***Materials and Methods:*** This is a secondary endpoint analysis of the data from our previously published multicenter trial (1). In this cohort, 75 patients with a histologically confirmed NET received both a [68Ga]Ga-DOTATATE (n=56) or [68Ga]Ga-DOTA-NOC (n=19) PET and a [18F]AlF-OC PET. A randomized read-out of the masked images from both tracers was performed by 5 readers. Concordance of lesion detection per organ was measured between [68Ga]Ga-DOTA-SSA and [18F]AlF-OC images. Lesions were characterized per organ as either benign or malignant, while lesion conspicuity per organ was assessed using a 5-point Likert scale. Six bins were used to categorize the number of malignant lesions (0, 1, 2-5, 6-10, 11-20 and >20) per organ. All PET/CT images underwent scoring for both a global Krenning score and overall image quality (5-point Likert scale) as well. Intraobserver agreement was determined by two readers who reassessed PET images from both tracers for 20 patients. The GWET AC statistic was determined as a measure of agreement on ordinal and categorical scores. ***Results:*** We observed almost perfect interobserver agreement for lesion characterization with [18F]AlF-OC and [68Ga]Ga-DOTA-SSAs, both across all organs as evidenced by a GWET agreement coefficient of 0.921 vs. 0.934, respectively, and at the organ level. Comparable agreement was found in terms of the number of lesions over all organs (GWET agreement 0.736 for [18F]AlF-OC and 0.749 for [68Ga]Ga-DOTA-SSAs). Organ-specific analysis revealed similar agreement for bone (0.819 vs. 0.823) and liver (0.788 vs. 0.786) lesions between [18F]AlF-OC and [68Ga]Ga-DOTA-SSAs, respectively. However, for lymph node assessment, slightly lower agreement was found for [18F]AlF-OC in terms of the number of lesions (0.490 vs. 0.618), although characterization agreement was higher (0.757 vs. 0.616). Both tracers demonstrated almost perfect agreement in determining Krenning scores (0.925 for [18F]AlF-OC and 0.927 for [68Ga]Ga-DOTA-SSAs). Mean lesion conspicuity was similar across all organs for both tracers, while [18F]AlF-OC exhibited a higher mean global image quality score compared to [68Ga]Ga-DOTA-SSAs (4.22 vs. 3.86; p<0.0001). Intra-observer agreement was comparable between the two tracers for lesion characterization and number of lesions. ***Conclusion:*** [18F]AlF-OC and [68Ga]Ga-DOTA-SSAs demonstrate comparable inter- and intraobserver agreement, further validating their potential interchangeability in clinical practice. ***References:*** Pauwels E et al. J Nucl Med. 2023;64:632-638

OP-610

Development of PET Response Criteria In Neuroendocrine tumors (PERCIN)

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Aim/Introduction: It is now well established that PET/CT imaging with radiolabeled somatostatin receptor ligands (SSTR-PET/CT) has a higher diagnostic accuracy for staging of neuroendocrine tumors (NETS) than anatomic imaging with CT or MRI. This suggests that SSTR-PET/CT may also be superior for assessing tumor response to therapy in NETs. However, this application of SSTR-PET/CT has been much less studied and validated criteria for assessing response are still lacking. ***Materials and Methods:*** In this international, dual center study we evaluated response by measuring changes in tumor volumes on SSTR-PET/CT before and after SSTR-targeted radionuclide therapy (typically 4 treatment cycles). Tissue specific threshold values were used to automatically delineate tumor volume on the pre- and post-therapeutic SSTR-PET/CT scans: for liver metastases voxels with a SUVbw more than 2.2 g/ml higher than the maximum liver SUVbw were included in the total tumor volume, for lung and bone metastases voxels with a SUVbw of more than 2.0 g/ml, and for all other metastases voxels with a SUVbw higher than the maximum liver SUVbw. These thresholds were derived from an analysis of a subset of patients with well defined tumor borders on CT. Changes in tumor volumes from the pre- to the post-therapeutic scan were correlated with progression-free survival (PFS). For comparison, tumor response was also assessed with CT and classified according to RECIST. ***Results:*** A total of 90 patients with well-differentiated GEP-NETs treated by SSTR-targeted radionuclide therapy at two centers were retrospectively analyzed. The highest concordance with progression-free survival was achieved by defining response as a 40% decrease of the tumor volume and progression as a 20% increase in tumor volume (p=0.008, c-index=0.62). The prognostic value was improved by defining progression also by the appearance of new metastatic lesions, irrespective of volume changes (p<0.0001, c-index=0.668). Response assessment by RECIST had a lower prognostic value (p=0.0002, c-index=0.590), this was mostly due to the lower sensitivity of CT to detect new lesions. Changes in tumor SUVbw were not significantly correlated with PFS (p=0.47) for various thresholds tested. ***Conclusion:*** Metastatic NETs can be automatically segmented by tissue specific thresholds using routinely available software. Changes of these tumor volumes are correlated with PFS, and their prognostic value is promising when compared to RECIST. Prospective validation of the response criteria derived from this retrospective analysis (PERCIN) is ongoing.

OP-611

Biochemical subtyping of pheochromocytoma and paraganglioma with quantitative parameters in ^{18}F-DOPA PET/CT

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Aim/Introduction: 18F-DOPA PET/CT is currently the most

sensitive functional imaging modality for the diagnosis of cluster 1B and cluster 2 pheochromocytoma/paraganglioma (PPGLs). The assessment of the biochemical secretion type is crucial for patient management, being linked to varying aggressiveness and metastatic risk. Therefore, the aim of this study was to compare the biochemical phenotype as well as single catecholamine metabolite levels measured in plasma and urine samples with uptake intensity and tumor volume on 18F-DOPA PET/CT imaging. ***Materials and Methods:*** All patients with histologically verified PPGLs who underwent 18F-DOPA PET/CT between 03/2012 and 11/2023 as well as hormonal laboratory analysis within up to 3 months after the PET/CT at LMU Klinikum were included. Patients with head and neck paragangliomas were excluded. The metabolic tumour volume (MTV) was quantified based on a threshold value of an SUVmax ≥ 4. Metabolic parameters on 18F-DOPA PET/CT (SUVmax, SUVmean) and total lesion uptake (TLU = MTV x SUVmean) were compared with catecholamine metabolite levels in plasma and 24-hour urine samples using Pearson's or Spearman's correlation analysis after testing for normal distribution with Kolmogorov-Smirnov test. Additionally, the diagnostic discriminative power of SUVmax in distinguishing between different biochemical phenotypes (noradrenergic/adrenergic phenotype) was evaluated using an ROC analysis. ***Results:*** 74/77 patients presented with DOPA-positive PPGLs, 3/77 patients showed DOPA-negative tumors. SUVmax showed moderate correlations with normetanephrines and noradrenaline in plasma (r=0.34, r=0.37, p=0.006-0.007) and urinary samples (r=0.36, r=0.41, p=0.008-0.018). TLU showed strong correlations with plasma normetanephrine (r=0.72, p<0.01), plasma metanephrine (r= 0.67, p<0.01), plasma noradrenaline (r=0.56, p<0.01), chromogranin A (r=0.61, p=0.003), urinary noradrenaline (r=0.60,p<0.01) and urinary metanephrines (r=0.69, p<0.01). Based on the ROC-analysis, a cut-off value of SUVmax 13.6 was determined for the detection of the non-adrenergic subgroup, giving a sensitivity of 78% and a specificity of 74%. ***Conclusion:*** The SUVmax of pheochromocytoma and paraganglioma on 18F-DOPA PET/CT indicates the biochemical phenotype. Furthermore, the total lesion uptake of PPGLs on 18F-DOPA PET/CT is predictive for the level of catecholamine metabolites in plasma samples and 24-hour urine samples potentially facilitating the metabolic profiling of patients with episodic hormonal secretion or suspected impaired laboratory results (e.g. with comorbidities like sleep apnoe or intake of certain medications).

OP-612

Pharmacokinetic analysis of 177Lu-DOTATATE using Mixed model across treatment cycles

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Aim/Introduction: Recent studies have presented evidence regarding the impact of decreased tumor uptake in subsequent cycles of peptide receptor radionuclide therapy (PRRT). However, this evidence remains limited, prompting a crucial exploration of potential cycle effects. Hence, our primary aim was to quantify these effects in tumors and normal organs with physiological uptake. ***Materials and Methods:*** : A pharmacokinetic model was developed using post-therapy SPECT images from 12 patients who received four cycles of 177Lu-DOTATATE. Our data acquired at the University of Michigan includes serial post-therapy SPECT/CT imaging at ~ 4, 24, 96, and 168 hours after each PRRT cycle. A 25 min single-bed SPECT/CT acquisition is performed on a Siemens Intevo using manufacturer-recommended protocol and quantitatively reconstructed with Siemens xSPECT. Up to five index lesions were manually segmented by a radiologist while the normal organs were segmented using a deep learning model on the CT portion of SPECT/CT images. The compartments' activities were obtained as the total activity in the volume of interest (MBq) and were normalized to the injected activity and decay-corrected to the administration time using the physical half-lives of 177Lu. We implemented a six-compartment model including a central, kidney, spleen, target tumor volume and rest compartment. The radiotracer transport between the central and other compartments was described by two rate constant parameters, while the elimination was defined by a bi-phasic rate constant from the central compartment. The cycle effect was evaluated in terms of changes in kinetic rates using mixed effect model. All model processing was performed using SimBiology (MATLAB version 2024a). ***Results:*** The biological half-life for kidneys (84.8±22.4), spleen (146.4±40.4) and tumor tissues (264.5±196.2) were calculated from non-compartmental analysis. From the multi-compartmental mixed model, the absorption and elimination rate for each compartment was calculated as follows: spleen (kin= 0.01; kout= 0.20), kidney (kin= 0.05; kout= 0.92), tumor (kin=0.02; kout=0.15). We observed a trend in which the population-based tumor absorption rate decreased to 81%, 66%, and 53% in the subsequent cycles compared to cycle one, indicating an impact of the treatment cycle on tumor physiology. ***Conclusion:*** Using population PK modeling, we investigated the cycle effect on tumor uptake in subsequent PRRT cycles highlighting a negative trend in tumor uptake that aligns with other studies, warranting further investigation for PRRT outcome enhancement. ***References:*** Siebinga, H., et al, (2024). "The cycle effect quantified: reduced tumour uptake in subsequent cycles of [(177)Lu]Lu-HA-DOTATATE during peptide receptor radionuclide therapy." EJNMMI 51(3): 820-827.

OP-613

Image quality for two administration regimens for [^{68}Ga]Ga-DOTA-TOC PET/CT-imaging - how low can we go?

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Aim/Introduction: For positron emission tomography (PET) with [68Ga]Ga-DOTA-TOC, guidelines recommend an administered activity to adults of 148 MBq (Food and Drug Administration) and 100-200 MBq (European Medicines Agency), respectively [1]. While administration of a fixed activity might have logistical advantages, a disadvantage might be an inconsistent image quality for differently sized patients, possibly affecting diagnostic confidence. The aim of this study was to evaluate how fixed dosing regimens is related to image quality and diagnostic confidence compared to weight-adjusted dosing, and to evaluate the minimum administered activity where diagnostic image quality is preserved. ***Materials***

and Methods: Fifty patients referred for [68Ga]Ga-DOTA-TOC-PET/CT (average: 83kg, 27.3kg/m2, 19 females) were included. Each patient received 2 MBq/kg [68Ga]Ga-DOTA-TOC and after on average 61.5 minutes, images were acquired in listmode for 3 minutes/bed position on a PET/CT system (20 cm axial field-of-view). Images were resampled to mimic administrations with fixed activities (200, 150, 100, 80 and 60 MBq) or weight-adjusted activity (2.0, 1.6, 1.2, 0.8, 0.6 and 0.4 MBq/kg). Images were reconstructed with a block-sequential regularization-expectation-maximization reconstruction-algorithm (beta-value 900). Image quality according to a four-grade scale (1-unacceptable, 2-poor, 3-moderate, 4-good) were assessed by two expert readers. The level of confidence regarding presence of pathology was evaluated on a binary scale ("confident"/"not confident"). From volumes-of-interest drawn in liver and muscle, mean activity concentration and standard deviation (std) were noted, and signal-to-noise ratios (SNR=mean/std) were calculated. ***Results:*** Assessed image quality agreed with average SNR in liver. A weight-adjusted activity regimen gave more consistent assessed image quality. For weight-adjusted activities of 2.0, 1.6, 1.2 and 0.8 MBq/kg the average image quality score was 3.7, 3.2, 2.9, 2.1. and average SNR in liver 16.2, 15.0, 13.7 and 11.4. The percentage of images scored as 4-good or 3-moderate was 100%, 100%, 85%, 5% with diagnostic confidence of 92%, 88%, 77% and 48%. For fixed activities of 200, 150, 100 and 60 MBq average image quality score was 3.4, 3.2, 2.9, 2.2, average SNR in liver 16.2, 14.6, 13.6 and 11.3, the percentage of images scored as 4-good or 3-moderate was 100%, 95%, 68%, 21% with diagnostic confidence of 92%, 89%,71% and 39%. ***Conclusion:*** For a consistent good-to-moderate image quality an activity of at least 1.6 MBq/kg or 150 MBq for 3-min/bed is needed, hence guidelines suggesting fixed dosing of 100 MBq may compromise diagnostic image quality. ***References:*** SNMMI Procedure Standard/EANM Practice Guideline for SSTR Receptor PET: Imaging Neuroendocrine Tumors (2023)

OP-614

Cholecystokinin-2 Receptor PET/CT Imaging using the ^{68}Ga-Labelled Minigastrin Analogue DOTA-MGS5 in Patients with advanced Neuroendocrine Tumours: a Prospective Phase I/IIA Study

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Aim/Introduction: Cholecystokinin-2 receptor (CCK2R) PET/CT can improve the diagnostic work-up in patients with neuroendocrine tumours (NET) and could serve as baseline imaging for potential peptide receptor radionuclide therapy (PRRT) targeting CCK2R. This receptor is expressed at high incidence >90% in medullary thyroid carcinoma (MTC) and by other NET. Within a prospective phase I/IIA pilot study PET/CT imaging with the 68Ga-labelled minigastrin analogue DOTA-MGS5 (68Ga-DOTA-MGS5) was performed in twelve patients at our center. ***Materials and Methods:*** In this prospective, monocentric, open-label, single-dose, diagnostic trial (ClinicalTrials.gov: NCT06155994) six patients with advanced MTC and six patients with other NET were included. The primary objective of the study was the evaluation of safety and tolerability, as well as whole body distribution and dosimetry. Local or distant metastases in the patients were confirmed by previous PET/CT imaging with 18F-DOPA or 68Ga-DOTA-TOC. Preliminary targeting properties of 68Ga-DOTA-MGS5 were investigated in comparison with standard imaging modalities. Intensity of tracer accumulation was measured using SUVmax/SUVmean and tumour-to-background ratios (TBR) were calculated. ***Results:*** In all patients the administered single dose of 180 MBq 68Ga-DOTA-MGS5 (range 111-222 MBq; maximum injected peptide amount of 50 µg) was well tolerated with minor side effects occurring only in three patients. The uptake of 68Ga-DOTA-MGS5 was highest in renal pelvis and urinary bladder as well as CCK2R-expressing stomach. About 50% of the activity was excreted within the first three hours after administration resulting in an acceptable effective whole body dose <5 mSv. On visual assessment, imaging at 2 h allowed for improved contrast in comparison with the time point of 1 h after injection. In four of six patients (67%) with advanced MTC (Calcitonin: 422-23,403 ng/L; CEA: 18-13,156 µg/L) CCK2R-positive lesions were detected and ~90% of the metastatic lesions known from previous 18F-DOPA or 68Ga-DOTA-TOC PET/CT were confirmed. In the six patients with other NET (CgA: <19-33,849 µg/L; NSE: 14-80 µg/L), 68Ga-DOTA-MGS5 PET/CT was rated positive in two patients with lung NET and one patient with ileal NET (50% of the patients) confirming ~70% of the lesions. ***Conclusion:*** The results from the prospective phase I/IIA study show that the intravenous administration of 68Ga-DOTA-MGS5 is well tolerated. The new PET-tracer allows for high-contrast PET/CT imaging of CCK2R-positive lesions. A good tumour detection was found in MTC patients indicating the potential applicability of DOTA-MGS5 labelled with therapeutic radiometals in PRRT. The additional value in patients with other NET was moderate.

OP-615

Diagnostic performance of [^{99m}Tc]Tc-N4-LM-3 (TECANT-1), a novel somatostatin receptor antagonist for imaging of neuroendocrine neoplasms - results of a first-in-human multicentre ERA-PerMed TECANT study

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Aim/Introduction: Somatostatin receptor (SSTR) expression is one of the defining features of neuroendocrine neoplasms (NEN), which allows them to be targeted by a molecular imaging approach. The paradigm of using SSTR agonists for theranostics of NEN is increasingly being challenged, with SSTR antagonists typically exhibiting higher and more sustained target binding in addition to lower background retention. As the availability of SPECT and SPECT/CT equipment is still higher than the PET/CT alternative, a single-photon emitting somatostatin receptor antagonist imaged with a robust, reproducible quantitative approach would represent a significant step forward towards patient-tailored management of NEN. The study aimed to develop and evaluate the performance of a novel single-photon emitting

radiopharmaceutical, SSTR antagonist [99mTc]Tc-N4-LM-3 (TECANT-1) for imaging of NEN. ***Materials and Methods:*** Patients with G1/G2 advanced NEN with metastatic disease proven on PET SSTR imaging ([68Ga]Ga-DOTATATE) were enrolled. Imaging consisted of a serial total-body (5 min, 30 min, 4h, 24h pi.) planar images and dual-bed SPECT/CT acquisition 4h pi. Patients were monitored for vital signs and potential adverse events. Dosimetry was performed in five patients using MIRD formalism and hybrid 2D/3D approach (planar and AC/SC SPECT/CT images). Target-to background (T/B) ratios (liver, bone and blood-pool background regions, as appropriate) were calculated for five lesions with the highest uptake in each patient; comparison with T/B ratios on PET imaging was performed in three patients. ***Results:*** Ten patients were enrolled (phase 0/I clinical trial). A significant adverse event unrelated to the radiopharmaceutical administration with no permanent effect on health status was noted in one patient. The kidneys received the highest absorbed dose (18,5±7,7 mSv), absorbed doses for the bone marrow and the bladder wall were 2,3±0,5 mSv and 5,5±2,1 mSv; total-body effective dose was estimated at 3,6±0,9 mSv. T/B ratio for the lesion with the highest uptake averaged at 18,2 (range 5,2-52,6) and at 11,4 (range 1,6-52,6) for all lesions; T/B ratios for SPECT/CT imaging were higher than for PET/CT imaging with average SPECT/PET ratio of 2,2 (range 1,4-2,8) for the lesion with the highest uptake and 1,6 (range 1,1-1,9) for all lesions (with several lesions not detected on PET imaging). ***Conclusion:*** SSTR antagonist [99mTc]Tc-N4-LM-3 (TECANT-1) is a safe, highly effective radiopharmaceutical with superior imaging characteristics to SSTR PET agonist imaging and comparable dosimetry profile to single photon agonist alternatives, warranting further validation and translation into clinical routine.

OP-616

[18F]F-AI-NOTA-Octreotide versus [111In]In-DTPA-Octreotide: Update on Fluorine-Octreo-PET Clinical Study

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Aim/Introduction: SPECT with [111In]In-DTPA-octreotide remains the option available in some countries for neuroendocrine tumor (NET) imaging, despite its limitations. An recently option is PET/CT with [18F]F-AIF-NOTA-Octreotide, with superior spatial resolution and improved anatomical localization, technical implementation and cost-effectiveness, making it the preferred choice for facilities unable to prepare [68Ga]Ga-radiopharmaceuticals. This study was a prospective, non-randomized clinical trial, aimed at comparing, for the first time, the efficacy of PET/CT with [18F]F-AIF-NOTA-Octreotide to SPECT/CT with [111In]In-DTPA-octreotide. ***Materials and Methods:*** Patients referred to the nuclear medicine department for SPECT with [111In]In-DTPA-octreotide were also invited to undergo PET/CT with [18F]F-AIF-NOTA-Octreotide within three weeks after SPECT. Lesions identified per organ in both exams were categorized as 1, 2-5, or > 5; nominal variables were analysed using Fisher's exact test. Differences with $p < 0.05$ were considered significant. ***Results:*** 32 patients were included, 19 female; mean age 53.3 ± 13.9 years; most of them grade I (n = 15) or grade II (n = 13) gastrointestinal (n = 15), pancreatic (n = 5) or lung (n = 4) NET. [111In]In-DTPA-octreotide identified hepatic disease in 15 patients - one patient with one, two with 2-5 and 12 with >5 lesions (Kreening 3-4) - and [18F]F-AIF-NOTA-Octreotide in 17 patients ($p < 0.001$) - four with 2-5 and 12 patients with >5 lesions (SUVmax 22.73 ± 11.4 versus SUVmax background 4.13 ± 1.3). Positive lymphonodes were found in six patients with [111In]In-DTPA-octreotide - one in four patients and 2-5 in two patients (Kreening 1-4) - and 16 in PET/CT with [18F]F-AIF-NOTA-Octreotide - one in six patients; 2-5 in six and >5 in four patients (SUVmax 17.9 ± 18.6 versus SUVmax background 1.00 ± 0.7) in PET/CT ($p = 0.034$). Differences were also found in bone lesions detection, with positive bone scan in four patients with [111In]In-DTPA-octreotide (Kreening 1-3) and in six patients with [18F]F-AIF-NOTA-Octreotide ($p < 0.001$) (SUVmax 7.75 ± 5.4 versus SUVmax background 0.95 ± 0.5). Additionally, [18F]F-AIF-NOTA-Octreotide imaged lesions in colon and rectum and heart, which were not identified by [111In]In-DTPA-octreotide. ***Conclusion:*** PET/CT with [18F]F-AIF-NOTA-Octreotide detected a greater number of lesions (upstaging) than SPECT/CT with [111In]In-DTPA-octreotide in liver, lymphonodes and bone and also imaged extra-hepatic disease not identified in SPECT/CT with [111In]In-DTPA-octreotide. We expect completing patient enrollment and assessing the clinical impact of the results on patient management by December 2024.

1307

Tuesday, October 22, 2024, 09:45 - 11:15
Hall Y10-Y12

Featured Session: Neuroimaging Committee: Tau PET Imaging

OP-617

Tau PET Imaging : Where Are We Now ?

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OP-618

Longitudinal monitoring of tau aggregation in 4-repeat tauopathies [18F]PI-2620 PET imaging

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Aim/Introduction: Progressive supranuclear palsy (PSP) and corticobasal degeneration (CBD), two primary 4-repeat (4RT) tauopathies, can be detected with tau-PET imaging using the second generation radiotracer [18F]PI-2620. However, unlike for Alzheimer's disease (AD), the value of sequential [18F]PI-2620 imaging for disease progression tracking has not yet

been investigated. ***Materials and Methods:*** We conducted a longitudinal [18F]PI-2620 study in individuals with probable or possible PSP and CBD (n=17), diagnosed according to the Movement Disorder Society PSP criteria. All patients received two (FUP 22.5±3.7 months) dynamic [18F]PI-2620-PET scans from 0 to 60 minutes post-injection. Serial imaging data, including atrophy correction, were compared to a cross-sectional cohort of healthy individuals (n=18) and disease controls (AD n=7). Distribution volume ratios (DVR, temporal reference region) of [18F]PI-2620-PET were measured in the globus pallidus internus and externus, putamen, subthalamic nucleus, substantia nigra, dorsal midbrain, dentate nucleus and dorsolateral prefrontal cortex and correlated with changes in disease severity. ***Results:*** DVR z-scores increased longitudinally among individuals with 4R-Tauopathies, particularly pronounced in the Globus pallidus (+46%, p=0.0038). Intriguingly, the most substantial increase in DVR occurred in individuals with a low initial tau burden at baseline, whereas those starting with a high DVR did not exhibit a similarly significant escalation (R= -0.7891, p=0.0002). According to disease specific measures of severity including PSPRS (+44%, p=0.0002), UPDRS (+43%, p<0.0001) and Schwab and England ADL scale (-22%, p<0.0001) patients deteriorated but there was no association between changes in tau PET and individual clinical deterioration. All effects were robust with and without voxel-based partial volume effect correction of [18F]PI-2620 PET signals. ***Conclusion:*** In summary, our longitudinal evaluation utilizing [18F]PI-2620 highlights its potential for diagnosing and tracking disease progression in individuals with 4R-tauopathies. Our data suggest a ceiling effect of tau pathology in 4R-Tauopathies once a specific threshold of tau load is attained.

OP-619

Cortical Tau Aggregation Patterns are associated with Apraxia in Alzheimer's Disease

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Aim/Introduction: Apraxia is a characteristic feature of Alzheimer's disease symptomatology, but the underlying mechanisms of this behavioural trait are poorly understood. In this study, we embarked on a systematic investigation of apraxia profiles in a carefully defined cohort of AD patients, complemented by PET imaging using the second-generation tau PET tracer [18F]PI-2620. ***Materials and Methods:*** Our hypothesis was that different patterns of tau pathology might underlie apraxic deficits. We assembled a group of 32 patients with a confirmed diagnosis of AD, additionally a sample of cognitively unimpaired controls (CU1; N=41). Both cohorts underwent comprehensive neuropsychological assessment for apraxia using the Dementia Apraxia Screening Test (DATE) and the Cologne Apraxia Screening (KAS). In addition, PET imaging with [18F]PI-2620 was used to assess tau pathology specifically in the AD patients. To investigate the relationship between apraxia and regional tau pathology, we compared PET data from the AD group with an independent set of amyloid-negative cognitively unimpaired participants (CU2; N=54) and computed z-score deviation maps, which were submitted to a voxel-based multiple regression analysis. ***Results:*** We observed significant clusters of tau aggregation within apraxia-associated regions, such as the angular gyrus and various temporal, parietal and lateral occipital cortical areas, all of which showed correlations with apraxia. Importantly, these regions were consistent across both apraxia assessment tools. Conversely, no correlations were found between tau tracer uptake in primary motor cortical or subcortical brain regions and apraxia. ***Conclusion:*** Our results suggest that tau deposition in specific cortical regions may trigger local neuronal dysfunction, ultimately leading to a dose-dependent deterioration in praxis performance. Our results provide an important step towards unravelling the complex interplay between tau pathology and the manifestation of apraxia in AD.

OP-620

Extent of Tauopathy and neural dysfunction and loss: how does it match? Insights from a cross-sectional study comparing [18F]MK-6240 to [18F]FDG PET.

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Aim/Introduction: In this study, we aimed to investigate whether the Extent Of Tauopathy (EOT index) extracted from [18F]MK-6240 Tau PET correlates with the degree of neurodegeneration (synaptic dysfunction, neuronal loss...) depicted by [18F]FDG PET/CT. ***Materials and Methods:*** Sixty-seven subjects underwent both [18F]MK-6240 tau PET and [18F]FDG PET within a one-year timeframe. The cohort was divided into 3 amyloid-negative(AMY-)/cognitively normal(CN) individuals, 16 AMY-/cognitively impaired subjects and 48 amyloid-positive(AMY+) subjects covering the full spectrum of Alzheimer's disease (AD) (5 cognitively unimpaired, 28 presenting mild cognitive impairment (MCI) and 15 demented subjects). [18F]MK-6240 tau PET were quantified using previously published method[1] resulting in a global (Braak≤6) EOT percentage. [18F]FDG PET were quantified using the PALZ 4.3 workflow (AD-score)[2]. Simple linear regressions were computed between EOT and AD-scores for the whole population initially and later focused on the AMY+ population.Categorial analyses Tau (T+/-) vs Neurodegeneration (ND+/-) were then performed using previously established cutoffs (T+ >12.1% EOT [1]; ND+ >1.0 AD-score). ***Results:*** The first simple linear regression revealed a decent correlation between the EOT and the AD-score, with a R2 of 0.39 (p<0.0001). After excluding the 16 AMY- subjects, the correlation improved significantly (R2: 0.57; p<0.0001). None of the AMY- (but one with frontotemporal lobar degeneration) presented a significative EOT, while some of them presented light to severe signs of neurodegeneration (max 3.04 AD-score). Accordingly, the simple linear regression in the AMY- population was not significant (R2= 0.06; p=0.32).Regarding the categorial analysis focused on AMY+(N=48) and 3 CN subjects (n=51), complete results were: T-/ND-: 7 (14%) ; T-/ND+: 4 (8%), T+/ND- 15 (29%) ;T+/ND+: 25 (49%).While only 4 (8%) subjects were T-/ND+ (slightly ND+, with AD-scores range [1.04-1.26]), 15 (29%) were T+/ND- (EOT range [12.6%-55.6%]). This potentially illustrates the hypothesis of a front of tauopathy preceding the neuronal dysfunction/loss - and subsequent neurodegeneration revealed by [18F]FDG PET. ND- and ND+ groups were also significantly different in terms of EOT, with respective mean EOT of 21.5% [range:0.7%-55.6%] versus 51.5% [range:3.5%-87.5%] (p<0.0001). ***Conclusion:*** In a cross-sectional timeframe, [18F]MK-6240 tauopathy strongly correlated with markers of neurodegeneration in the AD spectrum population. The categorical T/ND mismatch between AD-Score and EOT mainly concerned mild-to-moderate tauopathies without concurrent neurodegeneration. Ongoing and future longitudinal studies will enlighten the chronological relationship between the outbreak of tauopathy and the subsequent neuronal dysfunction and death depicted by [18F]FDG PET. ***References:*** [1]:https://doi.org/10.1007/s00259-024-06603-2 [2]:https://doi.org/10.1006/nimg.2002.1208

OP-621

Straight-forward Algorithm for visual assessment of 4-repeat-Tauopathies in [18F]PI-2620 PET scans

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Aim/Introduction: Efforts to standardize tau-PET scans for 4R-tauopathies through automated quantification methods highlight the need for clinically practical approaches. This study aims to investigate the effectiveness of visual evaluation of [18F] PI-2620 images for diagnosing 4R-tauopathies and to develop a straight-forward reading algorithm to improve objectivity and data reproducibility. ***Materials and Methods:*** A total of 83 individuals with [18F]PI-2620 PET scans were included. A priori clinical evaluations categorized participants into probable 4R-tauopathies, Alzheimer's disease (AD), α-synucleinopathies, and healthy controls. Visual assessment of tau-PET scans was conducted using either 20-40- or 40-60-minute intervals, with unprocessed (conventional) and cerebellum grey matter scaled standardized reading settings (prescaled). Two primary readers evaluated scans independently, with a third reader providing consensus in case of discrepancies. A subregion analysis was performed using frontal cortex, basal ganglia, midbrain, and dentate nucleus. Sensitivity, specificity, and interrater agreement were calculated for all modalities and compared against the visual reads of parametric images (0-60 min, distribution volume ratios, DVR). ***Results:*** Visual assessment of 4R-tauopathies resulted in greater sensitivity with 79% at the highest for the 20-40 minute time window compared to the 40-60 interval with 55% at the lowest, albeit concomitant with slightly reduced specificity. The prescaled reading setting demonstrated higher specificity, particularly notable in the earlier time frame compared to the conventional setting. In addition the prescaled mode showed almost perfect interrater agreement (κ=0.87). Combined assessment of multiple brain regions did not significantly improve diagnostic accuracy compared to assessing the basal ganglia alone. Dynamic scans had higher sensitivity of 86% compared to static scans with a maximum of 79% at similar specificity. ***Conclusion:*** Visual tau-PET reading of [18F]PI-2620 tau-PET scans demonstrated reliable detection of 4R-tauopathies, particularly when standardized processing methods and early imaging windows were employed, improving diagnostic accuracy.

OP-622

Tau PET deposition measured by [18F]PI-2620 increases along the Alzheimer's disease continuum in Down Syndrome

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Aim/Introduction: Down syndrome (DS) arises from chromosome 21 trisomy, leading to extra APP gene copies and triggering early-onset Alzheimer's disease (AD) pathology. DS-related AD shares neuropathological similarities with autosomal dominant AD (ADAD). Despite ADAD's tau burden dynamics are well-characterized, tau-PET imaging patterns in DS remains largely unexplored. This study aims to assess neurofibrillary tau burden in DS adults using [18F]PI-2620, aiming to evaluate the visual rate, correlate with clinical status, delineate tau deposition patterns, and investigate links with amyloid PET. ***Materials and Methods:*** Seventy-six subjects (20 euploid healthy controls [HC], 31 asymptomatic DS [aDS], 8 prodromal DS [pDS] and 17 demented DS [dDS]) underwent [18F]PI-2620 PET/CT and T1w-MRI, and 62 of them also [18F]Flutemetamol PET/CT. PET images were co-registered to the corresponding T1w-MRI and intensity normalized to inferior cerebelar cortex for [18F]PI-2620) and cerebellum for [18F]Flutemetamol. We computed the Centiloids for amyloid-PET and [18F]PI-2620 tracer retention was quantified as individual Standardized Uptake Value ratio (SUVr) in the anatomical definitions of Braak stages I-II, III-IV and V-VI. To assess the spatial pattern of tau deposition and the relationship with amyloid deposition, vertex-wise analysis (FWE-corrected $p<0.05$) were performed using PETSurf toolbox (Freesurfer). ***Results:*** We observed an increase of tau and amyloid deposition increase along the AD continuum: all the HC as well as the 83,9% of aDS (26/31) presented normal distribution of [18F]PI-2620, while 75% (6/8) of pDS and 82.2% (15/17) of dDS participants presented cortical [18F]PI-2620 deposition in AD areas (posterior-lateral temporal, occipital, parietal/precuneus, posterior cingulate or frontal cortex. These results aligned with the expected outcomes derived from the ROC analyses for visual inspection vs SUVr (AUC Braak I-II = 0.974; AUC Braak III-IV = 0.9874; AUC Braak V-VI = 0.9694). Differences in [18F]-PI2620 uptake were statistically significant in the three Braak staging for pDS and dDS when compared to HC and aDS ($p<0.05$), but no differences were found between the symptomatic subgroups (pDS vs dDS). Vertex-wise maps in symptomatic DS revealed tau deposition typical AD areas, regions where also there was identified a strong correlation between tau burden and global amyloid deposition ***Conclusion:*** [18F]PI-2620 PET presented high affinity to tau aggregates in symptomatic DS subjects, and allowed discrimination between asymptomatic subjects (euploid and aDS subjects) from symptomatic DS subjects. Tau PET deposition measured by [18F]PI-2620 increases along the AD continuum in DS and it was present in subjects with high amyloid burden.

OP-623

Reference-region-independent voxel-wise tau distribution pattern analysis in 3R/4R- and 4R-tauopathies

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Aim/Introduction: The second-generation tau PET ligand [18F] Florzolotau shows distinct binding patterns in patients with 3R/4R- (i.e., Alzheimer's disease, [AD]) and 4R-tauopathies (i.e., progressive supranuclear palsy [PSP] and β-amyloid-negative corticobasal syndrome [CBS]).1 However, quantification of tau PET data across different disease identities is hampered by the lack of a suitable reference region devoid of possibly specific binding. The aim of this study was to evaluate the feasibility of reference-region-independent analysis of [18F]Florzolotau PET with covariance patterns in patients with tauopathie. ***Materials and Methods:*** [18F]Florzolotau PET data were acquired at four different centres. A dataset of 30 healthy controls (HC, β-amyloid-negative) and 30 patients each with AD (β-amyloid-positive) and PSP with Richardson's syndrome (PSP-RS) served to establish disease-related covariance patterns by using scaled sub-profile modelling principal components analysis.2 We then calculated the AD- and PSP-RS-related pattern expression scores in an independent cohort of 44, 51, 6, 15 and 17 patients with AD, PSP/CBS, multiple system atrophy (MSA), Lewy body diseases, and frontotemporal dementia (FTD), respectively. ***Results:*** The AD-related pattern showed strong positive voxel weights in temporoparietal, precuneus/posterior cingulate, and frontal cortices and negative weights in cerebellum, brainstem, and sensorimotor cortex. The PSP-RS-related pattern had strong positive weights in brainstem, midbrain, thalamus, globus pallidus, striatum, sensorimotor cortex, and mild positive weights in dentate nucleus, occipital cortex, and parts of white matter. In the derivation cohort, both the AD- and PSP-RS-expression scores were strongly increased compared to HC (both p<0.001, AUC-ROC=0.99 and 0.90). In the validation cohort, patients with AD showed a clear increase of AD-scores compared to all other patients (p<0.001, AUC-ROC=0.95). PSP-RS-scores were higher in patients with PSP/CBS compared to all other (p<0.001, AUC-ROC=0.73). A mildly increased PSP-RS score was observed in FTD and MSA, though lower than in PSP/CBS (each groups vs. PSP/CBS, p<0.05). ***Conclusion:*** Definition of disease-specific covariance patterns with principal components analysis allows for reference-region-independent quantification of [18F]Florzolotau PET data. AD- and PSP-RS-related patterns showed high discriminatory power in both the derivation and the clinically heterogeneous validation cohorts. Increased PSP-RS-related pattern expression in patients with FTD and MSA may be related to 4R-pathology and known off-target binding in the putamen, respectively. ***References:*** 1. Tagai K, Ono M, Kubota M, et al. High-Contrast In Vivo Imaging of Tau Pathologies in Alzheimer's and Non-Alzheimer's Disease Tauopathies. Neuron 2021;109(1):42-58e8. 2. Spetsieris P, Ma Y, Peng S, et al. Identification of Disease-related Spatial Covariance Patterns using Neuroimaging Data. J Vis Exp 2013;26(76):50319.

OP-624

Regional associations of sleep architecture and Alzheimer's disease pathology

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Aim/Introduction: Recent evidence suggests that disturbances of sleep architecture are linked to Alzheimer's disease (AD) pathology. Here, we assessed the association between sleep architecture and regional amyloid and tau pathology employing a sleep-monitoring device in addition to PET imaging. ***Materials and Methods:*** 14 healthy controls (HC; M(Age) = 63.57 (7.23), Sex (M/F) =4/10) and 14 patients with mild cognitive impairment (MCI) or early AD (M(Age) = 64.79 (7.42), Sex (M/F) =7/7) were included from the "Tau Propagation Over Time" (T-POT) study. All subjects underwent amyloid ([11C]-PiB) and tau ([18F]-AV1451) PET imaging. PET images were normalized and intensity standardized to the whole cerebellum ([11C]-PiB) or the inferior cerebellum ([18F]-AV1451). All subjects were provided with a portable sleep-monitoring EEG-headband by Beacon Biosignal (former Dreem), which has been shown to reliably detect the different sleep phases similar to polysomnography. Participants were asked to wear the device for at least three consecutive nights within six months of the PET acquisition. Total duration of sleep phases per minutes (i.e. REM, N1, N2, N3) were extracted for the respective recordings. Nightly measurements were then averaged across the three nights after confirmation of their stability. Next, whole-brain voxel-wise correlation analyses were performed between the sleep measures (i.e. mean duration in respective sleep phase) and amyloid and tau load as assessed by PET imaging, respectively. Analyses were corrected for age and the significance threshold of the voxel-wise analyses was set at a p-value of p<.001 (uncorrected). ***Results:*** The MCI/AD group presented significantly reduced N3 duration (p=.011) and increased N1 duration (p=.039) in comparison to the HC group. The whole-brain voxel-wise analyses yielded that decreased N3 duration was linked to greater amyloid burden in the insula, prefrontal cortex and precuneus. In terms of tau pathology, a decrease in N3 duration was associated with greater medio-temporal, superior parietal and precentral gyrus tau pathology. N1 duration was not linked to regional neuropathological burden. ***Conclusion:*** Local changes in sleep architecture may arise from regionally-specific accumulation patterns of AD pathology. Yet, it remains unknown whether disruptions in sleep architecture are the cause or the consequence of pathology build-up.

OP-625

Amyloid and tau dynamics in preclinical autosomal dominant Alzheimer's disease mutation carriers: a dual-tracer PET/MRI study

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Aim/Introduction: Neuroimaging studies of autosomal dominant Alzheimer's disease (ADAD) enable characterization of the trajectories of cerebral amyloid-β (Aβ) and tau accumulation in the decades prior to clinical symptom onset. This study aims to assess the spread dynamics of 11C-PIB and 18F-MK6240 PET, and evaluate its relationship with the neuropsychological scores in asymptomatic ADAD mutation carriers. ***Materials and Methods:*** The study cohort consisted of 11 non-demented ADAD carriers and 11 age-matched healthy controls (HC). We acquired 20 mins PIB-PET with uptake time from 40 to 60 min, and 20 mins of MK6240-PET with uptake time from 70 to 90 min. The cortical-to-cerebellum standardized uptake value ratio (SUVR) was calculated. The ROI-based t-test analysis was employed to assess the SUVR

difference between groups, and spearman correlation analysis was used to evaluate the correlations between the SUVR of each tracer and neuropsychological scores. ***Results:*** Compared to HC, mutation carriers exhibited higher amyloid burden in whole cortex and striatum area, but no significant difference in tau PET binding. The mutation carriers were further divided into tau PET positive (tau+) and tau PET negative (tau-) groups according to the qualitative visual analysis. The tau+ group demonstrated higher MK6240-PET uptake in medial temporal lobe (MTL) and frontal cortex (FC) compared to the tau- group, and higher MK6240-PET binding in MTL, FC and parietal cortex compared to HC. Compared to HC, the tau+ group exhibited increased 11C-PIB retention in the neocortex, but much greater in the striatum. While the tau- group presented negative PIB retention or only slightly increased amyloid binding in the partial cortical regions. In mutation carriers, higher PIB-PET binging in the striatum area was correlated with worse global cognitive function (MMSE, r=-0.716, P=0.013), and the higher Tau PET binding in striatum was correlated with less estimated years to/from symptom onset (r=0.755, P=0.007). ***Conclusion:*** Our study suggests that amyloid initially accumulated in the cortex, followed by striatum in the preclinical stage of ADAD. In contrast, tau pathology firstly accumulated in MTL, suggesting that the pathological changes in ADAD is similar to sporadic AD and highlighting the common spatiotemporal dynamics. ***References:*** 1. Qin Q, et al. Prominent Striatum Amyloid Retention in Early-Onset Familial Alzheimer's Disease With PSEN1 Mutations: A Pilot PET/MR Study. Front Aging Neurosci. 2021;13:732159. 2. Sanchez JS, et al. Longitudinal amyloid and tau accumulation in autosomal dominant Alzheimer's disease: findings from the Colombia-Boston (COLBOS) biomarker study. Alzheimers Res Ther. 2021;13(1):27.

1308

Tuesday, October 22, 2024, 09:45 - 11:15
Hall G2

TROP Session: Thyroid Committee: Clinical Factors and Diagnostic Managementof Differentiated Thyroid Cancer

OP-626

Sex-specific differences in patients with differentiated thyroid carcinoma and their possible impact on survival

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Aim/Introduction: The incidence of thyroid cancer is increasing in Germany. Women are more frequently affected by differentiated thyroid carcinoma (DTC) than men, although women are more likely to develop a less aggressive subtype. The aim of this study is to investigate whether these differences are also reflected in the survival probabilities of men and women with DTC. ***Materials and Methods:*** This study is a retrospective analysis of a monocentric cancer registry from 01/1965 to 09/2023 and included adult patients with DTC and all tumor stages. For each case, an age- and sex-matched control (Monte Carlo simulation) was simulated, relying on data derived from official mortality tables from the federal statistical office of Germany. Overall survival (OS) in the complete cohort was analyzed using a proportional hazards model with multivariable cox regression and a two-way interactions model. ***Results:*** This analysis includes 3186 patients with DTC as well as their respective matched-pair (complete cohort: n = 6372). Most DTC patients were affected by UICC stage I (n = 2405, 76%; stage II: n = 355, 11%; stage III: n = 32, 1%; stage IVa: n = 10, 0,3%; stage IVb: n = 164, 5%; unknown: n = 220, 7%). Women (n = 2251, 71%) suffered more frequently from DTC than men (n = 935, 29%). Follicular thyroid carcinoma was relatively more common in men (n = 245, 27%) than in women (n = 449, 20%). Female sex and presence of DTC in the medical history were both associated with a significantly longer OS (hazard ratio (HR) = 0.74; 95% CI 0.68 - 0.79; $p < 0.0001$ and HR = 0.71, 95% CI 0.60 - 0.83; $p < 0.0001$, respectively). However, the interaction model showed no sex-specific impact on survival in DTC patients (HR = 1.03: 95% CI 0.85 - 1.25; p = 0.79). ***Conclusion:*** This analysis of a large German cancer registry shows sex-specific differences in incidence of DTC subtypes. Life expectancy in the general population is higher for women than for men. Interestingly, patients with DTC including all tumor stages show a longer OS, which is presumably due to a greater health awareness and regular preventive visits, but also reflects the highly effective therapeutic regimen. However, there is no sex-specific impact on survival in patients with DTC.

OP-627

Obesity and differentiated thyroid cancer aggressiveness: more is better?

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Aim/Introduction: Some authors postulated the possible relationship between obesity and different cancers. Recently, the association between obesity and differentiated thyroid cancer (DTC) aggressiveness has also been postulated but available data are sparse. We aimed to evaluate the prevalence of obesity in a large series of DTC patients and the impact of obesity on the response to initial treatments in such patients. ***Materials and Methods:*** 209 consecutive DTC [papillary thyroid carcinoma (PTC)=192 (91.9%), follicular thyroid carcinoma (FTC)= 12 (5.7%), Hurthle-cells carcinoma (HC)= 5 (2.4%)] patients (F=156, M=53, F/M ratio=2.94:1, mean age 49.75±14.70, median= 50 yr) were retrospectively reviewed. They were enrolled for iodine-131 therapy (RIT) with ablative (1.1-2.2 MBq) or adjuvant (2.2-5.5 MBq) purpose within three months after thyroidectomy. A post-therapy whole body scintigraphy coupled with SPECT/CT imaging (i.e. pT-imaging) was obtained 2-5 days after RIT. The response assessment was performed 6-12 months after RIT according to 2015 ATA guidelines thus using laboratory test (i.e. basal and stimulated thyroglobulin), neck-ultrasound and, in selected patients, 123/131I diagnostic whole body scintigraphy coupled with SPECT/CT imaging as well. ***Results:*** Among all patients, one hundred and sixty-five (78.9%) and forty-four (21.1%) were not obese (i.e. BMI <30) and obese (i.e. BMI ≥30), respectively. No significant difference in terms of age, gender and ATA score distribution were noted (p= 0.191, p= 0.440, p= 0.267). Among low-risk (n=28) and intermediate-risk DTC (n=16) patients 16, 10, 2 and 11, 2 and, 3 carried a grade I, II and, III obesity, respectively. We did not observe a significant difference in the prevalence of obese

patients between low and intermediate risk-DTC ones (p= 0.425) regardless of age (p= 0.526), gender (p= 0.798), obesity grading (p= 0.179), BMI (p= 0.750) and, absolute weight (p= 0.471). Persistent disease occurred in 14.9% of intermediate risk and 4.9% of low-risk DTC (4.9%) patients (p= 0.013). Moreover, persistent disease occurred in 16.9% and 5.3% of non-obese patients having intermediate rather than low-risk DTC, respectively (p=0.015). Conversely, we did not observe any significant difference among obese patients having intermediate (6.2%) or low-risk (3.6%) DTC (p=0.682). Finally, obesity was not an additional risk factor for having both a more aggressive DTC (Odds ratio 0.75, p= 0.433) and a less than ER to initial treatments (Odds ratio 0.38, p= 0.222) regardless of gender and age. ***Conclusion:*** In our patients series obesity was not associated with a more aggressive DTC and/or a worse response to initial therapies.

OP-628

Thyroglobulin Measurement is the Most Powerful Outcome Predictor in Differentiated Thyroid Cancer: A Decision Tree Analysis in a European Multicenter Series

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Aim/Introduction: An accurate prognostic assessment is pivotal to adequately inform and individualize follow-up and management of patients with differentiated thyroid cancer (DTC). We aimed to develop a predictive model for recurrent disease in DTC patients treated by surgery and 131I by adopting a decision tree model. ***Materials and Methods:*** Age, sex, histology, T stage, N stage, risk classes, remnant estimation, TSH, Tg, administered 131I activities and post-therapy whole body scintigraphy (PT-WBS) were identified as potential predictors and put into regression algorithm (conditional inference tree, c-tree) to develop a risk stratification model for predicting persistent/recurrent disease over time. ***Results:*** The PT-WBS pattern identified a partition of the population into two subgroups (PT-WBS positive or negative for distant metastases). Patients with distant metastases exhibited lower disease-free survival (either structural, DFS-SD, and biochemical, DFS-BD, disease) compared to those without metastases (MTS). Meanwhile, the latter were further stratified into three risk subgroups based on their Tg values. Notably, Tg values >63.1 ng/mL predicted a shorter survival time, with increased DFS-SD for Tg values <63.1 and <8.9 ng/mL, respectively. A comparable model was generated for biochemical disease (BD), albeit different DFS were predicted by slightly different Tg cutoff values (41.2 and 8.8 ng/mL) compared to DFS-SD (Table 1). ***Conclusion:*** We developed a simple, accurate and reproducible decision tree model able to provide reliable information on the probability of structurally and/or biochemically persistent/relapsed DTC after a TTA. In turn, the provided information is highly relevant to refine the initial risk stratification, identify patients at higher risk of reduced structural and biochemical DFS, and modulate additional therapies and the relative follow-up.

OP-629

The Role of ^{18}F-Tetrafluoroborate Imaging in the Follow-up of Patients with Differentiated Thyroid Cancer

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Aim/Introduction: Different anions including tetrofluoroborate are transported into thyrocytes by Sodium-iodine symporter (NIS) receptors similar to radioiodines i.e. I-123, I-131 and I-124. Therefore, F^{18} labeled tetrofluoroborate (TFB) could be expected as a suitable radiopharmaceutical to evaluate the function of the NIS carrying system in tissues and a few studies have supported this hypothesis suggesting that it would be an alternative PET imaging agent in the follow-up of well-differentiated thyroid cancer (DTC) to come over disadvantages of radioiodines. In this prospective study, we aimed to evaluate the role of TFB in patients with DTC. ***Materials and Methods:*** 52 patients who are seemed as candidates for radioiodine therapy (RAIT) following total thyroidectomy were included in this prospective study. PET imaging is performed at 60 min after injection of 3-6 mCi TBF. All patients have stimulated TSH levels being at least 30 mIU/L. PET findings compared with either post-treatment high dose I-131 (post-RAIT) SPECT images or diagnostic whole-body scans with 5 mCi I-131 (Dx) SPECT images. TFB scans were divided into 4 groups according to performing timeline: a) before RAIT (n=19), b) after RAIT (n=11), c) before Dx-SPECT (n=8), and d) after Dx-SPECT (n=14). ***Results:*** A total of 47 different lesions were observed with SPECT and PET in 19 patients in group A. While 45 of them had been detected in TFB, only 31 of them could be seen with post-RAIT SPECT. A total of 8 lesions were observed in group B, and while all of them were shown with SPECT, only 2 of them could be shown with TFB-PET, probably due to the stunning effect created by radioiodine. 1 lesions in group C were monitored with both methods. While all 4 lesions in group D were observed with SPECT, only 2 of them could be observed with TFB-PET (possible stunning). The average SUVmax and SUVmean values were 39.41 and 25.6, respectively, in TFB-positive lesions. Additionally, atypical increased TFB accumulations in pelvis were observed in 18 patients due to Nabothi cysts (averageSUVmax: 19.76). ***Conclusion:*** TFB-PET has a higher sensitivity compared to radioiodine-SPECT in detecting residual/metastatic lesions in patients with DTC (50/60 vs 44/60). However, the sensitivity has been decreased when TFB-PET imaging is performed after RAIT, probably due to the stunning effect. It seems as a better alternative agent to radioiodine scanning if it is performed before RAIT or Dx-SPECT.

OP-630

68Ga-Pentixafor PET/CT demonstrates the in vivo evidence of CXCR4 expression in radioiodine refractory thyroid cancer patients

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Aim/Introduction: The undifferentiated radioiodine refractory thyroid cancers (RAI-R) pose a therapeutic challenge. Though, this fraction (5.0-15%) of thyroid cancer patients often shows high avidity to ^{18}F-FDG, but there are no radionuclide therapeutic options available currently. In this pilot study, we used 68Ga-Pentixafor PET/CT imaging to document the presence of CXCR4 receptors' expression in a small group of radioiodine refractory (RAI-R) patients. ***Materials and Methods:*** Ten (3-Male: 7-Female, mean age = 48.8 ± 12.9 years) papillary thyroid cancer patients

documented as refractory to radioiodine treatment were recruited in the study. All the patients underwent both ^{18}F-FDG and 68Ga-Pentixafor PET/CT within a gap of 7- days. Whole body acquisitions from skull to mid-thigh (7-9 bed positions) were done at 1-h post injection with mean injected dose of 7.52 ± 0.71 mCi & 2.26 ± 0.55 mCi of ^{18}F-FDG & 68Ga-Pentixafor respectively. The reconstructed images projected in three planes (cross-sectional; coronal and sagittal) were used for visual and quantitative analysis for both the scans. A head-to-head lesion-based comparison was done between both the PET procedures. ***Results:*** All the ten patients showed scan evidence of residual/metastatic disease on ^{18}F-FDG while 9/10 showed 68Ga-Pentixafor scan positivity. A total of 70 lesions were identified which showed increased ^{18}F-FDG avidity as compared to 61 lesions showing increased CXCR4 expression on 68Ga-Pentixafor scan. The mean SUV-max of the lesions on 18F-FDG was found to be significantly higher as compared to 68Ga-Pentixafor (9.3±7.3 vs 2.9±1.6, p=0.003) PET/CT. The regional distribution of lesions were as follows: remnant or recurrent thyroid lesions, loco-regional lymph nodes and distant metastasis. ^{18}F-FDG outscored 68Ga-Pentixafor in picking up local (5/4) and loco regional lymph nodes (45/40) respectively. However, 68Ga-Pentixafor picked more metastatic bone lesions (13 versus 11) as compared to ^{18}F-FDG. ***Conclusion:*** 68Ga-Pentixafor PET/CT imaging demonstrated the in vivo evidence of CXCR4 expression both in the primary recurrent tumors, lymph nodes and distant metastatic sites. In the background of absence of no definitive treatment available in RAI-R thyroid cancers, CXCR4 receptors may be potential disease targets for therapeutic applications in widely disseminated RAI-R thyroid cancer using the CXCR4 based radio-theranostics. However, expanding the study in to larger number of RAI-R variants of thyroid cancer may further explore the potential of CXCR4 based radio-theranostics in such patients.

OP-631

Comparison of Ga-68 DOTATATE PET and Ga-68 PSMA PET in Radioactive Iodine Refractory Thyroid Cancer

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Aim/Introduction: The prognosis of radioactive iodine refractory thyroid cancer (RAIR-TC) is worse than in other patients, and 10-year survival is predicted to be approximately 10%. RAIR-TC patients are treated with TKIs, but generally the aim is to stabilize the disease or slow the progression. For this reason, new treatment studies are gaining importance. In our study, we compared the patients in whom we performed Ga-68 DOTATATE and Ga-68 PSMA PET in order to evaluate the possibility of Lu-177 DOTATATE and Lu-177 PSMA treatment in this patient group. ***Materials and Methods:*** Patients underwent Ga-68 DOTATATE PET/CT and Ga-68 PSMA PET/CT imaging in accordance with current guidelines. Uptakes higher than background activity were considered positive. SUVmax and SUVmean values of all positive lesions were calculated. Background SUVmean was calculated by drawing a 1 cm3 volumetric region of interest (VOI) from the mediastinal blood pool, liver SUVmean was calculated by drawing VOI in 1 cm3 volume from the liver. ***Results:*** 15 patients were included in the study (6M, 9W). Average age was 60.7 (±11.5) years. Cumulative RAI dosage was 546.7 mCi (±275.4). Tg values of 5 patients were >500 ng/ml, and the average Tg value of the other 10 patients was 30.3 ng/ml. TSH values of 12 patients were <1 mIU/L. While 58 lesions were detected in DOTATATE PET, 52 lesions were detected in PSMA PET. While DOTATATE PET showed more lesions in 6 patients, PSMA PET showed more lesions in 3 patients, and an equal number of lesions were detected in 6 patients. In 2 patients, no lesion was observed on DOTATATE PET, in 1 patient, no lesion was observed on PSMA PET. The mean SUVmax, mean SUVmean, mean SUVmax/blood pool SUVmean values of the lesions detected in DOTATATE PET were 4.64±3.75, 2.50±2.01, 10.1±7.73, respectively. The mean SUVmax, mean SUVmean, mean SUVmax/blood pool SUVmean values of the lesions detected in PSMA PET were 4.59±3.36, 2.54±1.92, 4.65±4.35, respectively. Lesions with SUVmax value greater than the liver SUVmean value were detected in DOTATATE PET in 2 patients and in PSMA PET in 4 patients. In 2 patients, lesions with SUVmax values greater than the liver SUVmean value were detected in both DOTATATE PET and PSMA PET. ***Conclusion:*** With new imaging methods in RAIR-TC, it is possible to better understand the extent of the disease and investigate radionuclide treatment possibilities. More comprehensive studies need to be conducted on this subject.

OP-632

Diagnostic accuracy of [18F]TFB-PET-CT compared with therapeutic activity of [131I]iodine SPECT-CT and [18F] FDG-PET-CT in recurrent differentiated thyroid cancer

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Aim/Introduction: [18F]tetrafluoroborate (TFB) is a promising positron emission tomography (PET) tracer for NIS-based imaging in patients with differentiated thyroid cancer (DTC). It has excellent properties for this purpose. The objective of this study was to compare [18F]TFB-PET with high-activity post-therapeutic [131I]iodine whole-body-scintigraphy/single photon emission computed tomography (TxWBS-SPECT-CT) in recurrent DTC and [18F]Fluorodeoxyglucose(FDG)-PET-CT in suspected dedifferentiation. ***Materials and Methods:*** Twenty-six patients were retrospectively included in the study, who had been treated with high-activity radioactive [131I]iodine therapy (RAI) between May 2020 and November 2022, with a range of 5.00 - 10.23 GBq. Prior to treatment, all patients underwent [18F]TFB-PET-CT 40 minutes after receiving a median dose of 321 MBq [18F]TFB. To investigate tracer kinetics in DTC lesions, an additional scan was performed on 23 patients at 90 minutes. [131I]Iodine-TxWBS-SPECT-CT was performed at a median of 3.8 days after treatment. Additionally, [18F]FDG-PET was performed on 25 patients. ***Results:*** A total of 62 suspicious lesions were identified. Of these, 30 were [131I]iodine-positive, 32 were [18F]TFB-positive, and 52 were [18F]FDG-positive. The Tumor-to-Background Ratio (TBR) measurements at the 40 and 90-minute timepoints showed a close correlation (e.g. TBR_muscle: rp = 0.91, p < 0.001, n = 49). A significant negative correlation was found between [18F]TFB and [18F]FDG uptake, which could serve as a potential marker for dedifferentiation (rp = -0.26, p = 0.041, n = 62). ***Conclusion:*** Pre-therapeutic [18F]TFB-PET-CT can predict the positivity of recurrent DTC lesions on [131I]iodine scans, aiding in the selection of patients for [131I]iodine therapy. Future prospective trials are needed for iodine therapy guidance. Lesional [18F]TFB uptake appears to be inversely correlated with [18F]FDG uptake and could potentially serve as a dedifferentiation marker in DTC.

OP-633

Limited diagnostic role of ^{18}F FDG PET/CT in metastatic pediatric thyroid carcinoma : A retrospective analysis.

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Aim/Introduction: To evaluate the usefulness of ^{18}F FDG PET/CT in differentiated thyroid carcinoma of pediatric and adolescent populations; notably its role in disease detection, in patients with distant metastases and treated with radioactive iodine. ***Materials and Methods:*** A retrospective analysis was conducted on 264 patients (median age 11 years ; range 6-18) who underwent total thyroidectomy for thyroid cancer and received iodine-131 therapy between 1991 and 2019 at Gustave Roussy 1MCi/Kg of Iodine 131 was administered within 3 months after surgery and Whole Body Scan±SPECT/CT was performed 3-5 days after treatment. A total of 17 patients performed ^{18} FDG PET within less than 6 months following the initial course of iodine therapy and were considered for this analysis. ***Results:*** 13/17 patients presented with Papillary thyroid carcinoma and 4/17 with tall cells sub-type The TNM stage was respectively: 35 % T2, 29% T3a , 17% T3b, 11 % T4a and 5% T1b),(82% N1b , 11 % Nx 5% N1a) and all patients presented M1 at diagnosis. Median Tg at the moment of RAI treatment was 414 ng/ml (range: 29-4200 ng/ml) A median number of 3 (range: 2-10) 131I treatment was administered. The initial 131I WBS revealed thyroid remnant in 15 patients, cervical lymphnodes metastases in 9, and distant metastases in 12 patients (lung =11, mediastinal lymph nodes 1). In 16/17 patients 18FDG PET was negative without any significant uptake in the cervical region or a distant level despite elevated Tg levels and 131I WBS uptake. The only case of positive ^{18}FDG PET/CT examination revealed cervical lymph nodes and bilateral pulmonary micro nodular lesions uptake in a female patients of 13 years old .Tg levels at the moment of 131I uptake was 425 ng/ml and WBS was also positive at the same sites. After a median follow up of 90 months 12/17 patient was in remission and 5/17 presented persistent elevated Tg or structural disease. The patient with positive ^{18}FDG PET/CT received a total of 7 131I treatment showing stable disease at the end of follow up. ***Conclusion:*** FDG PET is rarely positive in pediatric metastatic thyroid cancer. This cohort underscores its limited utility in detecting pathological sites and in predicting response to treatment, despite it is porposed in guidelines. Further studies are need to confirm these data and to evaluate its prognostic value.

OP-634

The Role of ^{18}F-FDG PET/CT and 68Ga-DOTATOC PET/CT imaging in evaluating Patients with Differentiated Thyroid Cancer (DTC) with Elevated Serum Thyroglobulin and Negative Whole-Body I-131 Scan (TENIS syndrome)

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Aim/Introduction: The study aims to critically assess the effectiveness of ^{18}F-FDG PET/CT and 68Ga-DOTATOC PET/CT in detecting recurrent or metastatic differentiated thyroid cancer (DTC) in patients who have raised serum thyroglobulin but negative I-131 whole-body scans. It is crucial for patients with the TENIS syndrome, a condition marked by elevated thyroglobulin levels and metastases that do not absorb iodine, since it has been associated with a reduced 10-year survival rate. ***Materials and Methods:*** This retrospective study examined 20 DTC patients at Mashhad's Ghaem Hospital's nuclear medicine ward thyroid clinic. This study investigated patients with recent negative whole-body scans with I-131 and thyroglobulin (Tg) levels over 10 with TSH stimulation by levothyroxine withdrawal or above 5 with rhTSH Injection After total thyroidectomy, thyroid ablation, or iodine therapy. All patients had an ^{18}F-FDG PET/CT scan initially, then Ga68-DOTATOC PET / CT in a week. ***Results:*** A total of 20 patients with TENIS syndrome were examined.19 individuals had papillary thyroid cancer (PTC) and 1 had follicular thyroid cancer (FTC). Both scans found 23 of 27 lesions positive. 68Ga-DOTATOC and ^{18}F-FDG scans were positive in 65% and 70% of patients, respectively. Most patients were in stage IV according to the seventh AJCC edition, while 10 were stage I according to the eighth AJCC edition. Patients with positive 68Ga-DOTATOC results were 13 candidates for therapy. Six had Lu177-DOTATATE therapy, five had surgery, one had surgery plus radiotherapy, and one received lutetium and radiation. Six of 14 patients with positive ^{18}F-FDG scans had surgery, and one had radiation plus surgery. In both PET tracers, positive and negative results were not statistically related (P=1). 68Ga-DOTATOC and ^{18}F-FDG scan results had no association with patient Tg levels (P=0.67). There was a significant association between Tg levels and ^{18}F-FDG scan results, notably in the non-TSH stimulation condition (P=0.015), but not in the TSH stimulation state (P=0.262). No association was seen between Tg levels and pathogenic subtypes (P=0.602). ***Conclusion:*** 68Ga-DOTATOC PET/CT shows somatostatin receptor expression in patients with negative whole-body iodine scans and elevated Tg levels, suggesting alternative diagnostic modality for restaging and metastasis work up. Positive results from both modalities revealed no significant difference and The study suggests that 68Ga-DOTATOC PET/CT may guide therapy with lu177-Dotatate for patients with positive FDG PET/CT results who need a systemic therapy.

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Tuesday, October 22, 2024, 09:45 - 11:15
Hall F

e-Poster Presentations Session 10: Oncology & Theranostics Committee: Lung, Breast and Haemato Oncology

EPS-190

Comparing ^{68}Ga-Pentixafor, ^{18}F-FDG PET/CT and chemokine receptor 4 immunohistochemistry staining in locally advanced breast cancer: a prospective cross sectional study

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Aim/Introduction: CXCR4 is a chemokine receptor that is frequently overexpressed in invasive breast cancer and plays a major role in tumour proliferation, aggressiveness and metastasis. The aim of this prospective study was to establish the value

CXCR4-directed PET imaging in patients with breast cancer using 68Ga-Pentixafor by comparing it with 18F-FDG PET/CT and CXCR4 immunohistochemistry staining (IHC) and correlate these with molecular subtypes, HIV status and patient survival. ***Materials and Methods:*** Thirty-three (33) patients with breast cancer aged 33-81, mean±SD 56.5±13.5 with initially diagnosed breast cancer, underwent CXCR4-targeted PET imaging using 68Ga-Pentixafor. Maximum standardised uptake values (SUVmax), total lesion uptake (TLU) and metabolic tumour volume (MTV) of primary tumour were measured and correlated with pathological prognostic factors, molecular subtypes and CXCR4 IHC. The patients were followed up for an average of 10 months (range 4-80 months) and CXCR4 expression was correlated with survival. ***Results:*** 68Ga-Pentixafor-PET/CT, though positive in all cases, demonstrated less uptake compared to 18F-FDG PET. The SUVmax for 68Ga-Pentixafor and 18F-FDG were 6.93(5.31-8.72) and 18.2(14.3-25.7) , and SUVmean 3.94(3.15-4.94) and 10.6±5.56(52.4), TLU 342(121-807) and 626(258-1210) and MTV were 75.6(28.0-180) and 92.0(28.0-205) respectively. The histological subtypes were: (50%) triple negative breast cancer (n=16), 25% (n=8) Luminal B (25%), 12.5% (n=4) had Luminal A and 12.5% (n=4) HER-2 enriched. Twelve (12/33) patients (36%) were HIV positive. There was a statistically significant correlation between grade of primary tumour and 68Ga-Pentixafor SUVmax p0.046. A weak but significant positive correlation was seen between SUVmean for 68Ga-Pentixafor PET and proliferative index (Ki67) r= 0.337 p=0.052. Higher 68Ga-Pentixafor accumulation was seen in triple negative breast cancer (TNBC) compared to other molecular subtypes. The median (Q1-Q3) 68Ga-Pentixafor TLU was significantly higher in HIV positive 376(219-881) compared to HIV negative 174(105-557) breast cancer patient 68Ga-Pentixafor MTV was higher in HIV positive patients compared to HIV negative p=0.049. There was no correlation between 68Ga-Pentixafor PET uptake and CXCR4 IHC or survival. Also, 68Ga-Pentixafor detected more brain lesions than 18F-FDG, which detected more bone marrow lesions. ***Conclusion:*** 68Ga-Pentixafor showed lower tracer accumulation than 18F-FDG PET. Patients with triple negative breast cancer, HIV+, higher tumour grade and Ki-67 had more 68Ga-Pentixafor uptake. This suggests that CXCR4-targeted PET imaging may be more useful in TNBC as well as high grade tumours. Future research on CXCR4 targeted imaging should examine the impact of this technique in the selection of triple negative breast cancer patients who are eligible for CXCR4-targeted therapies.

EPS-191

Pre-treatment [18F]FDG PET biomarkers and clinical outcomes of patients with metastatic triple-negative breast cancer treated with Sacituzumab govitecan

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Aim/Introduction: Sacituzumab govitecan (SG), a Trop-2-directed antibody-drug conjugate (ADC), has recently been approved as a monotherapy for metastatic triple-negative breast cancer (mTNBC) patients who have undergone two or more prior systemic therapies. We aimed to evaluate the prognostic significance of [18F]FDG PET/CT biomarkers before SG in mTNBC. ***Materials and Methods:*** This bicentric retrospective study included mTNBC patients who underwent [18F]FDG PET/CT imaging before SG and were treated from August 2020 to October 2023. PET biomarkers studied included total metabolic tumor volume (TMTV), maximum standardized uptake value (SUVmax), and maximum tumor dissemination (Dmax), extracted using LIFEx software. Overall response rate (ORR) corresponded to the proportion of patients who had a partial or complete response. The median (m) was used to dichotomize initially continuous biomarker values. The median follow-up (mFU) was estimated by the reverse Kaplan-Meier (KM) method. Cox proportional hazards models for progression-free survival (PFS) and overall survival (OS) with KM curves were used. Statistical analysis was performed using R studio. ***Results:*** Seventy-one patients were eligible. ORR was 45%. After a mFU of 12.9 (95%CI 9.7-17.5) months, 64 (90%) and 42 (59%) patients experienced progression and death, respectively. The mPFS and mOS were 4.8 (95%CI 4.2-5.5) and 8.9 (95%CI 7.7-10.0) months, respectively. In univariable analyses, high TMTV (>38.5 cm3) and high Dmax (>34cm) were associated with shorter PFS (HR 2.7, 95%CI 1.6-4.5 and HR 2.0, 95%CI 1.2-3.3) and shorter OS (HR 4.3, 95%CI 2.1-8.5 and HR 2.9, 95%CI 1.5-5.6). TMTV and Dmax were combined to stratify the population into three groups: a low-risk group with low TMTV and low Dmax (n=28, 39%), an intermediate-risk group with high TMTV or high Dmax (n=17, 24%) and a high-risk group with high TMTV and high Dmax (n=26, 37%). mPFS was 5.7 (95%CI 4.9-9.5) months for the low-risk group versus 4.2 (95%CI 2.9-9.6) and 2.9 (95%CI 2.0-5.1) months for the intermediate-risk and high-risk groups, respectively. mOS was 25.3 months (95%CI 17.0-not reached/NR) for the low-risk group versus 8.9 (95%CI 6.2-NR) and 7.2 (95%CI 4.3-NR) months for the intermediate-risk and high-risk groups, respectively. ***Conclusion:*** Pre-treatment [18F]FDG PET/CT biomarkers TMTV and Dmax hold promise as prognostic indicators for mTNBC patients prior to SG therapy. The combination of TMTV and Dmax accurately identifies patient groups with markedly different clinical outcomes under SG. These findings warrant further validation in prospective studies to establish their clinical utility.

EPS-192

Myocardial [18F]FDG uptake patterns at staging PET are related to patient outcome in lung cancer patients.

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Aim/Introduction: The LuCaPET project (ERAPERMED 2021-324) has been conceived to explore the relationship of multi-organ [18F]-FDG uptake and the onset of cancer-induced cachexia and subsequent overall survival in lung cancer patients. Here, we investigated how both qualitative and quantitative analyses of myocardial uptake correlate with patient outcomes. ***Materials and Methods:*** We evaluated 188 treatment-naïve lung cancer patients. All patientsunderwent a whole-body [18F]-FDG PET/CT study for staging before advancing on the most appropriatefirst-line treatment and finally to clinical follow up. [8F]-FDG PET/CT was evaluated for the visualuptake pattern according to the established classification (A = no uptake, B = diffuse, C = focal and D =focal on diffuse uptake). We employed the automated segmentation

tool MOOSE to define themyocardial volume of interest on the CT images from which we calculated the SUVmean, normalized tothe aorta uptake. ***Results:*** The following tumor stages were found on [18F]-FDG PET/CT: I (53/188 patients), II (36/188), III in (37/188) and IV (62/188). Myocardial uptake pattern was A in 105 patients, B in 24, C in 32 and Din 27 patients. During follow up (17 ± 13 months) 53 tumor-related deaths were registered. There was asignificant difference (p<0.001) in the Kaplan-Meier survival curves of the different tumor stages, withstage IV showing the worst survival. However, a significant difference (p<0.01) was as well observedamong the four myocardial uptake patterns; the two groups with worst prognosis were A and B. It couldmean that the focal patterns (C and D) are potential favorable indicators, whilst uptake absence (A) hasadverse implications. The diffuse intense uptake B could be regarded as a casual interference causedby dietary variables. This was confirmed by the finding that myocardial SUVmean between survivorsand non-survivors is just borderline significant on the whole cohort (p<0.05), whilst it becomes highlysignificant (p<0.005) after exclusion of the B pattern patients. ***Conclusion:*** Data from this small cohort suggest that the myocardial uptake pattern is related to patient outcome. Thus, they confirm that metabolic changes in organs not affected by cancer could play a role in the disease evolution. ***References:*** Shiyam Sundar LK, Yu J et al.Fully Automated, Semantic Segmentation of Whole-Body ^{18}F-FDG PET/CT Images Based on Data-Centric Artificial Intelligence. J Nucl Med. 2022 Dec;63(12):1941-1948.Chareonthaitawee P, Beanlands RS et al Joint SNMMI-ASNC Expert Consensus Document on the Role of ^{18}F-FDG PET/CT in Cardiac Sarcoid Detection and Therapy Monitoring. J Nucl Med. 2017 Aug;58(8):1341-1353.

EPS-193

Development and validation of a PET/CT-based radiomics model for preoperative prediction of spread through air spaces in non-small cell lung cancer

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Aim/Introduction: Spread through air spaces (STAS) is a recently identified invasive pattern in non-small cell lung cancer (NSCLC), associated with increased recurrence risk and poor prognosis1. The objective of this research was to develop and validate a predictive radiomics model using 18F-FDG-PET/CT imaging to assess the preoperative presence of STAS and to identify related genomic markers. ***Materials and Methods:*** This investigation encompassed patients histopathologically verified to have STAS at two medical institutions. The inclusion criteria constituted adults diagnosed with stage I-III NSCLC, excluding those previously treated for lung cancer. Radiomics features were derived from preoperative PET-CT scans. Tumors and an adjacent 8 mm peritumoral region were segmented independently by two radiologists, with resolution of discrepancies achieved through consensus. A comprehensive set of 3,078 radiomics features were organized into seven categories including shape, texture, and intensity. Feature selection was performed utilizing a Random Forest algorithm, and model efficacy and robustness were assessed via k-fold cross-validation. A radiomic risk-score signature was established through a Cox regression model employing LASSO regularization. Furthermore, RNA sequencing data from The Cancer Genome Atlas were examined to discern gene expression linked to radiologically predicted STAS. ***Results:*** The study cohort included 350 patients, distributed across a training set (n=165), an external validation set (n=95), and a set for RNA sequencing analysis (n=90). The integration of radiomic and clinical features (including age, smoking status, and tumor stage) significantly improved STAS prediction over clinical features alone, evidenced by an increase in the area under the receiver operating characteristic curve (AUC) from 0.760 to 0.826 in the training set and from 0.731 to 0.788 in the external validation set (P<0.05). Radiomic signatures were significantly correlated with overall survival (P<0.05). Differentially expressed genes associated with the radiomics profiles were predominantly involved in glucose metabolism pathways. ***Conclusion:*** The PET/CT-based radiomics model, integrating both peritumoral and intratumoral features, effectively predicted STAS and indicated prognostic value for overall survival in patients with NSCLC. The incorporation of radiomic and clinical data provides superior predictive accuracy, offering potential improvements in preoperative decision-making and patient management. ***References:*** 1. Spread Through Air Spaces (STAS) in Lung Cancer: A Multiple-Perspective and Update Review. Cancer Manag Res. 2020;12:2743-2752.2. Significance of tumor spread through air spaces (STAS) in lung cancer from the pathologist perspective. Transl Lung Cancer Res. 2020;9(3):847-859.

EPS-194

Heterogeneity of PD-L1 expression: Correlation of immunohistochemical PD-L1 expression and genetic profile with 99mTc-iPD-L1 SPECT/CT in patients with metastatic non-small cell lung cancer

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Aim/Introduction: Lung cancer modulates the immune response through the expression of PDL1 and PDL2, these ligands targets the surface receptor of the programmed cell death protein (PD1), which is expressed on the surface of T cells, B cells and NK cells. There are no immunohistochemical biomarkers with adequate prediction of selection and response because the expression of this receptor is dynamic and highly heterogeneous. Molecular imaging has helped to complement the study and characterization of neoplasms with a cyclic peptide inhibitor of PD-L1 (iPD-L1) radiolabeled. The aim of this pilot study is to analyze the correlation of 99mTc-iPD -L1 SPECT/CT with ^{18}F-PET/CT and the immunohistochemical expression of PD-L1 to demonstrate its high heterogeneity. ***Materials and Methods:*** We evaluated prospectively 10 patients with a diagnosis histologically and immunohistochemistry confirmed non-small cell lung carcinoma, oncogenic driver mutation, ^{18}F-PET/CT and 99mTc-iPD-L1 SPECT/CT. Performing a qualitative and semiquantitative analysis with volumetric parameters with the subsequent correlation between these, the. immunohistochemistry results, and we correlate with the tomography used to take the biopsy to verify that the sampling sites match with the uptake sites. We classify uptake patterns in peripherical, homogeneous and patched. ***Results:*** We included 7 woman and 3 men, mean age of 62 y/o (range 44 to 90). 8 had adenocarcinoma and 2 squamous cell carcinomas. All patients were stage IV, 50% (n=5) had EGFR mutation, 40% (n=4) were wild-type and 10% (n=1) ALK (+). MTV with FDG and iPD-L1 in primary tumor showed a statistically significant correlation (r:0.81, p=0.0038). Immunohistochemistry was performed with Sp263:1 assay: 2 patients had positivity of 20% , 1 of 1% and the remaining patients (n=7) 0%. 9/10 patients had peripherical uptake pattern with iPD-L1 and 6/10 with FDG, 1/10 patients had patched pattern

with iPD-L1 and 0/10 with FDG and none had homogenous uptake pattern with iPD-L1 and 4/10 with FDG. In 5 patients biopsy sites did not correlate with areas of iPD-L1 uptake due to a peripheral uptake pattern, explaining negative immunohistochemistry. There was no correlation between patterns or intensity of PD-L1 imaging with oncogenic driver mutation. ***Conclusion:*** Our results indicate a high intratumoral heterogeneity evaluated with 99mTc-iPD-L1 SPECT/CT that does not fully correlate with FDG, these preliminary findings may help explain discrepancy in biopsy sites; Therefore, this new imaging tool could be a potential diagnostic biomarker for selection and response to immunotherapy, as well as auxiliary in biopsy sampling.

EPS-195

Diagnostic performance of 99mTc-IFAP SPECT/CT in the initial staging of patients with lung cancer: A comparative analysis with ^{18}F-FDG-PET/CT

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Aim/Introduction: Lung cancer is a major problem worldwide, with the highest morbidity and mortality of all cancers. Fluorodeoxyglucose remains the most widely used PET marker for the diagnosis of malignant diseases. However, there are limitations in the availability of PET equipment in many countries. Therefore, a more accessible diagnostic modality at an early stage is crucial and inspired us to evaluate the performance of 99mTc EDDA HYNIC- iFAP SPECT/CT for lung cancer patients with that of 18F-FDG PET/CT as the reference standard. ***Materials and Methods:*** A prospective controlled analysis from September 2023 to February 2024, of 16 individuals with suspected lung cancer who underwent 99mTc-iFAP SPECT and ^{18}F-FDG PET/CT was conducted. Histopathological findings were used for final diagnostic determinations for all primary tumors. The performance of the two imaging modalities was compared based on visual assessment, rates of cancer detection, and semi-quantitative parameters (target-to-background ratio [TBR] for both primary tumors and metastases. ***Results:*** In total, this study enrolled 16 participants (8 female; median age: 57.5 years, range: 35 - 79 years. A total of 253 lesions were analyzed. For the 16 primary tumors 99mTc-iFAP and 18F-FDG had identical detection performance (16/16). 99mTc-iFAP detected 36 of 78 locoregional lymph nodes (46%), and 44 of 159 metastatic lesions on the central nervous system (2/4), pulmonary contralateral lymph nodes (2/5), non locoregional lymph nodes (11/45), adrenal glands (2/3), bone lesions (18/93). Furthermore,99mTc-iFAPSPECT/CT demonstrates good performance on metastases in pleura (6/6), liver (2/2), and omental lesions (1/1). There were no statistically significant differences between TBR values in relation to that of 18F-FDG and 99mTc -iFAP SPECT/CT. (p=0.71) There was no significant difference in detection of primary tumors, lymph nodes, and metastases based on pathological type: adenocarcinoma (n=13), squamous cell carcinoma (n=2), and small cell carcinoma (n=1), between the two examination modalities. We also found the lowest sensitivity of the IFAP in the detection of lymph nodes smaller than 14 mm, and visceral metastases smaller than 20 mm. ***Conclusion:*** 99mTc iFAP SPECT imaging of lung cancer is feasible and provides diagnostic image quality in the assessment of pulmonary masses. In response to the limited availability of infrastructure and resources in developing countries to offer PET/CT studies to their population. Our results demonstrate non-inferiority in primary diagnosis with 99mTc iFAP SPECT in comparison with PET in lung cancer. This could encourage its use and promote the benefit of its clinical utility.

EPS-196

^{18}FDG PET/CT PERCIST outperforms RECIST as predictor of pathological response to preoperative immune checkpoint inhibition in patients with resectable NSCLC: a prospective trial

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Aim/Introduction: Immune checkpoint inhibition (ICI) with antibodies targeting PD-1/PD-L1 and CTLA-4 prior to surgery is active in patients with curatively resectable non-small-cell-lung-cancer (NSCLC). A prospective, randomized, multicenter study, NEOpredict-Lung, explores short-term preoperative ICI with nivolumab (anti PD-1) with/without relatlimab (anti-LAG-3) in patients with NSCLC stages I B, II or III A (1). Aim of the present analysis was to compare the non-invasive imaging-based response estimation using either 18FDG PET/CT PERCIST or RECIST1.1 criteria for prediction of the pathological response in NEOpredict-Lung participants. ***Materials and Methods:*** NEOpredict-Lung (NCT04205552) requires imaging-based staging at baseline, and immediately prior to surgery. In one center, 18FDG PET/CT was prospectively used for these imaging studies. Imaging-related responses to ICI were estimated by PERCIST and RECIST1.1. Pathological response rates were determined in resected tumors following IASLC criteria. Results were correlated by calculating Spearman's Rho. Correlational results were regarded significant when $p<0.05$. ***Results:*** 30 patients with baseline 18FDG PET/CT staging (mean 22±11 days prior to first ICI therapy; range: 1 to 47 days) were included in this post-hoc analysis. Per protocol curative resections had to be performed within 43 days of initiation of ICI therapy. A second 18FDG PET/CT was performed at a median of 4 days before surgery. A mayor pathological response (MPR, 0-10% viable tumor cells) was achieved in 8 patients, a pathological response (11-50% viable tumor cells) was observed in 12 patients, and no response (≥51% viable tumor cells) was found in 10 patients. PERCIST identified partial metabolic responses in n=12, stable disease in n=13 and progressive disease in n=5 patients. In contrast, RECIST1.1 demonstrated partial responses in n=2, stable disease in n=23, and progressive disease in n=5 patients. A significant correlation between PERCIST response (Spearman's Rho 0.56, p=0.001), but not RECIST 1.1 response (Spearman's Rho 0.26, p=0.17) and pathological responses was observed. ***Conclusion:*** 18FDG PET/CT PERCIST- but not RECIST1.1- holds promise as predictor of pathological response following short-course ICI therapy in patients with resectable NSCLC. Our results demonstrate the high potential of baseline 18FDG PET/CT plus follow-up 18FDG PET/CT instead of sole CT follow-up for non-invasive response assessment to ICI treatment in NSCLC patients. This provides a basis for future studies on metabolic imaging-based personalization of immunotherapy in lung cancer patients. ***References:*** (1) Schuler M et al.: Neoadjuvant nivolumab with or without relatlimab in resectable non-small-cell lung cancer:

a randomized phase 2 trial. Nat Med. 2024. doi: 10.1038/s41591-024-02965-0.

EPS-197

PET-CT guided versus CT guided lung biopsy in suspected lung malignancies: An interim analysis of randomized controlled trial

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Aim/Introduction: Histopathology is a cornerstone in the evaluation of lung masses. The standard sampling technique for peripheral lung lesions is CT-guided lung biopsy. Still, large lesions may yield inconclusive results (12-16%) due to sampling from adjacent atelectasis or necrosis due to poor differentiation on CT. PET-CT-guided biopsy targets metabolically active areas of mass, minimizing sampling errors. This study aims to compare PET-CT-guided lung biopsy's diagnostic efficacy and safety to CT-guided lung biopsy. ***Materials and Methods:*** This is a prospective, open-label, randomized controlled trial performed at AIIMS Bhubaneswar. Between August 2023 to March 2024, 43 subjects with peripheral lung mass were enrolled in this study, of which 36 patients met the eligible criteria. 36 subjects were randomized in 1:2 ratio using computer generated randomization chart.12 patients were enrolled in the PET-CT guided biopsy arm, and 24 were enrolled in the guided biopsy arm. Lung biopsies were performed under standard aseptic precautions. An interim analysis compared the diagnostic yield and complication rates between 2 arms. ***Results:*** Baseline characteristics like age, coagulation parameters, size of lesion and depth from the surface showed no significant differences between the PET/CT-guided biopsy arm (n=12) and the CT-guided biopsy arm (n=24) ($p > 0.05$). Conclusive results in the PET/CT-guided biopsy arm were obtained in 11/12 cases (91.67%) compared to 20/24 cases (83%) in the CT-guided biopsy arm. The diagnostic yield was higher in the PET/CT-guided biopsy group (91.67%) compared to the CT-guided biopsy group (83%) ($p < 0.05$). No serious periprocedural or post-procedural complications were observed in either group. The most common complications were mild pneumothorax and haemoptysis. In the PET/CT guided biopsy arm, the rate of complications was pneumothorax 1/12 (8.3%) and haemoptysis 1/12 (8.3%). In the CT-guided biopsy arm, pneumothorax was seen in 3/24 (12.5%) and haemoptysis in 2/24 (8.3%) ($P < 0.05$). ***Conclusion:*** PET-CT-guided lung biopsy is a safe and effective alternative to CT-guided lung biopsy with higher diagnostic yield and comparable complication rates.

EPS-198

Predicting lung cancer response to radiotherapy with pre- and early post-treatment $^{[18F]}$FDG PET/CT imaging

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Aim/Introduction: This study aims to investigate the potential power of metabolic features extracted from pre- and early post-treatment $^{[18F]}$FDG PET/CT images of primary and secondary lung cancer lesions to predict local response to radiotherapy one year after treatment. ***Materials and Methods:*** 156 lung lesions from 95 oncology patients (66±10 y.o., 55 female), treated with radiotherapy alone or chemoradiotherapy, were retrospectively included. All patients underwent pre-treatment (up to 3 months before radiotherapy) and one-year post-treatment $^{[18F]}$FDG PET/CT scans. From these, for a subgroup of 142 lesions, an early post-treatment $^{[18F]}$FDG PET/CT (3 to 6 months post-radiotherapy) was also available. Demographic (age, sex), clinical (primary tumor, staging, treatment combination), and dosimetry-related features (clinical tumor volume, total dose, and percentage of dose cover) were collected. $^{[18F]}$FDG uptake-related features (8 first-order and 4 geometry-based) were extracted from treated lesions. Segmentation was performed semi-automatically with an adaptive Bayesian classifier [1]. Classification into responder/non-responder lesion was based on clinical reports from one-year post-treatment PET/CT. The association between features and response was assessed using univariate and multivariate logistic regression. Multivariate classification performance was assessed with the area under the receiver operating characteristic curve (AUC) and balanced accuracy (BAcc). Leave-one-out cross-validation (LOOCV) was further performed to assess evaluation metrics' reproducibility. ***Results:*** 100 out of 156 lung lesions responded to treatment (92 out of 142 lesions in the subset with early post-treatment PET/CT). In the univariate analysis, no demographic, clinical, or dosimetric features were significantly associated with the response. Association with response was significant ($p<0.05$) for kurtosis, skewness, and coefficient of variation (CoV) from the pre-treatment $^{[18F]}$FDG uptake; and for SUVmax, SUVmean, and SUVpeak from early post-treatment $^{[18F]}$FDG uptake. The multivariate models achieved the following significant AUC and BAcc: 0.70 and 0.55 for the model with demographic, clinical and dosimetry-related features; 0.72 and 0.65 for the model based on pre-treatment $^{[18F]}$FDG uptake; 0.79 and 0.73 for the model based on the early post-treatment $^{[18F]}$FDG uptake, and 0.86 and 0.75 for the model combining features from both pre- and early post-treatment $^{[18F]}$FDG uptake. When applying LOOCV, there was a decrease in BAcc to 0.54, 0.61, 0.66, and 0.66, respectively, for the above-mentioned models. ***Conclusion:*** This preliminary study showed that $^{[18F]}$FDG uptake-based features from lung cancer lesions may have value in predicting local response to radiotherapy/chemoradiotherapy. Further studies, with larger data sampling and stratified tumors, are needed to evaluate the potential added value of these features. ***References:*** [1]Constantino et al, doi:10.1007/s10278-023-00823-y.

EPS-199

Predictive modeling of lymphovascular invasion in NSCLC using PET/CT-derived body composition indicators

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Aim/Introduction: Lymphovascular invasion (LVI) in non-small cell lung cancer (NSCLC) significantly influences prognosis and treatment strategies due to its association with higher metastasis and recurrence risks1,2. This study aims to develop and validate a predictive model using body composition metrics from 18F-FDG PET/CT imaging to assess LVI risk non-invasively in early-stage NSCLC patients before surgery. ***Materials and Methods:*** This retrospective cohort study analyzed 262 NSCLC patients—166 from Vienna and 96 from Budapest medical center. All patients underwent preoperative PET/CT scans and surgical resections, with at least 5 years of follow-up. Metabolic parameters of primary

tumors and several body composition parameters, including visceral and subcutaneous adipose tissues, intermuscular adipose tissue, and skeletal muscle from the region confined between the L1-L5 vertebrae were assessed. Employing LASSO logistic regression, we developed a predictive nomogram, validated through calibration curves, ROC analysis, and decision curve analysis. The model's ability to predict lymphovascular invasion (LVI) was evaluated using ROC curves. The prognostic value was assessed by Kaplan-Meier estimates and Cox regression analysis using progression-free survival (PFS) as primary endpoint. ***Results:*** LVI was identified in 116 of 262 patients (44.3%). Key prognostic factors included metabolic tumor volume, SUVmean of intermuscular adipose tissue and visceral adipose tissue, TNM stage, and age, all significantly associated with LVI (HRs: 3.323, 3.031, 2.772, 1.924, 1.035; $p < 0.05$). The nomogram incorporating these factors reached concordance indexes of 0.79 and 0.73 in the training and validation cohorts. ROC curves and decision curve analysis of the nomogram showed better performance compared with the model depending on clinical or imaging features. Multivariate Cox regression showed that LVI predicted by the nomogram was linked to poorer PFS ($p < 0.05$). ***Conclusion:*** This study highlights the value of detailed body composition analysis via PET/CT scans in predicting LVI in early-stage NSCLC. The integration of body composition data with tumor and clinical features provides new insights into NSCLC prognosis, potentially improving management strategies and patient care. ***References:*** 1. Pathak R, Goldberg SB, Canavan M, Herrin J, Hoag JR, Salazar MC, et al. Association of survival with adjuvant chemotherapy among patients with early-stage non-small cell lung cancer with vs without high-risk clinicopathologic features. JAMA Oncol. 2020;6:1741-50.2. Brandt WS, Bouabdallah I, Tan KS, Park BJ, Adusumilli PS, Molena D, et al. Factors associated with distant recurrence following R0 lobectomy for pN0 lung adenocarcinoma. J Thorac Cardiovasc Surg. 2018;155(1212-24):e3.

EPS-200

The role of [18F]FDG PET/CT in pulmonary microwave ablation

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Aim/Introduction: As the population ages, an increasing number of patients cannot afford surgery because of comorbidities. Consequently, in the last two decades numerous techniques for local treatment have been developed. Microwave ablation (MWA) presents several advantages, such as higher temperatures, larger ablation volumes, shorter ablation times, and less intra-procedural pain. Today, [18F]FDG PET/CT is continually applied in clinical oncology routine for assessing treatment response. The purpose of our study was to retrospectively evaluate whether semi-quantitative and volumetric parameters from [18F]FDG PET/CT could be associated with clinical outcomes in patients with pulmonary lesions treated with MWA. ***Materials and Methods:*** Between January 2013 and December 2023, 40 patients (26 male, 14 female, mean age 76 years) underwent MWA in our hospital. [18F]FDG PET/CT was performed before and after a median of 3 ± 3 months (median ± IQR; range: 1-17 months) from procedure. For each lesion we semi-automatically calculated SUVmax, SUVmean, total lesion glycolysis (TLG), and metabolic tumor volume (MTV), as well as their percentage of change (Δ) using Syngo-via software. Progression-free survival (PFS) and overall survival (OS) were determined and compared using the Kaplan-Meier and the log-rank test. The median follow-up was 76 months. ***Results:*** Overall 50 pulmonary lesions, primary lung cancers (n=41) and metastases (n=9), were treated with MWA. The mean maximal axial diameter of lesions was 16.4 ± 6.97 mm (mean ± SD; range: 5-35 mm). The complication rate was 40%: pneumothorax (n=15), pulmonary hemorrhage (n=2), pneumonia (n=2), and pleural effusion (n=1), while no adverse events occurred in 25 (62.5%) patients. Patients with median SUVmax after MWA lower than 2.53 and those with median ΔSUVmean lower than -4.17% showed longer PFS (p=0.02 and p=0.021, respectively). Likewise, median SUVmax and median SUVmean after MWA, as well as median ΔSUVmean were significantly associated with OS (p=0.038, p=0.037, and p=0.02, rispectively), whereas median SUVmax at baseline showed only a tendency (p=0.06). On the other hand, volumetric parameters, SUVmax at baseline showed only a tendency (p=0.06). On the other hand, volumetric parameters, expressed by TLG and MTV, were not prognostic neither for PFS nor for OS. ***Conclusion:*** Even if these are preliminary data, this is the first study which showed that the metabolic activity, at the first evaluation after MWA, was correlated with PFS and OS. SUVs parameters can be a potentially valuable tools for identifying patients who are likely to benefit from MWA.

EPS-201

Comparison between PET/CT with 68Ga-FAPI46 and FDG for the detection of primary and metastatic lesions in patients with different types of cancer. Initial experience.

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Aim/Introduction: To evaluate the diagnostic efficacy of PET/CT with fibroblast activation protein inhibitor (FAPI) labeled with gallium 68 (68Ga-FAPI46) for detecting primary and metastatic lesions in patients with different types of cancer, compared to PET/CT with FDG. ***Materials and Methods:*** Patients with different types of cancer confirmed by histopathological study were evaluated with PET/CT with 68Ga-FAPI and with FDG for initial staging or to detect tumor recurrence. The results of PET/CTs were compared to the findings of conventional imaging methods, such as computed tomography and magnetic resonance imaging and with anatomopathological studies. ***Results:*** Fifteen patients were evaluated, 7 of whom were male, aged between 20 and 78 years, ten of whom were diagnosed with lung carcinoma, three with soft tissue sarcoma, one with gastric carcinoma and one with breast carcinoma. Three patients with lung cancer underwent paired studies with 68Ga-FAPI46 and FDG for initial staging. The remaining patients underwent paired studies to detect tumor recurrence/restaging. The primary tumor detection rate was the same for both radiopharmaceuticals. However, the degree of investigation into the primary lesion of 68Ga-FAPI46 was higher compared to FDG in most cases. On the other hand, PET/CT with 68Ga-FAPI46 detected a greater number of lung carcinoma metastases compared to PET/CT with FDG, especially in lymph nodes, pleura, skeleton and central nervous system, observing a greater intensity of 68Ga-FAPI46 uptake in most metastatic lesions. In patients with soft tissue sarcoma and breast carcinoma, PET/CT with 68Ga-FAPI46 generally showed a greater number of positive lung metastases and a greater degree of uptake in secondary bone and lymph node lesions. By contrast, there was false-positive 68Ga-FAPI46 uptake in inflammatory process.

Conclusion: PET/CT with 68Ga-FAPI46 is a promising alternative to PET/CT with FDG in the detection of primary and metastatic neoplastic processes and can detect a greater number/extent of secondary lesions, particularly in lymph nodes, pleura, central nervous system and skeleton. ***References:*** Chen, H.; Pang, Y.; Wu, J. et al. Comparison of [68Ga]Ga-DOTAFAPI-04 and [18F] FDG PET/CT for the diagnosis of primary and metastatic lesions in patients with various types of cancer. Eur. J. Nucl. Med. Mol. Imaging 2020, 47, 1820-1832. Giesel, F.L.; Kratochwil, C.; Schlittenhardt, J.; et al. Head-to-head intra-individual comparison of biodistribution and tumor uptake of (68)Ga-FAPI and ^{18}F-FDG PET/CT in cancer patients. Eur. J. Nucl. Med. Mol. Imaging 2021, 48, 1-19.

EPS-202

Higher diagnostic accuracy in NSCLC lymph node staging with Total-Body compared to conventional PET/CT - results form a prospective single center head-to-head comparative study

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Aim/Introduction: To compare Total-Body (TB) and short-axial field-of-view (SAFOV) PET/CT diagnostic performance in mediastinal lymph nodes (N-staging) of non-small cell lung cancer (NSCLC) and assess potential changes in tumor stage. ***Materials and Methods:*** 68 patients were included of which 28 (male: 10, female: 18) were referred for staging/restaging of NSCLC. Patients received both TB (uEXPLORER, United Imaging Healthcare) and SAFOV (Biograph mCT, Siemens Healthineers) PET/CT on the same day in a cross-over prospective single-center head-to-head comparative study design. PET/CT was acquired after 60- or 90-minutes post injection of ~370 MBq [18F]FDG. PET was read by two blinded experts in a randomized order. Follow-up data (histology after biopsy/mediastinoscopy, treatment, imaging, therapy response) after 24 [2-41] months was used for validation of positive and negative lymph nodes and N-stage. Twenty-five different mediastinal lymph node levels (1R/L, 2R/L, 3a/p, 4R/L, 5, 6, 7, 8-14R/L) were evaluated per patient and per scan. Sensitivity, specificity, negative and positive predictive values (NPV/PPV) were analyzed for both PET scans with 95% confidence interval (CI). TNM-staging and tumor stage group according to 8th Edition (AJCC) was recorded for each patient on both PET/CTs. McNemar's test was used to assess statistically significant differences ($p<0.05$). ***Results:*** Overall, 700 mediastinal lymph node levels were evaluated. We detected higher numbers of true positive lymph nodes on TB PET (50 vs. 41), whereas false positive (7 vs. 13) and false negative (6 vs. 15) lymph nodes were lower on TB compared to SAFOV PET. Subsequently, sensitivity (89% CI: 81-97% vs. 73% CI: 62-85%) and PPV (88% CI:79-97% vs. 76% CI: 65-87%) was higher on TB, whereas specificity (99% CI: 98-99% vs. 98% CI: 97-99%) and NPV (99% CI: 98-99% vs. 98% CI: 97-99%) was similar between TB and SAFOV PET. The diagnostic accuracy was significantly higher for TB compared to SAFOV PET/CT ($p=0.005$). In total, N-staging was correct in 22/28 patients (79%) on SAFOV PET and in 27/28 patients (96%) on TB PET. The tumor stage group was incorrect in one SAFOV PET case, where biopsy confirmed correct upstaging in TB PET/CT, which may have impacted the patient's management. ***Conclusion:*** TB PET/CT showed significantly higher sensitivity and PPV in lymph node staging compared to SAFOV PET/CT, which affected N-staging in 18% of patients and might have changed clinical management in one case. TB PET/CT may therefore be of importance to establish the best therapy plan in clinical routine for NSCLC patients.

EPS-203

Role of ^{18}F-FDG PET/CT in the management of secondary Hemophagocytic lymphohistiocytosis

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Aim/Introduction: Hemophagocytic lymphohistiocytosis (HLH) is a rare and potentially fatal systemic inflammatory syndrome, developing secondary to varied aetiologies ranging from infection, inflammation to malignancy. This single-centre retrospective study aims to assess the utility of 18F-FDG PET/CT in secondary HLH. ***Materials and Methods:*** A retrospective analysis of patients who underwent 18F-FDG PET/CT from 2010 to 2024 for workup of HLH was done. Whole-body 18F-FDG PET/CT images were analysed to find secondary causes of HLH, and findings were correlated with clinical, biochemical parameters and the final diagnosis. Focal PET uptake was considered positive at sites other than physiological sites. SUVmax was measured in liver, spleen and bone marrow (BM), and spleen-to-liver ratio (SLR) and bone-to-liver ratio (BLR) were calculated. ***Results:*** Data of 23 patients [median age 22 years (IQR 13-35)] and male preponderance (n=17) was analysed. Hepatomegaly was observed in all patients (100%), splenomegaly in 18 (78.3%), splenic FDG uptake > liver in 17 (73.9%), BM uptake > liver in 17 (73.9%), lymphadenopathy in 15 (65.2%), lung involvement in 6 (26.1%) and basal ganglia hypermetabolism in nine (39.1%) patients. There was no significant difference in SUVmax and BLR in patients with and without evidence of HLH on BM sampling, but a significant difference in median marrow SUVmax (4.5 vs 2.1, p=0.002), spleen SUVmax (4.7 vs 2.2, p=0.006) and BLR (1.51 vs 1.0, p=0.016) was observed in patients with hypercellular vs normo/hypocellular marrow. BLR showed a statistically significant moderate positive correlation with total leukocyte count (r 0.557, p =0.013) and absolute neutrophil count (r 0.592, p = 0.006).The most common aetiology of secondary HLH was infection (11/23, 47.8%) with Ebstein barr virus (n=3), parvovirus B19 and hepatitis A virus (PET negative) in one each. One patient with X-linked lymphoproliferative disorder was seropositive for EBV, CMV, HAV and herpes simplex viruses. Two patients (8.7%) had brucellosis, and three (13%) had mycobacterium tuberculosis infection. PET was positive in 10/11 patients with infections (91%). Three (13%) had Still's disease and 1 patient had combination of malignancy (B-NHL) and infection (CMV) (4.3%). Six patients (26.1%) had haematological malignancies - T-cell rich B-cell lymphoma, cutaneous T-cell lymphoma, B-ALL, HL, DLBCL and B-NHL (in one each) with PET-positive findings in all. PET was also positive in two patients with idiopathic HLH (8.6%). ***Conclusion:*** 18F-FDG PET/CT is useful in localising the malignant and infective cause of secondary HLH and uptake correlates with bone marrow and peripheral blood findings.

EPS-204

Prognostic Role of FDG PET/MRI Findings in Patients with R-ISS Stage 2 Multiple Myeloma

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Aim/Introduction: Revised International Staging System (R-ISS) was develop in 2015 and is used in the risk classification in multiple myeloma (MM). However, the number of patients classified as stage 2 is high and this group includes a heterogeneous patient population in terms of survival. This study aimed to evaluate the prognostic value of FDG PET/MR in further risk stratification in R-ISS stage 2 MM patients. ***Materials and Methods:*** This study analyzed 77 newly diagnosed, R-ISS stage 2 MM patients who underwent FDG PET/MRI for primary staging. FDG PET, T1 and T2-w images, DWI and ADC maps were analyzed to evaluate the presence and number of FDG (+) and DWI (+) focal lesions (FL), diffuse bone marrow (BM) involvement, the presence of extramedullary and paramedullary disease (EMD/PMD). In quantitative evaluation, the highest SUVmax and the lowest ADCmin values were obtained. International Staging System (ISS) and Durie-Salmon stages, BM plasma cell ratios and laboratory parameters were recorded. Cox proportional hazard regression models were performed to determine the prognostic factors for overall survival (OS). Survival curves were estimated by using the Kaplan-Meier method. Statistical analyses were performed on SPSS version 23.0. ***Results:*** The median follow-up duration after the start of therapy was 22 months. During the follow-up period, 29 patients had died. In univariate Cox regression analyses, Durie-Salmon stage (stage 1-2 vs 3), FL number on FDG PET/MRI and DWI (<5 vs ≥5), the presence of EMD/PMD and the highest SUVmax levels were found to be prognostic factors. In multivariate analysis, the presence of EMD/PMD on FDG PET/MRI and FL number on DWI were found as independent prognostic factors for OS (HR: 3.3, 95% CI: 1.4-7.6, p=0.006 and HR: 3.1, 95% CI: 1.4-6.9, p=0.005, respectively). The Kaplan-Meier survival analysis showed that EMD/PMD positive patient group and the patients with higher FL number on DWI (≥5) had significantly lower OS rates (38.5% vs 67.2%, p=0.002; 39.4% vs 79.5%, p=0.002, respectively). ***Conclusion:*** The presence of EMD/PMD on FDG PET/MRI and higher FL number on DWI can be used as prognostic biomarkers to identify higher risk patients within the heterogeneous R-ISS stage 2 MM group. However, prospective larger studies are needed to confirm these findings.

EPS-205

Prospective Comparison of [18F]FDG and [68Ga]Ga-PSMA PET/CT in Staging Multiple Myeloma

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Aim/Introduction: PSMA is expressed on the endothelium of neoangiogenic blood vessels; therefore, it can be targeted to image a variety of tumors. The aim of this study is to evaluate the diagnostic performance and limits of [68Ga]Ga-PSMA PET/CT(PSMA-PET) in assessing Multiple Myeloma (MM) through the comparison with [18F]FDG-PET/CT (FDG-PET), particularly in the light of possible novel theranostic approaches. ***Materials and Methods:*** We prospectively enrolled 41 consecutive patients(pts) with newly diagnosed symptomatic MM and performed a FDG-PET and a PSMA-PET within 14 days. The two scans were compared in terms of number of bone focal lesions (FL), paramedullary lesions (PM), SUVmax and diffuse bone marrow (BM) uptake. ***Results:*** R-ISS and mean plasma cell bone marrow infiltration were: I(14pts, 58%), II(18pts, 64%), III(4pts, 90%), not-valuable(5pts, 27%). 32/41 patients(78%) had concordant FDG-PET and PSMA-PET scans, while 9/41(22%) had discordant scans in terms of positivity/negativity(p .00015). Among concordant studies, 12/32(37%)pts were negative at both the tracers while 20/32(63%) were positive at both. In 9/20(45%) the two tracers identified the same number and sites of lesions. In the remaining 11/20(55%), FDG and PSMA showed a different number of lesions; in 5/11(45%) FDG-PET detected more lesions, in 5/11 less lesions, while in 1/11(9%) there were both types of discordant lesions. Among discordant studies, 8/9pts had a positive FDG-PET and a negative PSMA-PET, whereas 1/9 had a positive PSMA-PET and a negative FDG-PET. Overall, 298 focal lesions were detected, of which 286 were FL and 12 were PM. FDG-PET detected 276/298(93%) lesions in 26 patients and PSMA 100/298(34%) lesions in 21 patients. All(12/12) PM lesions were FDG positive and 11/12 showed PSMA uptake(p 1.0). BM diffuse uptake was observed in 5 PSMA-PET, all positive in the FDG counterpart, and in 16 FDG-PET (DS4 in 13, DS3 in 3)(p .02). FL-SUVmax had a median of 5,8(3,9-7,4) for FDG and 5,3(3,5-6,2) for PSMA; PM-SUVmax had a median of 5,8(3,9-11,5) for FDG and 4,9(4,3-6,1) for PSMA. However, the higher PSMA-PET SUVmax was superior to physiologic liver uptake (reference for radioligand therapy clinical indication) only in 2/13 PSMA positive scans. ***Conclusion:*** According to these preliminary results, FDG-PET features a higher positivity rate than PSMA-PET in detecting myelomatous lesions. For this reason and for the low PSMA uptake, PSMA does not seem optimal for imaging MM. It is not excluded that PSMA uptake may increase in advanced phases of the disease. Further analysis of larger cohorts is needed.

EPS-206

Imaging features and clinical data-based network analysis of CAR-T treated B-cell lymphoma patients in relation to their TP53 mutation status

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Aim/Introduction: Despite the promising results of Chimeric antigen receptor T-cell (CAR-T) therapy for relapsed/refractory (R/R) B-cell lymphoma, the heterogeneity of treatment responses requires further understanding of the triggering factors, such

as the TP53-mutation status. This study aims to investigate the network patterns among R/R B-cell lymphoma patients treated with CAR-T therapy based on their TP53-mutation status. ***Materials and Methods:*** Fifty-four R/R B-cell lymphoma patients that underwent TP53 determination, treated with CAR-T therapy at Valencia Clinic and La Fe University Hospitals between 2019 and 2023 were included. Pre-infusion ^{18}F-FDG PET/CT scans, clinical, and genetic data were collected. Imaging features included maximum standardized uptake value (SUVmax), metabolic tumor volume (MTV), total lesion glycolysis (TLG), entropy, and kurtosis radiomics, were calculated across all lesions (total). To evaluate the network profile, sparse gaussian graphical models were constructed. Graphical Lasso regularization function and Extended Bayesian Information criterium were used as tuning parameter. Additionally, 200 nonparametric bootstrap samples were generated. Weights between nodes were estimated as partial correlations under a high-dimensional nonparanormal model. Partial correlations were estimated by regularized nodewise regression based on the ranks from the original data. ***Results:*** Mean age of included patients (n=54) was 57.5 [range 21-76] years, with gender balance. Axicabtagene ciloleucel and tisagenlecleucel were administered to 37 (68.5%) and 17 (31.5%) patients, respectively. TP53 mutations were detected in 19 (35.2%) patients. The exploration of network patterns revealed that entropy, an imaging feature that specifies randomness or disorder in the image region of interest, plays a significant role in both networks, occupying a central position. However, node connection between TP53-mutated and non-mutated patients differ. Entropy shows a positive association with LDHratio and SUVmax in TP53-mutated patients as indicated by the estimated edge weights 0.372 and 0.513 respectively, while these associations were lower in non-mutated patients (0.000 and 0.261). Kurtosis, which measures the peakedness of the distribution, also shows a significant relationship with progression-free survival time, overall survival time, and the AUC of the CAR-T follow-up by digital PCR. Both networks exhibited the strongest positive correlation between MTVtotal and TLGtotal, showing edge-weights of 0.789 for TP53-mutated patients and 0.669 for non-mutated. ***Conclusion:*** The complex network pattern in R/R B-cell lymphoma patients undergoing CAR-T therapy, emphasizing the influence of TP53-mutational status shows differential associations, highlighting the importance of personalized treatment strategies. These findings contribute to understanding treatment responses in CAR-T therapy and may guide future therapeutic approaches for improved patient outcomes.

EPS-207

Prognostic Ability Of The Measurement Of Maximum Tumor Dissemination (Dmax) In PET/CT Images Of Patients With Diffuse Large B Cell Lymphoma (DLBCL)

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Aim/Introduction: To analyse the prognostic performance of the measurement of maximum tumour dissemination (Dmax) in PET/CT images with [^{18F}]FDG of patients affected by diffuse large B cell lymphoma (DLBCL). ***Materials and Methods:*** Retrospective observational study of consecutive patients diagnosed with DLBCL between January/2016-May/2019, with histopathological confirmed diagnosis, and studied by staging PET/CT. The distance in millimetres from centre to centre (Dmax) of the two most distant lesions in the obtained images was measured; that same distance corrected by the patients' body surface area (SDmax) was also measured. Statistical analysis was conducted using SPSS v29. Cox regression analysis between the quantitative variables (Dmax and SDmax) and overall (OS) and disease-free survival (DFS) was performed. ***Results:*** One hundred and forty-three patients (63 women) with a mean age of 64.6 years (19-92) were included, with the following mean distances: Dmax 341.9 mm (17.8-807.7) and SDmax 190.2 mm (9.4-502.3). Forty-three of the patients in our sample (30.1%) presented progression or recurrence of their disease, and forty-six (32.2%) died during clinical follow-up. About the progressions, it is worth noting that only 2 patients with a Dmax less than or equal to 99 mm progressed. Cox regression analysis found a statistically significant correlation between Dmax and SDmax with DFS: p=0.003 and HR=1.002 (95%CI: 1.001-1.003) for Dmax, p=0.004 and HR=1.003 (95%CI: 1.001-1.005) for SDmax; this represents an increase in the risk of progression of 3% for every centimetre that the interlesional distance increases. A statistically significant correlation was also found with OS, with p=0.006 and HR=1.002 (95%CI: 1.000-1.003) and p=0.005 and HR=1.003 (95%CI: 1.001-1.005) for Dmax and SDmax, respectively, both showing a similar trend, with SDmax being slightly better associated with an increased risk of progression or recurrence than Dmax. Overall, the HR shows an increase in risk the greater the interlesional distance. Cox regression analysis also showed that advanced Ann-Arbor stages (III and IV) showed a significant correlation with OS (p=0.005 and p=0.04, respectively). ***Conclusion:*** Dmax and SDmax seem to have a potential role as prognostic estimation measures in patients affected by DLBCL and could be useful tools to implement in daily clinical practice, given their value and simple calculation, but further studies may be warranted.

EPS-208

Prognostic value of maximum height-normalized tumour dissemination (HDmax) from ^{18}F-FDG PET/CT staging studies in follicular lymphoma

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Aim/Introduction: To analyse the prognostic value of maximum height-normalized tumour dissemination (HDmax) from 18FDG-PET/CT staging scans in patients with a histologically confirmed diagnosis of follicular lymphoma (FL). ***Materials and Methods:*** A retrospective analysis of consecutive patients with FL undergoing 18FDG-PET/CT staging scan between January/2017 and November/2020 was conducted. The Euclidean distance (centre-centre) between the two most distant pathological lesions corrected for height (HDmax) was measured, and its relationship with disease-free survival (DFS) and overall survival (OS) was studied using Cox regression analysis and Pearson's correlation coefficient (ρ). ***Results:*** A total of 107 patients (56 men), mean age 60 years (13-86), with a mean HDmax value of 211.3 mm (112.8-354.6), wereincluded. Thirty-one patients had progression confirmed by clinical and/or imaging evidence and

20 died during a minimum follow-up of 4 years. In the analysis with Pearson's correlation, statistically significant relationships were obtained between HDmax and death (ρ:0.223; p<0.05) and HDmax and age (ρ:0.960; p<0.001). However, no statistically significant correlation was obtained with DFS or OS, although in the Kaplan Meier curves there is a visual increase in risk with higher HDmax. These findings maintained the same trend in Cox regression analysis, with HR of 1.002 for DFS and OS without reaching statistical significance. This means that the risk of death or progression is increased by 2% for every centimetre of distance. Patients with HDmax ≤152.1 mm had no progression at 2 years, nor did they die during follow-up. ***Conclusion:*** HDmax from 18FDG-PET/CT staging scans could play a role as prognostic factor in FL patients, with a cutoff level of ≤152.1 mm potentially representing patients with a better prognosis.

EPS-209

MTV-based risk scores for outcome prediction in large B-cell lymphoma: Data from a multicenter analysis of patients undergoing chimeric antigen receptor T-cell therapy

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Aim/Introduction: Chimeric antigen receptor (CAR) T-cell therapy has shown remarkable efficacy in relapsed and refractory large B-cell lymphoma. However, it remains unclear how potential non-responders can be identified before infusion and successfully treated. Some international research groups are currently undertaking efforts to integrate metabolic tumour volume (MTV) measured on 2-[18F]fluoro-2-deoxy-D-glucose positron emission tomography (PET) into newly developed stratification tools, particularly for first-line therapy. We therefore investigated the predictive value of proposed risk scores in patients undergoing CAR T-cell treatment. ***Materials and Methods:*** Our analysis set consisted of 88 individuals from four German university hospitals and one Italian centre who underwent PET-based staging before CAR T-cell therapy with tisagenlecleucel or axicabtagene ciloleucel. We examined the risk scores published by Leithner et al.,1 Thieblemont et al.,2 and our group,3 which, in addition to MTV, include lactate dehydrogenase level, Eastern Cooperative Oncology Group status, and extra-nodal involvement, respectively. All study sites provided information about basic patient characteristics, conventional disease parameters, and PET measures. The models' predictive values with regards to six-month progression-free survival (PFS) were determined based on receiver operating characteristic analysis. Additionally, we assessed whether their performance can be improved through use of individual MTV thresholds that have proved optimal for the CAR T-cell products in a previous study.3 ***Results:*** The risk scores considered showed different PFS prediction power in our cohort of patients undergoing CAR T-cell treatment. We found areas under the curve (AUC) of 0.52 (95% confidence interval [CI], [0.40, 0.63]), 0.60 (95% CI, [0.49, 0.71]), and 0.68 (95% CI, [0.57, 0.78]) for the models proposed by Leithner et al., Thieblemont et al., and our group, respectively. In all scores assessed, patients without any risk factors had the lowest PFS event rates after six months. When using construct-specific MTV thresholds for tisagenlecleucel and axicabtagene ciloleucel, AUC of the stratification tool published by Leithner et al. increased to 0.57 (95% CI, [0.46, 0.69]). ***Conclusion:*** Our study suggests that different PET-based models might be useful for risk stratification in the context of CAR T-cell therapy. Their predictive performance can improve by optimization with construct-specific MTV thresholds. We are currently enrolling additional patients to evaluate the risk scores and identify further relevant factors. Results from our extended analysis will be available at the time of presentation. ***References:*** (1) Leithner D, et al. DOI: 10.1186/s13045-024-01540-x. (2) Thieblemont C, et al. DOI: 10.1182/bloodadvances.2021006923. (3) Voltin CA, et al. DOI: 10.1007/s00259-023-06554-0.

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Tuesday, October 22, 2024, 09:45 - 11:15
Hall G1

Technologists Oral Presentations 3: Technologists Committee: Dose and Image Optimization

OP-635

Paediatric Dose Optimization for Long Axial Field-of-View FDG PET/CT

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Aim/Introduction: Paediatric patients are more radiation-sensitive, therefore minimizing exposure during imaging is vital, while tailoring protocols to their varying sizes and ages is complex. The European Association of Nuclear Medicine (EANM) developed the paediatric dose card, a tool helping to determine safe and sufficient tracer activity levels. This dose card relies on data from large retrospective paediatric patient cohorts. Consequently failing to incorporate recent breakthroughs in whole-body and long axial field-of-view (LAFOV) PET/CT imaging, which hold significant promise for reducing radiation exposure in children. This study evaluates the potential dose reduction capabilities of LAFOV-PET/CT for paediatric [18F]FDG imaging. ***Materials and Methods:*** Between October 2021 and April 2024, 39 paediatric patients underwent [18F]FDG LAFOV-PET/CT imaging, aged 0.2 to 17 years (mean 11 ± 5.3). Post-introduction of the LAFOV system, a systematic dose reduction was implemented, resulting in a wide range of doses (0.6 to 4 MBq/kg) and scan durations (mean 9.3 ± 2.1 minutes, range 3 to 15 minutes). To facilitate data comparison, a regression model was employed to derive an average count statistic for the study cohort, so-called reference image quality (RIQ), corresponding to a dose model of 1.87 MBq/kg (1.2 MBq offset) for a 5-minute scan. Subsequent reconstructions were generated at 100%, 75%, 50%, 25%, and 12.5% of the RIQ. Quantitative assessment focused on measuring SUV mean, max, and peak within predefined liver volumes, alongside subjective clinical image quality (IQ) evaluation using a Likert scale by five nuclear medicine physicians. ***Results:*** The RIQ served as an internal reference for further dose-image quality optimization

and already represents a reduction of 67% and 49% in FDG dose compared to the EANM dose cards of 2016 and 2023, respectively. Qualitative clinical IQ analysis demonstrated the possibility of additional dose reductions by 51% (0.78 MBq/kg, 3.5 MBq offset) and 64% (0.55 MBq/kg, 3.12 MBq offset) if the IQ is reduced to 4 and 3.5 Likert score, respectively. Quantitative image analysis revealed no significant reduction in mean SUV with up to a 50% dose reduction. ***Conclusion:*** This study highlights that LAFOV-PET/CT can significantly reduce paediatric doses by a total of 88% and 81%, compared to EANM dose cards from 2016 and 2023, respectively, without compromising acceptable image quality. The dose-reducing potential can be further maximized by leveraging the ultra-high sensitivity mode of LAFOV-PET/CT, technology that has recently become available and was not covered in this work.

OP-636

CT dose reduction possible with tin filter in SPECT-CT

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Aim/Introduction: Previous work demonstrated that a new generation of SPECT-CT system allows large CT dose reductions based on improved detector design and iterative reconstruction (IR). A tin filter is also available for further CT dose reduction. Aim of this study was to determine by how much CT dose can be reduced with the tin filter in different tissue types, whilst achieving comparable image quality to images acquired with standard aluminium filtration alone. ***Materials and Methods:*** A whole-body phantom was scanned from vertex to proximal femur, with and without tin filter. Non-tin filter scans were made using 130kV and 110kV, at 100, 50, 30, 20, and 13mAs, whilst tin filter scans were made using Sn130kV and Sn110kV, at 400, 300, 200, 100, 50, 20, and 13mAs. Regions-of-interest were placed in the lung, spine, cerebellum, thyroid, heart, liver and spleen. Contrast-to-noise-ratios (CNR) of the tissues of interest were calculated using the heart as a reference. CNR was plotted against dose-length-product (DLP) for tin filter and non-tin filter scans, for each tissue type and tube voltage, and maximum dose-saving with the tin filter calculated for each kV and tissue, where the greatest relative difference in DLP was seen at comparable CNR. ***Results:*** Dose reductions with the tin filter were dependent on tube voltage and absolute CNR, with relative dose reductions often being greater at lower CNR. At 130kV, maximum relative dose reductions with tin filter for comparable image quality to non-tin filter scans were 17%, 17%, 40%, 43%, 32% and 0% for lung, spine, liver, spleen, thyroid bed and cerebellum, whilst at 110kV maximum relative dose reductions were 61%, 31%, 43%, 33%, 11% and 0%, respectively. At 110kV/13mAs, the scan with standard filtration scan delivered a DLP of 87mGy.cm (effective dose 1.13mSv) for the vertex to proximal femur scan range, whilst the tin filter scan with these settings delivered a DLP of 18mGy.cm (effective dose 0.23mSv), representing an 80% dose reduction with tin filter. ***Conclusion:*** Tin filter can provide additional dose reduction to the already-high reductions provided by a new detector and IR on a next generation SPECT-CT system. Furthermore, the tin filter allows these high theoretical dose reductions to be realised in clinical practice by delivering a much lower dose at a given mAs. Such CT dose reductions in SPECT-CT may make transition to cross-sectional rather than planar imaging more feasible, potentially improving diagnostic accuracy for some Nuclear Medicine examinations.

OP-637

Implementing $^{[18F]}$fluorocholine PET/CT leads to a reduced effective patient dose compared to standard [^{99m}Tc]-sestamibi and [^{99m}Tc]-pertechnetate scintigraphy SPECT/CT

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Aim/Introduction: Minimizing radiation dose in nuclear imaging is paramount, as patients receive dose from both the radioactive tracer and CT. Protocol specifications were designed considering image quality and patient dose to comply with the As-Low-As-Reasonable-Achievable (ALARA) principle. To replace the standard [99mTc]-sestamibi and [99mTc]-pertechnetate scintigraphy SPECT/CT (Tc-99m), $^{[18F]}$fluorocholine PET/CT (FCH) was implemented, aiming for a better sensitivity and specificity for parathyroid detection. The literature reports an effective patient dose from 2.6-6 mSv for FCH and 6.3-12 mSv for Tc-99m, respectively. The aim of this study was to assess the radiation burden of FCH compared to Tc-99m at our department. ***Materials and Methods:*** There are currently no standardized imaging acquisition guidelines for PET/CT parathyroid imaging according to EANM Guidelines [1]. Aiming for a diagnostic quality of the CT scan, acquisition parameters were inspired and optimized from other studies in the literature and a collaborating hospital. Two groups, each consisting of 82 patients were included in the study. Scan ranges covered lower neck and upper mediastinum, with a minimum axial field-of-view of 263 mm, limited by the scanner. The total injected dose was 2.5 MBq/kg and 840 MBq for FCH and Tc-99m, respectively. All examinations were performed on a LSO/SiPM-based (249 ps. timing resolution) PET/CT system for FCH and a conventional dual-headed gamma camera for Tc-99m. The effective dose of injected radiotracer, CT dose and the total effective dose was determined for each patient. Results are presented as mean values ± SD (min-max), and the total effective doses were analysed to establish the difference between the two methods. ***Results:*** The effective dose for the administered radiotracer was 3.8 mSv ± 0.8 (2.4-5.9) for FCH and 8 mSv ± 0 (8.0) for Tc-99m. Effective CT dose was 1.4 mSv ± 0.5 (0.6-2.8) for FCH (high-dose) and 1.1 mSv ± 0.3 (0.6-2.1) for Tc-99m (low-dose). The total effective patient dose was 5.2 mSv ± 1.2 (3.3-8.2) for FCH and 9.1 mSv ± 0.3 (8.6-10.1) for Tc-99m, resulting in a significant reduction of 43 % ($p<0.05$). ***Conclusion:*** Implementing and optimizing FCH for localizing potential parathyroid adenomas, results in a significant reduction in total effective patient dose. This reduction is due to the lower effective dose from the administered radiotracer. CT doses were unchanged but image quality was improved from low dose to diagnostic quality. ***References:*** P.P. Ovcaricek et al., EANM Practice Guidelines for Parathyroid Imaging, Eur J Nucl Med Mol Imaging (2021)48:2801-2822

OP-638

Optimizing lung ventilation protocol on 3D digital SPECT-CT by using measured count rate- comparison of detection efficiency with conventional SPECT-CT

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Aim/Introduction: We use measured count rate, during Technegas inhalation, to define sufficient inhaled 99mTc activity in pulmonary ventilation study. Current clinical cut-off value is set to 1.2kcps on PA detector for the conventional SPECT-CT (cSPECT-CT) to indicate adequate inhaled activity. However, our 3D digital SPECT-

CT (3D-CZT) might enable use of lower activity and/or shorter scan time due to increased sensitivity and different acquisition geometry. The aim of the study was to setup lung ventilation protocol on 3D-CZT using count rate to define adequate inhaled activity. And to evaluate the possibility to decrease inhaled activity and/or scan time by comparing measured count rate and image quality with cSPECT-CT. ***Materials and Methods:*** Count rates were measured using typical inhaled activities in syringe and lung phantom. The lung phantom consisted of activity filled, healthy lung mimicking, containers placed inside a chest cavity phantom. Count rates, with 99mTc energy window, were measured using seven different activities (20-85MBq) from the bottom detector and all detectors on 3D-CZT and from PA detector on cSPECT-CT. Count rates from five patients were measured similarly. To evaluate image quality, a lung phantom containing 10 different sizes of defects, was scanned for 10min on 3D-CZT and according to clinical protocol on cSPECT-CT. In addition, five patients were scanned on both scanners. ***Results:*** Count rate increased linearly (R2>0.97) with increasing activity on both scanners, in syringe and phantom measurements. Measured count rates were 1.7 to 3.3 times higher from syringe than phantom for the same activity, which should be noted if deciding cut-off value based on syringe measurements. Count rate from bottom detector was more sensitive to patient positioning, making total count rate from all detectors more reproducible. Total count rates from phantom on 3D-CZT were 1.7 to 2.2 times higher than those measured on cSPECT-CT. Cut-off value of 1.20kcps in current protocol corresponded 2.55kcps in 3D-CZT, with activity of 28MBq. Count rates from phantom were in the same range as count rates from patients. However, in patient studies variation between scanners was greater. ***Conclusion:*** Total count rate measured on 3D-CZT was the most reproducible method to assess if enough activity has been inhaled. Due to different measurement geometry, count rate values between scanners are not directly comparable. However higher achieved count rate values indicate potential to decrease scan time and/or injected activity on 3D-CZT. This will be further evaluated in ongoing data analysis of lung phantom with defects.

OP-639

Large CT dose savings associated with new generation of SPECT-CT system: impact of new state-of-the-art CT detector and iterative reconstruction

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Aim/Introduction: A new generation of CT system was recently introduced to SPECT-CT, with advanced CT noise reduction technologies, including a new-state-of-the-art detector(ND) and second generation Iterative Reconstruction (IR). The aim was to determine by how much CT dose could be reduced, whilst providing comparable image quality to an older generation SPECT-CT system, comprising a standard detector and filtered back projection (FBP) reconstruction. ***Materials and Methods:*** A whole-body phantom was CT scanned from vertex to proximal femur on a recently installed system (new) equipped with ND and IR, and a 13 year-old system (old) with standard detector and FBP reconstruction. CT scans were made at 130kV and 110kV, and a range of mAs settings: 13-100mAs (new) and 8-100mAs (old). Images were reconstructed on the new system with IR and FBP, and on the old system with FBP only. On each reconstruction, regions-of-interest (ROIs) were drawn in homogenous areas of the lung, spine, cerebellum, thyroid, heart, liver and spleen. For each tissue and kV, image noise (standard deviation of Hounsfield Units, SD HU) was plotted against dose, for: old (standard detector)+FBP; new+FBP; and new+IR. Logarithmic fits were applied. Dose-length-product (DLP) and HU SD were compared for New+FBP vs Old+FBP, New+IR vs New+FBP and New+IR vs Old+FBP, to determine the relative dose reductions provided by ND, IR and the two technologies combined, respectively. ***Results:*** At 13mAs the new system provided DLPs of 87mGy.cm and 135mGy.cm, with 110kV and 130kV tube voltages respectively, giving whole-body effective doses of 1.1 and 1.8 mSv. When considering noise reduction with the ND only, these doses represented a 40% to >90% dose reduction for comparable image quality to the old system, according to tissue type and tube voltage. When considering noise reduction with IR compared with FBP, there was a 47% to >90% dose reduction for comparable image quality. When considering the combined effect of ND and IR, dose-savings were 68% to >90% for comparable image quality to the old system. ***Conclusion:*** Substantial CT dose reductions can be made on the new generation SPECT-CT system with ND and IR, as compared with an older generation system. In addition to providing lower radiation doses for current patients. The dose reduction may also justify greater use of SPECT-CT over planar imaging in clinical practice for improved diagnostic accuracy, where justification of the CT radiation dose has previously been a barrier.

OP-640

Prospective PET Dose Reduction Study of F^{18}-PSMA: Dose Reduction, Optimization of Acquisition Time and Radioprotection

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Aim/Introduction: ^{18}F-PSMA is a PET radiopharmaceutical used for the diagnosis and follow-up of prostate cancer. PET-CT with PSMA is an innovative method for the diagnosis of prostate cancer that overcomes the limitations of traditional techniques such as PET-CT with choline Among the main advantages is greater accuracy: in fact, PET-CT with PSMA is much more sensitive and specific in detecting prostate cancer, especially when other tests tend to give non-definitive values, as in the case of:o Low PSA valueso Negative prostate biopsyo Suspicion of biochemical recurrenceo Advanced prostate cancer• Better visualization of metastases: PET-CT with PSMA allows you to identify prostate cancer metastases with greater accuracy, even in locations that are difficult to reach with other tests, such as lymph nodes and viscera. Furthermore, the package leaflet indicates an administration dose of 3-5 MBq/Kg. ***Materials and Methods:*** This prospective study aims to reduce the radiation exposure by reducing the activity of ^{18}F-PSMA administered to patients, optimizing their radiation protection, and aiming to reduce the acquisition time per bed. Methodology:• Phase 1 (March-May 2024): 20 patients will receive 4.5 MBq/Kg of ^{18}F-PSMA and the acquisition time will be of 2.5 minutes per bed.• Phase 2 (June-August 2024): 20 patients will be acquired after 3 MBq/Kg of ^{18}F-PSMA with an acquisition time of 2.5 minutes per table.• Phase 3, Analysis: Liver SUV will be compared between Phase 1 and Phase 2 patients to evaluate the impact of reducing dose and acquisition time on image quality. Additionally, list-mode data from both phases will be used for retrospective image reconstruction simulating a 2-minute acquisition time per bed position. These reconstructed images will be evaluated by the medical team in a double-blinded fashion to assess potential image quality degradation with a shorter acquisition time. ***Results:***

This study is expected to demonstrate the feasibility of reducing the administered dose of ^{18}F-PSMA, optimizing patient radiation, while maintaining image quality for prostate cancer detection. Furthermore, a secondary expected objective is also the reduction of the acquisition time per patient, with the possibility of acquiring a higher number of patients in each single session. ***Conclusion:*** The study will evaluate whether the reduction of ^{18}F-PSMA activity and acquisition time is compatible with satisfactory image quality. If the results are favorable, this strategy could be adopted to improve the radioprotection of patients, optimize the use of the radiopharmaceutical and increase the number of patients subjected to the examination.

OP-641

Determining the Impact of Low Dose Administrations of [^{11}C]UCB-J on $SUV_{R'}$ for PET-MR Brain Datasets

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Aim/Introduction: Positron Emission Tomography (PET)-Magnetic Resonance (MR) is an imaging technique used to investigate the pathophysiology of neurological conditions, which allows for the simultaneous acquisition of PET and MR images. The [^{11}C]UCB-J radiopharmaceutical has been proposed as a marker of synaptic density for Alzheimer's disease (AD) patients, due to targeting the synaptic vesicle glycoprotein 2A. Patients with AD are likely to undergo longitudinal PET-MR examinations with [^{11}C]UCB-J, for disease monitoring and treatment follow-up. The aim of this project is to investigate the impact of low dose administration of [^{11}C]UCB-J, in PET-MR brain datasets, to optimise clinical protocols and reduce radiation burden. ***Materials and Methods:*** Five in vivo datasets, belonging to five healthy volunteers who received 228.6±58.3 MBq of [^{11}C]UCB-J and were scanned on a General Electric SIGNA PET-MR, were reconstructed once with the full administered dose and 7 times with different simulated low doses. The low dose simulations were obtained by undersampling the time frames and represented 1/2, 1/3, 1/4, 1/5, 1/6, 1/10, 1/15 of the full dose. An OSEM algorithm with time-of-flight was used with 6 iterations, 16 subsets, a 5mm filter (xy-axis). Regions of interest were drawn in the accumbens, substantia nigra, thalamus, striatum, caudate, putamen, hippocampus, insular cortex, temporal lobe, parietal lobe, frontal cortex and cerebellum. The standardised uptake value ratio (SUVR) was determined for each of the brain regions, per reconstruction. Coefficient of variation (CV) and bias were calculated. The two-way ANOVA and Kruskal-Wallis tests were used for group comparisons between the low dose and the full dose datasets. ***Results:*** The caudate (10.21%), cerebellum (11.21%), substantia nigra (10.68%) and temporal lobe (10.25%) presented the highest CV, for the full dose datasets. When investigating the difference between the CV from the full dose with the highest CV from the low dose datasets, no differences exceed 3%. The 1/2 low dose reconstruction consistently produced the lowest bias, when compared to the full dose. The 1/10 and 1/15 low dose datasets produced the highest bias, for all structures. The 1/2 and 1/3 low dose datasets consistently did not show significant differences for the regions under investigation. Apart from the thalamus and cerebellum, the remaining regions also did not present significant differences when the 1/4 low dose was compared to the full dose dataset. ***Conclusion:*** Results indicate that, when investigating the outcome measure SUVR for the [^{11}C]UCB-J datasets, it is possible to reduce the administered to 1/2 or 1/3.

OP-642

Quality assurance of [^{18F}]FDG-PET/CT scans after reduction of the FDG dose

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Aim/Introduction: When conducting [^{18F}]FDG-PET/CT scans, it is desirable to keep the radiation dose low and at the same time maintain high image quality for accurate diagnosis. In this quality-assurance study, we aimed to show that reducing the FDG dose for [^{18F}]FDG-PET/CT can be done without compromising image quality and diagnostic confidence. ***Materials and Methods:*** At the Department of Nuclear Medicine at Odense University Hospital, Denmark, we reduced the FDG dose from 4 to 3 MBq/kg. We standardized the overlap and scan time on different generations of PET/CT scanners aiming to gain the same sensitivity. We included patients with metastatic breast cancer who had undergone a minimum of four repetitive [^{18F}]FDG-PET/CT scans to evaluate treatment response; two should be conducted before and two after the FDG dose reduction. Four nuclear medicine specialists evaluated the scans independently and blinded to one another and to FDG dose. A five-point scale was used for evaluation of the scans that were graded according to noise, sharpness, and diagnostic confidence. Scans performed with an FDG dose of 4 versus 3 MBq/kg were compared. Differences between the dose levels were assessed with linear regression adjusting for intra-patient correlation. Agreement across raters was evaluated with proportions of agreement. ***Results:*** We included 25 breast cancer patients, resulting in 100 [^{18F}]FDG-PET/CT scans, using either FDG doses of 3 (n=50) or 4 MBq/kg (n=50), respectively. Only top scores of 1 and 2 were given for evaluations of noise and sharpness, and the best score of 1 was given to all scans for diagnostic confidence. No difference was observed for evaluation diagnostic confidence. Regarding noise, scans with FDG doses of 3 and 4 MBq/kg were comparable (mean score: 1.53 vs. 1.5; p=0.56), whereas the mean score in sharpness was slightly worse for low-dose than for high-dose scans (mean score: 1.35 vs. 1.2; p=0.026). Our results showed reasonable agreement between four raters according to their evaluation of the scans with proportion of agreement for noise, sharpness and diagnostic confidence of 0.6, 0.6, and 1, respectively, for low-dose scans and 0.5, 0.7, and 1 for high-dose scans. ***Conclusion:*** While there was a slight decrease in sharpness observed in the low-dose scans, our study found that reducing the FDG dose did not compromise the diagnostic confidence of [^{18F}]FDG-PET/CT. This dose reduction initiative aligns with the ALARA principle and supports our goal of minimizing radiation exposure for patients and the technologists performing the scans.

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Deep Learning-based Whole-liver Segmentation Using only ^{18}F-FDG PET Images

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Aim/Introduction: 18F-FDG PET imaging uses liver uptake measurements as a key metric, and in this context, deep learning countouring of liver region has been proposed because it has small errors compared to manual contouring. However, although approaches using mask images generated from CT or MRI are widely used for deep learning segmentation of PET images, the quantitative accuracy is variable due to differences in PET resolution and misregistration during image fusion. Consequently, the aim of this study was to develop a deep learning segmentation method of whole-liver regions based on the exclusive use of 18F-FDG PET images. ***Materials and Methods:*** We retrospectively analyzed 18F-FDG PET images of 120 patients (normal: 99, tumor: 11, cyst: 10). Consecutive slices containing the liver regions were extracted from whole-body PET images. The PET image scale was converted to standardized uptake value (SUV) units, and to stabilize the image in the abdomen, the SUV range was subsequently set from 0 to 6. As the deep learning architecture, we used the 3D U-net for semantic segmentation of the nnUNet system. The whole-liver region of the ground truth for supervised learning was created by manual contouring. The 120 PET images were randomly divided into 100 training and 20 test datasets, and segmentation accuracy was evaluated using the images from 20 patients that were not used for training. As evaluation measures, we used intersection over union (IoU) and Dice coefficients. The quantitative accuracy and image quality of volumes of interest (VOI) generated by deep learning were compared with those generated by manual contouring, using SUVmean, SUVmax, and signal-to-noise ratio (SNR). ***Results:*** The deep learning-extracted liver regions from 18F-FDG PET images were comparable to the ground truth regions. In the test dataset, the mean IoU and mean Dice coefficients were 0.890 and 0.941, respectively. Furthermore, the SUVmean values obtained for the deep learning and ground truth VOIs were almost identical, although the SUVmax and SNR tended to be slightly higher for the deep learning VOI. Notably, using deep learning segmentation, whole-liver regions were extracted in approximately 10 s. ***Conclusion:*** We developed a deep learning liver segmentation method based exclusively on the use of 18F-FDG PET images. The PET-only segmentation approach offers considerable potential for rapid and stable image analysis, thereby facilitating the accurate evaluation of whole-liver uptake.

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Tuesday, October 22, 2024, 09:45 - 11:15
Hall Y1-Y3

M2M Track - Featured Session: Radiopharmaceutical Sciences + Translational Molecular Imaging & Therapy Committee: Combination Therapies in Oncology

OP-645

Combination of Fibroblast Activation Protein (FAP)-targeted Radioligand Therapy with Anti-PD-L1 immunotherapy and Anti-VEGF Therapy

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Aim/Introduction: Fibroblast activation protein (FAP) has emerged as a promising cancer theranostic target, which is highly expressed in cancer-associated fibroblasts (CAFs) in various solid tumours. While FAP has been extensively utilised in diagnostic imaging, recent efforts have focused on optimising FAP-targeted compounds for therapeutic applications. Our group has previously reported such optimised compounds, including strategies like conjugation of an albumin-binding moiety, multimerisation of FAP inhibitors (FAPIs) and peptide cyclisation. When radiolabelled with therapeutic radioisotopes from bench to bedside, these compounds have shown more favourable pharmacokinetics and a better therapeutic effect. We envision an even stronger, synergistic antitumor effect by combining targeted radioligand therapy (RLT) with chemotherapy and/or immunotherapy. In this study, we used a group of optimised FAP peptides and inhibitors with either anti-VEGF (vascular endothelial cell growth factor) or anti-PD-L1 (programmed death-ligand 1) treatment to evaluate the converging force of the combination therapy preclinically. ***Materials and Methods:*** Three FAP compounds were used in this study, including a cyclic peptide, 3BP-3940, a FAP derivative conjugated with a truncated albumin-binding moiety, Evans-blue (EB)-FAPI (LNC1004), and a homodimer, DOTA-2P[FAPI]2. Tumour models were established by inoculating BALB/c mice with transfected CT26 cell lines, overexpressing murine FAP. The mice were randomly grouped (n = 8/group) to receive control, monotherapy or combinational therapy treated using 18.5 MBq 177Lu-3BP-3940 with anti-VEGF; 177Lu-LNC1004 with anti-PD-L1; 177Lu-DOTA-2P[FAPI]2 with anti-PD-L1 and monitored for body weight and tumour size. ***Results:*** The combination therapies were well-tolerated with a better anti-tumour effect than either monotherapy alone. Intravenous administration of single FAP-targeted RLT for the three compounds demonstrated adequate therapeutic effect, as reported previously - the additional anti-VEGF and anti-PD-L1 treatment greatly enhanced tumour suppression. For 177Lu-3BP-3940 and anti-VEGF, we observed enhanced treatment response and 2/8 complete response (CR). For 177Lu-LNC1004 and 177Lu-DOTA-[FAPI]2 with anti-PD-L1, all mice (8/8) achieved CR by day 28 and day 18 post-treatment, suggesting a tremendous tumour eradication efficacy and a synergistic effect, as all mice receiving a control treatment, anti-PD-L1 only or 177Lu-LNC1004 had succumbed to the disease by day 20, 34 and 42 respectively, while 177Lu-DOTA-[FAPI]2 monotherapy-treated mice succumbed on day 30. Remarkably, the immune response persisted when the mice were rechallenged three months post-therapy. ***Conclusion:*** Combining FAP-targeted RLT with anti-PD-L1 and anti-VEGF therapies demonstrated significant promise in FAP-positive tumour-bearing mouse models. With the development of novel compounds for FAP-targeted theranostics, investigating complementary treatment strategies is poised for a new clinical regimen for cancer management.

OP-646

Combination therapy of ^{211}At-labeled RGD peptide with immune checkpoint blockade to enhance anti-tumor efficacy

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Aim/Introduction: Targeted alpha therapy (TAT) has gained much attention because of its high therapeutic effects derived from the high linear energy transfer of α-particles. We recently synthesized and evaluated a compound (Ga-DOTA-K(APBA)-c(RGDfK) (1)) for TAT using RGD peptide with 4-(4-astatophenyl)butyric acid (APBA) as an albumin binding moiety. In U-87 MG human glioma cells inoculated BALB/c nu/nu mice, [211At]1 accumulated highly in the tumor and inhibited tumor growth1. Meanwhile, it was reported that a TAT agent could alter the tumor microenvironment and induce antitumoral immune responses, and the combination of a TAT agent with immune checkpoint blockade (ICB) enhanced anti-tumor efficacy2. Thus, we supposed that [211At]1 also induces antitumoral immune responses. In this study, the antitumoral immune responses induced by [211At]1 treatment were evaluated using Colon-26 murine colon cancer cells inoculated BALB/c mice. ***Materials and Methods:*** The biodistribution experiments of [211At]1 and therapeutic experiments by two doses of [211At]1 (370 or 925 kBq) with or without anti-PD-1 antibody (αPD-1, 10 μg/g) were performed in Colon-26 cells inoculated BALB/c mice. Colon-26 cells were subcutaneously reinoculated into BALB/c mice treated with [211At]1 (925 kBq) without αPD-1 to confirm antitumoral immune responses. As a control group, Colon-26 cells were inoculated subcutaneously into BALB/c mice without prior inoculation of Colon-26 cells and treatment of [211At]1. Therapeutic experiments treated with [211At]1 (925 kBq) in Colon-26 cells inoculated BALB/c nu/nu mice were also conducted and compared to the therapeutic effects in BALB/c mice. ***Results:*** [211At]1 was highly accumulated in the tumor (4 h: 7.12±0.95%ID/g) and inhibited tumor growth dose-dependently in Colon-26 cells inoculated BALB/c mice. Colon-26 tumors were not engrafted (6 out of 8 mice) or were remarkably inhibited tumor growth (2 out of 8 mice) in Colon-26 cells reinoculated BALB/c mice after [211At]1 treatment. The effects of inhibiting tumor growth in BALB/c nu/nu mice model were reduced compared to those in BALB/c model. Also, combining [211At]1 (925 kBq) and αPD-1 drastically enhanced anti-tumor efficacy in 2 out of 4 mice and not very effective in 2 out of 4 mice. ***Conclusion:*** These results suggest that [211At]1 could induce antitumoral immune responses, and combination therapy of [211At]1 and ICB could be effective against cancer. ***References:*** 1. H. Echigo et al. Eur J Nucl Med Mol Imaging. 2024. 2. T. Ertveldt et al. J Nucl Med. 2023.

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The impact of cytotoxic drug type and drug-to-affibody ratio on biodistribution of HER2-targeting affibody-drug conjugates using radiolabeling

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Aim/Introduction: Affibody molecules are promising for targeted delivery of cytotoxic drugs to cancer due to selective and high-affinity binding to molecular targets. Their fusion to an albumin-binding domain (ABD) extends the half-life in vivo and reduces renal reabsorption. We previously developed an affibody-ABD-drug conjugate (AffiDC) with the maytansinoid DM1 ZHER2-ABD-DM1 targeting human epidermal growth factor receptor 2 (HER2), which demonstrated potent anti-tumor effect in mice bearing SKOV3 xenografts. Comparing the payload DM1 with a clinically relevant deruxtecan (DXD) is of interest. Increasing the payload number from one to three might further improve the anti-tumor efficacy of AffiDCs. The aim of this study was to investigate the impact of a cytotoxic payload type and number, and compare the AffiDC carrying DM1 with the conjugates carrying DXD in vitro and in vivo. ***Materials and Methods:*** AffiDCs were site-specifically radiolabeled using technetium-99m tricarbonyl via N-terminal (HE)3-tag. Binding specificity, affinity and internalization were studied using HER2-overexpressing SKOV3, BT474 and SKBR3 cells. Cytotoxicity was investigated. Biodistribution of [99mTc]Tc(CO)3-labeled AffiDCs was performed in Balb/c nu/nu mice bearing SKOV3 xenografts at 4, 24 and 48 h post-injection. Specificity of tumor targeting was tested in HER2-negative Ramos xenografts. The therapeutic efficacy of ZHER2-ABD-DM1, ZHER2-ABD-DXD, ZHER2-ABD-(DM1)3 and ZHER2-ABD-(DXD)3 was compared at equimolar doses with vehicle control in SKOV3-xenografted mice. ***Results:*** AffiDCs were radiolabeled with radiochemical yield over 75%, purified with 98% radiochemical purity and high label stability. Binding to HER2-overexpressing cancer cells was specific with sub-to-low nanomolar affinity. Internalization by SKOV3 cells varied between 24 to 42% at 24 h. Biodistribution of [99mTc]Tc(CO)3-labeled AffiDCs was characterized by extended half-life in blood and renal clearance. Area Under the Curve (AUC) for tumor uptake was the largest for ZHER2-ABD-DXD, followed by ZHER2-ABD-DM1, ZHER2-ABD-(DXD)3 and the lowest for ZHER2-ABD-(DM1)3. AUCs for hepatic uptake of ZHER2-ABD-DXD and ZHER2-ABD-DM1 carrying single drug molecules were similar and were ca. 2.2-2.5-fold lower than for the conjugates carrying triple drugs. Estimation of uptake in drug equivalents suggested higher potential liver toxicity for triple conjugates. An ongoing therapy study shows effective suppression of tumor growth for all conjugates, however, a higher general toxicity of ZHER2-ABD-(DM1)3 is seen in comparison to the other groups. ***Conclusion:*** Radiolabeling using a residualizing technetium-99m tricarbonyl radiolabel enabled quantitative characterization of AffiDCs in vitro and measurements of uptake in normal organs and tissues in vivo. This allowed for prediction of toxicity and selection of doses for experimental therapy showing promising preliminary results.

OP-648

Evaluation of a Preclinical Radio-Antibody-Drug-Conjugate-^{131}I-HLX-58-Deruxtecan for the Precision Treatment of Gastric Cancer

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Aim/Introduction: CLDN18.2 is exclusively present in gastric mucosa and is retained on malignant transformation. Due to the high malignancy of Gastric cancer (GC), we hypothesis to combine therapeutic radionuclide-131I and cytotoxic drug-Deruxtecan with antibody targeting CLDN18.2 to synthesize Radio-Antibody-Drug-Conjugate (RADC). The combination of accurate internal irradiation therapy achieved by 131I and cytotoxicity of Deruxtecan can achieve a dual strike to GC. ***Materials and Methods:*** The antibody HLX-58 targeting CLDN18.2 was humanized to optimize its physicochemical properties such as affinity, stability, immunogenicity and aggregation behavior. We attached topoisomerase I (TopI) inhibitor Dxd to the functionalized antibody through maleimide-GGFG peptide linker with a drug to antibody ratio (DAR) of 2. Further, by labeling 131I on the tyrosine of the HLX-58, we obtained the CLDN18.2 targeting RADC-131I-HLX-58-Deruxtecan. The binding affinity, tumor killing ability, metabolic characteristics and biodistribution were performed in vitro and in vivo. ***Results:*** 131I-HLX-58-Deruxtecan was stable for more than 14 days. 131I-HLX-58-Deruxtecan showed significantly higher uptake in CLDN18.2 high-expression cells than that in CLDN18.2 low-expression cells ($P<0.05$). The required concentration for

HLX-58 to inhibit 50% binding of 131I-HLX-58-Deruxtecan to intracellular CLDN18.2 is 0.19 nM. Remarkable inhibitory activity to the cell growth was observed for 131I-HLX-58-Deruxtecan against NUGC4-CLDN18.2, with the IC50 value of 11.28 ng/mL (131I: 0.148 MBq). We monitored the biodistribution of 131I-HLX-58-Deruxtecan in vivo by SPECT/CT imaging. SPECT/CT imaging of 131I-HLX-58-Deruxtecan showed an increased tumor-to-muscle ratio (T/NT) with the maximum T/NT of 5.49±1.12 at 72 h post-injection for NUGC4-CLDN18.2 tumors (n = 3). The effective dose of 131I-HLX-58-Deruxtecan against tumor in vivo was 5 mg/kg (131I: 0.74 MBq). The results showed that for the treatment group of 131I-HLX-58-Deruxtecan, significant inhibition of tumor growth was observed. Within 24 d, the standard tumor volume of 131I-HLX-58-Deruxtecan was significantly less than other groups. Therefore, the effectiveness of the treatment was demonstrated in our study. Besides, the body weight of 131I-HLX-58-Deruxtecan did not change significantly, indicating the safety of the RADC in vivo. ***Conclusion:*** 131I-HLX-58-Deruxtecan displayed a significant CLDN18.2 positive tumor affinity and effective tumor therapy without significant toxicity. Therefore, the RADC-131I-HLX-58-Deruxtecan could be further investigated in the theranostic field of gastric cancer.

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Gastrin-releasing peptide receptor as theranostic target in breast cancer. A preclinical study of the theranostic pair [^{55}Co]Co- and [^{177}Lu]Lu-DOTA-RM26

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Aim/Introduction: Patients with advanced metastatic estrogen receptor-positive breast cancer often develop resistance to standard treatments, leading to uncontrolled progression. Thus, innovative therapies are urgently needed. The gastrin-releasing peptide receptor (GRPR) is overexpressed in various cancers, including breast cancer, making it an interesting target for radionuclide therapy. RM26, a GRPR-targeting antagonist, has demonstrated promising in vivo kinetics in prostate cancer models [1]. This study evaluates the theranostic capabilities of [55Co]Co-/[177Lu]Lu-DOTA-RM26 in vitro in estrogen receptor-positive breast cancer cells and assesses the diagnostic potential of [55Co]Co-DOTA-RM26 in vivo in a breast cancer mouse model. ***Materials and Methods:*** We analyzed the binding specificity of [57Co]Co-/[177Lu]Lu-DOTA-RM26 in T47D breast cancer cells, using [57Co]Co-DOTA-RM26 as a surrogate for [55Co]Co-DOTA-RM26. The therapeutic efficacy of increasing concentrations of [177Lu]Lu-DOTA-RM26 was determined via viability assay in vitro. Ex vivo biodistribution of [57Co]Co-DOTA-RM26 (17.2±2.7 kBq, 33±5.2 pmol/ mouse) was investigated in 12 mice (n= 4/group) with orthotopic breast cancer tumors. The mice were sacrificed at 4 and 24 hours post-injection (pi), including a blocking group (20 nmol of unlabeled [Tyr4]-Bombesin) at 4 hours pi. [55Co]Co-DOTA-RM26 PET/CT imaging of tumor-bearing mice was performed at 4 and 24 hours pi (2.8±0.2 MBq, 167.5±0.5 pmol/mouse), ± GRPR blocking. ***Results:*** In vitro studies revealed high, specific cell-associated binding of [57Co]Co-DOTA-RM26 (43±1% of total added activity per 106 cells) and [177Lu]Lu-DOTA-RM26 (37±4% of total added activity per 106 cells). The activity was predominantly localized at the cell surface; 71±3% and 80±6% for [57Co]Co-DOTA-RM26 and [177Lu]Lu-DOTA-RM26, respectively. [177Lu]Lu-DOTA-RM26 significantly reduced cell viability at all activity concentrations >0.625 MBq/ml ($p<0.0001$), with cell viability below 1% at concentrations ≥5 MBq/mL. Biodistribution data indicated a high, specific tumor uptake of [57Co]Co-DOTA-RM26, surpassing all other tissues significantly at both time points, 3.7±0.6% of the injected activity per gram (IA/g) 4 hours pi and 0.98±0.05% IA/g 24 hours pi. The kidneys showed the second-highest uptake (2.0±0.1% IA/g 4 hours pi), followed by the pancreas (1.4±0.4% IA/g 4 hours pi). PET/CT imaging with [55Co]Co-DOTA-RM26 distinctly visualized the tumor 24 hours pi, while other GRPR-expressing tissues cleared over time. Effective GRPR blocking significantly reduced tumor uptake in the PET images 24 hours pi. ***Conclusion:*** These findings suggest that the theranostic pair [55Co]Co-/[177Lu]Lu-DOTA-RM26 holds significant promise as a theranostic agent for estrogen receptor-positive breast cancer. ***References:*** 1. Mitran B et al. High Contrast PET Imaging of GRPR Expression in Prostate Cancer Using Cobalt Labeled Bombesin Antagonist RM26. Contrast Media Mol Imaging 2017.

OP-650

HER2-radioligand therapy using [^{131}I]I-GMIB-2Rs15d combined with olaparib results in prolonged survival in HER2 low expressing preclinical animal models.

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Aim/Introduction: Radioligand therapy (RLT) has recently emerged as a promising tool for treating cancer patients. However, the complete treatment response is limited to only a subset of patients; therefore, attempts have been made to improve RLT through combination strategies. Similarly, [131I]I-GMIB-2Rs15d showed therapeutic efficacy only in xenografts expressing high levels of HER2[1]. This study describes the first proof-of-concept combination therapy with [131I]I-GMIB-2Rs15d and Olaparib in HER2 low tumor xenografts. ***Materials and Methods:*** Radiotracer [131I]I-GMIB-2Rs15d was produced as previously described[1]. Human colon cancer DLD-1 and DLD-1-BRCA(-/-) cells (Horizon Discovery) were plated and incubated with [131I]I-GMIB-2Rs15d (1 or 10MBq/mL, for 1h), Olaparib (1µM, 5 days incubation) or a combination of both sequentially. Cell viability was assessed using an ATP assay (Promega), normalized to non-treated cells. To assess pharmacokinetics, tumor-bearing DLD-1-BRCA(-/-) athymic mice (n=3 per time point) were iv injected with [131I]I-GMIB-2Rs15d (~6.5MBq,~5µg), and sacrificed at different timepoints up to 192h pi, after which animals were dissected for ex vivo analysis and dosimetry calculations. For therapeutic efficacy, DLD-1 BRCA(-/-) tumor-bearing athymic mice (n=8) were subjected to single [131I]I-GMIB-2Rs15d (6x37MBq,~20µg), single olaparib (IP injection 50 mg/kg, 28 consecutive days), 0.9% NaCl, or a combination of [131I]I-GMIB-2Rs15d and olaparib (regimen as described above). Survival curves were analyzed using the Log-Rank(MantelCox) test with Holm-Bonferroni correction. ***Results:*** DLD-1 cells showed ~100% at 1µM Olaparib, ~92% at 1MBq/mL or ~77% cell viability at 10MBq/mL [131I]I-GMIB-2Rs15d. No combinatorial effect was observed in DLD-1 cells. DLD-1-BRCA(-/-) showed higher sensitivity with a cell viability of ~65% for 1µM Olaparib and ~85% for 1MBq/mL and ~37% for 10MBq/mL [131I]I-GMIB-2Rs15d. A combination effect was visible with, cell viability of ~45% for

1MBq/mL and ~25% for 10MBq/mL [131I]I-GMIB-2Rs15d with 1µM Olaparib. Long-term biodistribution of [131I]I-GMIB-2Rs15d in DLD-1 BRCA(-/-) xenografts revealed limited tumor uptake (1.47±0.32%IA/g) 1h pi which decreased to 0.14±0.029%IA/g 24h pi. Kidney uptake was high at early timepoints (50.17±4.22%IA/g, 1h pi) but cleared quickly with only 0.54±0.10%IA/g remaining at 24h pi. The combination of [131I]I-GMIB-2Rs15d and olaparib resulted in prolonged survival compared with single [131I]I-GMIB-2Rs15d (p=0.0107), single olaparib (p=0.0022), and 0.9% NaCl (p=0.0009). Dosimetry calculations for the therapeutic regimen showed 5.35Gy for the tumor and 38Gy for the kidney as a dose-limiting organ, without weight loss. Similar fractionated treatment regimens showed no kidney toxicity[2]. ***Conclusion:*** Prolonged survival was observed when treated with a combination of [131I]I-GMIB-2Rs15d with olaparib compared to mono treatment arms in HER2 low expressing tumor xenografted mice. ***References:*** [1]D'Huyvetter,ClinCancerRes,(2017),23(21). [2] Dekempeneer,JNuclMed,(2023),64(12).

OP-651

$^{123/125}$Iodine labelled-PARP inhibitor-loaded polymeric micelles for combination radio-chemotherapy against triple-negative breast cancer

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Aim/Introduction: Radio-nanomedicine, the combination of nuclear- and nanomedicine, is an emerging strategy in nuclear imaging and therapy. Nanoformulations offer benefits as protection of radiopharmaceutical agents, reduction of hepatic degradation, prolongation of blood circulation time, which finally increase drug´s therapeutic efficacy. BRCA-mutated (BRCAmut) triple-negative breast cancer (TNBC) is commonly treated with poly (ADP-ribose) polymerase inhibitors (PARPi). We have previously developed a therapeutic radiotracer combining the inhibitory effect of PARPi with the radiotherapeutic properties of 125Iodine (125I). Preclinical evaluation of the 125I-PARPi indicated poor biodistribution and tracer instability in vivo, resulting in suboptimal therapeutic outcomes. To improve tracer stability, biodistribution and tumor accumulation, we developed a combined radio-nanoformulation consisting of polymeric micelles co-loaded with radioactive and non-radioactive I-PARPi. ***Materials and Methods:*** Radiolabeling was performed using a tributyltin-precursor with chloramine-T as catalyst. Radioactive and non-radioactive I-PARPi co-loaded polymeric micelles were prepared via nanoprecipitation method. Formulation properties were analyzed by high-performance liquid chromatography (HPLC), dynamic light scattering (DLS) and transmission electron microscopy (TEM). Investigation of the in vivo biodistribution via SPECT/CT and therapeutic efficacy of the radio-nanoformulation was done using human BRCAmut TNBC xenograft models in mice. ***Results:*** Microscopy (TEM) images of co-loaded micelles showed a homogenous size distribution of spherical particles, with diameters around 70nm and polydispersity indices below 0.1, as confirmed by DLS. Encapsulation efficiency of radioactive and non-radioactive I-PARPi was > 80%. Co-loaded micelles showed a similar release profile for both compounds (i.e., 60% released after 48h). Formulation in micelles improved in vitro tracer stability about 10-fold. In vivo SPECT/CT measurements revealed prolonged circulation, higher tumor accumulation and decelerated deiodination of the tracer encapsulated in micelles as compared to the naked tracer. In vivo one-shot therapy with co-loaded micelles showed a significant reduction in tumor volume (> 50%) after 12 days of treatment compared to both the NaCl control group and the corresponding carrier-free PARPi-group. Ex vivo immunohistochemical analysis of the tumors showed characteristic γ-H2AX nuclear foci signal in the group treated with co-loaded micelles. ***Conclusion:*** This newly developed co-loaded micelle formulation showed improved in vivo tracer stability, prolonged blood circulation and cell uptake, resulting in increased therapeutic efficacy in a BRCAmut TNBC model compared to the "naked" application of compounds. Ongoing work involves dose optimization studies to maximize clinical benefit with optimal tolerability. Overall, this dedicated radio-nanoformulation combination allows for precise monitoring and adjustment of drug levels based on imaging, thereby individualizing and improving treatment outcomes.

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Radionuclide Therapy Using ^{177}Lu-HER2-BCH Affibody Molecule in Combination with Trastuzumab or Immunotherapy in HER2 High Expression and Resistant Models

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Aim/Introduction: HER2-BCH is a scaffold-protein-based HER2-targeting affibody molecule. The purpose of this study was to evaluate the efficacy of 177Lu-HER2-BCH in HER2 high-expression tumor models, including trastuzumab-resistant models. And to explore its utility in combination with trastuzumab or immunotherapy. ***Materials and Methods:*** In vitro cellular uptake and cytotoxicity assays were performed in HER2-overexpressing N87 cells, while SPECT/CT imaging, biodistribution, and treatment with single 177Lu-HER2-BCH or trastuzumab and combination of both were performed in the HER2 high-expressing gastric cancer patient-derived xenografts (PDX) model. 177Lu-HER2-BCH treatment and combined anti-CD47 immunotherapy were performed in the N87 trastuzumab-resistant model. Maximum dose toxicity monitoring was performed in KM mice for 28 days. ***Results:*** In vitro cellular assays in HER2 high-expressing cells showed significant specific uptake and cytotoxicity of 177Lu-HER2-BCH. High tumor uptake and favorable retention of this tracer in SPECT/CT imaging and biodistribution assays within the HER2 high-expression PDX model. The uptake of 177Lu-HER2-BCH was not replaced by excess trastuzumab, suggesting a different binding site. Compared to the control, 177Lu-HER2-BCH was effective in reducing tumor growth in a dose-dependent manner, with increased efficacy of treatment in combination with trastuzumab. Tumor growth was also significantly inhibited in the drug-resistant model, and the anti-tumor effect of combined anti-CD47 immunotherapy was superior. ***Conclusion:*** Targeted radionuclide therapy with 177Lu-HER2-BCH or in combination with trastuzumab, or immunotherapy is a potential therapeutic strategy for HER2-overexpressing tumors, including trastuzumab-resistant tumors.

1401

Tuesday, October 22, 2024, 11:30 - 13:00
Hall 1

Plenary 4: Trailblazing Trends for Tomorrow's Nuclear Medicine

OP-653
Extended Field of view PET: managing expectations
S. Fanti;
Nuclear Medicine Division, IRCCS Azienda Ospedaliero-Universitaria Di Bologna, Policlinico S.Orsola, Bologna, ITALY.

OP-654
Nuclear Medicine as a Pillar of Precision Oncology
P. Lambin;
Maastricht University, Precision Medicine, School for Oncology and Develop Biol, Fac. Health, Medicine and Life Sciences, Maastricht, NETHERLANDS.

OP-655
Nuclear medicine in the operating room: present and future
T. Maurer;
Martini-Klinik am UKE GmbH, Universitätsklinikum Hamburg-Eppendorf, Hamburg, GERMANY.

OP-656a
AI in clinical routine: are we ready?
P. Slomka;
Cedars-Sinai Medical Center, David Geffen School of Medicine University of California, Los Angeles, UNITED STATES OF AMERICA.

OP-656b
How to meet the requirements of health technology assessment keeping up with innovation
I. Durand-Zaleski;
Université de Paris, CRESS, INSERM, INRA, URCEco, AP-HP, Hôpital de l'Hôtel Dieu, Paris, FRANCE.

OP-656c
The EU strategy to guarantee the future of Nuclear Medicine
K. von Bremen;
SWAN Isotopen AG, Bern, SWITZERLAND.

1501

Tuesday, October 22, 2024, 15:00 - 16:30
Hall 1

CME 11 - Radiopharmaceutical Sciences Committee - Pre-targeting Approach: Moving into Clinical Application, Utopia or Reality?

OP-657
Basics of pre-targeting in Nuclear Medicine
F. Elvas;
University of Antwerp, MIRA, Antwerp, BELGIUM.

OP-658
From past to present
M. Herth;
University of Copenhagen, Department of Drug Design and Pharmacology, Copenhagen, DENMARK.

OP-659
Clinical perspective with strengths and limitations
B. Zeglis;
Hunter College, Department of Chemistry, New York, UNITED STATES OF AMERICA.

OP-660
Future generation of pre-targeted theranostics
A. Airaksinen;
urku PET Center, University of Turku, Turku, FINLAND.

1502

Tuesday, October 22, 2024, 15:00 - 16:30
Hall 4

Special Track 11 - Cardiovascular Committee - Debate: Cardiovascular Imaging: Quantification is the Way to Go, Yes or No?

OP-661
Point of View: Why we should use quantification in cardiovascular imaging
F. Caobelli;
University Clinic of Nuclear Medicine, University Hospital Bern, SWITZERLAND.

OP-662
Point of View: Point of View: Quantification in cardiovascular nuclear medicine imaging. No!
S. Nekolla;
Department of Nuclear Medicine, Technical University of Munich, Munich, GERMANY.

1503

Tuesday, October 22, 2024, 15:00 - 16:30
Hall X9-X12

LIPS Session 11 - Thyroid Committee - Tips and Tricks in Ultrasonography combined with Molecular Imaging of Thyroid and Parathyroid Imaging

OP-664
Ultrasonography of thyroid and parathyroid glands
M. Radzina;
Paula Stradina Clinical University Hospital, Diagnostic Radiology Institute, Riga, LATVIA.

OP-665
Molecular imaging of thyroid nodules
M. Kreissl;
Division of Nuclear Medicine, Department of Radiology and Nuclear Medicine, University Hospital Magdeburg, Magdeburg, GERMANY

OP-666

[99mTc]Tc-MIBI parathyroid scintigraphy

D. Taïeb;
La Timone University Hospital, Department of Nuclear Medicine, Marseille, FRANCE.

OP-667

[18F]fluorocholine PET/MR(CT) parathyroid imaging

M. Hüllner;
University Hospital Zurich, Department of Nuclear Medicine, Zurich, SWITZERLAND.

1504

Tuesday, October 22, 2024, 15:00 - 16:30
Hall X1-X4

M2M Track - TROP Session: Radiopharmaceutical Sciences + Translational Molecular Imaging & Therapy Committee: Targeted Radionuclide Therapy

OP-668

Comparative Evaluation of [161Tb]Tb-NeoB and [177Lu]Lu-NeoB for GRPR-mediated Targeted Radionuclide Therapy

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Aim/Introduction: Targeted radionuclide therapy (TRT) with lutetium-177 labelled molecules has proven to be effective for the treatment of several malignancies. This includes radiopharmaceuticals targeting the gastrin releasing peptide receptor (GRPR), e.g. [177Lu]Lu-NeoB, which is currently in clinical trials for treatment of GRPR-expressing cancers such as breast cancer (BCa) and prostate cancer (PCa). Due to the growing demand of lutetium-177 for TRT, as well as the aim to further improve the efficacy of the therapy, alternative radionuclides are being explored. A promising radionuclide is terbium-161; this radionuclide emits β- radiation similar to lutetium-177, while also emitting auger electrons. Accordingly, we aimed to compare [161Tb]Tb-NeoB and [177Lu]Lu-NeoB for targeting GRPR-expressing cancers. ***Materials and Methods:*** The binding affinity of both [161Tb]Tb-NeoB or [177Lu]Lu-NeoB was assessed by performing an in vitro autoradiography on frozen GRPR-positive human BCa sections (n=3). Tissue slices were incubated with 1nM [161Tb]Tb-NeoB or [177Lu]Lu-NeoB (+/- 1 µM unlabelled NeoB) for 1 hour, exposed to phosphor screens, and read using a Cyclone phosphor imager. Binding of the radiopharmaceuticals was expressed as percentage added dose/mm2 (%AD/mm2) by normalizing the data to standards. Additionally, the uptake of [161Tb]Tb-NeoB and [177Lu]Lu-NeoB was determined in a human GRPR-expressing PCa cell line PC3-PIP. Cells were incubated with 1nM [161Tb]Tb-NeoB or [177Lu]Lu-NeoB (+/- 1 µM unlabelled NeoB) for 1 hour and cellular uptake was determined using a γ-counter, expressed as percentage added dose/200.000 cells (%AD/200.000 cells). ***Results:*** In vitro autoradiography revealed an overall slightly lower binding affinity of [161Tb]Tb-NeoB compared to [177Lu]Lu-NeoB in the same tissue sections, with respective values ranging from 0.020-0.11 %AD/mm2 vs. 0.013-0.15 %AD/mm2. Similarly, the specific uptake of [161Tb]Tb-NeoB was slightly lower but within the same range as that of [177Lu]Lu-NeoB, i.e. 9.16±0.61 vs. 12.02±0.41 %AD/200.000 cells, respectively. ***Conclusion:*** Our studies demonstrate that the binding affinity and specific cellular uptake of [161Tb]Tb-NeoB is slightly lower but still within the same range as that of [177Lu]Lu-NeoB. We have previously observed similar slightly lower specific uptake of terbium-161 labelled compounds directed to different targets, with a yet unknown underlying cause. Further assessment of the cytotoxic effects of [161Tb]Tb-NeoB in comparison to [177Lu]Lu-NeoB are currently ongoing. So far, our observations support the idea that terbium-161 can be a good alternative to lutetium-177 for GRPR-mediated TRT. Our future studies will reveal whether the auger electrons emitted by terbium-161 will benefit GRPR-mediated TRT.

OP-669

A 47Sc-labeled GRPR Antagonist with Superior SPECT Imaging Characteristics Compared to its 177Lu-labeled Counterpart

T. Läppchen[1], *E. Pilatis[1], E. Menéndez[1], A. Bilinska[1], A. D'Onofrio[1], E. Moon[2], M. Zoltowska[3], D. Pawlak[3], I. Cieszykowska[3], R. Mikolajczak[3], F. Rösch[2], A. Rominger[1], E. Gourni[1]; [1]Department of Nuclear Medicine, Inselspital, Bern University Hospital, University of Bern, Bern, SWITZERLAND, [2]Department of Chemistry - TRIGA site, Johannes Gutenberg University Mainz, Mainz, GERMANY, [3]Radioisotope Centre POLATOM, National Centre for Nuclear Research, Otwock, POLAND.*

Aim/Introduction: In view of the increasing importance of targeted radioligand therapy (RLT), apart from new targets and targeting vectors, also novel radionuclides are finding their way in the clinic. While lutetium-177 is commonly used for RLT and therapy monitoring by SPECT, the decay characteristics (208 keV gamma, 11%) lead to limited spatial resolution and longer imaging times. With a half-life of 3.35 days, the beta emitter scandium-47 has recently garnered interest due to its 159 keV gamma (68%), making it suitable for RLT and SPECT. In this comparative study, we report first preclinical data on a gastrin releasing peptide receptor (GRPR) antagonist labeled with scandium-47, and evaluate the in vitro and in vivo performance and imaging characteristics compared to the 177Lu-labeled counterpart. ***Materials and Methods:*** AZZTA5-Pip-D-Phe-Gln-Trp-Ala-Val-Gly-His-Sta-Leu-NH2 (LF1) was radiolabeled with lutetium-177 and scandium-47, which was provided by NCBJ/Polatom within PRISMAP. [177Lu]Lu-LF1 and [47Sc]Sc-LF1 were evaluated in vitro (lipophilicity, protein binding, saturation, internalization) on GRPR+ PC3 cells. In vivo studies (SPECT/CT imaging, metabolic stability, biodistribution) were performed on PC3 xenografts. ***Results:*** [177Lu]Lu-LF1 and [47Sc]Sc-LF1 were obtained in >99% radiochemical purity and molar activities up to 38 GBq/µmol. They were stable for a period of 6 days post labeling exhibiting a hydrophilic profile with a LogDoctanol/PBS value of -2.9 and -2.8, respectively. The activity bound to human serum proteins was ~10% in both cases. Both radiotracers showed high affinity for GRPR, with Kd values between 2 and 5 nM. Internalization studies revealed slow internalization with a maximum of 10% at 6h, while at the same time point the specific cell-surface bound uptake was 15-25%. In the in vivo studies, [177Lu]Lu-LF1 and [47Sc]Sc-LF1 exhibited high, retained and specific tumor uptake, with values of 36.5±4.9 and 7.2±1.9 %IA/g and 40.4±5.2 and 5.6±1.2 %IA/g at 4 and 72 h p.i., respectively. The activity from the pancreas was washed out fast (from ~55 to ~13 %IA/g from 1 to 4h p.i. for both tracers). HPLC analysis of the blood indicated formation of three radioactive metabolites. The ex vivo biodistribution

results are well illustrated by SPECT/CT imaging. Importantly, the superior decay characteristics of scandium-47 compared to lutetium-177, was clearly reflected in the higher resolution of the corresponding SPECT images, which were obtained in much shorter time. ***Conclusion:*** [177Lu]Lu-LF1 and [47Sc]Sc-LF1 showed promising potential for RLT due to their high tumor uptake and low background signal. [47Sc]Sc-LF1 demonstrated superior resolution and shorter imaging time for SPECT.

OP-670

Abscopal effect following targeted radionuclide therapy in metastatic melanoma: preclinical studies in a new double-tumor mouse model

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Aim/Introduction: The radiopharmaceutical 131I-ICF01012, targeting intra- and extracellular melanin, was developed for targeted radionuclide therapy (TRT) of metastatic melanoma. Promising preclinical results in reducing tumour growth and improving survival have led to an ongoing Phase 1 clinical trial (NCT03784625)1. However, one of the limitations of 131I-ICF01012 is its ability to target only pigmented metastases, whereas pigmented and non-pigmented metastases may coexist in the same patient. The abscopal effect is an immunological phenomenon occurring after external radiotherapy and resulting in the metastases regression outside the irradiated target tumour. This effect, although suspected, has never been demonstrated for TRT, but if there is an abscopal effect induced by the use of 131I-ICF01012, it could enable the non-pigmented metastases immunological decrease. In this study, we aim to demonstrate this possible abscopal effect. ***Materials and Methods:*** To study the immunological mechanisms linked to this effect, we developed a new murine C57BL6/J double pigmented (B16-OVA) and non-pigmented tumour (B16-OVAmTYR-/-) model for treatment with 131I-ICF01012. This model made it possible to transpose clinical observations into a preclinical model. Moreover, two single-tumour models, one pigmented (B16-OVA) and one unpigmented (B16-OVAmTYR-/-), were used for control purposes. ***Results:*** After tumour growth and pigmentation characterization, imaging and biodistribution studies confirmed a 131I-ICF01012 accumulation in the pigmented tumour and an absence of binding in the non-pigmented tumour. In this double-tumour mouse model, 131I-ICF01012 significantly decreased the non-pigmented tumour volume 9 days after TRT injection. Immunofluorescence and transcriptomics studies showed a trend towards increased CD8+ T cells markers 6 days after treatment in the non-pigmented tumour of the double tumour model. ***Conclusion:*** Firstly, results showed it is possible to study the abscopal effect by inhibiting a target of interest, and this method can be extrapolated to other studies. Secondly, these results were the first to demonstrate the possibility of an abscopal effect in a pre-clinical model of pigmented and non-pigmented double-tumour melanoma after TRT with 131I-ICF01012. Finally, this project demonstrated the proof-of-concept of a double tumor model, one carrying the target and the other not, for the study of the abscopal effect following TRT. ***References:*** 1 Thivat, E et al. Phase I study of [131I] ICF01012, a targeted radionuclide therapy, in metastatic melanoma: MELRIV-1 protocol. BMC Cancer (2022)

OP-671

Discovery of [^{177}Lu]Lu-EVS459, a novel low-molecular weight radioligand therapy for the treatment of folate receptor positive cancers

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Aim/Introduction: Folate receptor (FR) α is a GPI-anchored protein present at the cell membrane and overexpressed in several types of epithelial cancers including ovarian, endometrial, lung and breast cancers. Due to its highly restricted expression in normal tissues, FRα is an attractive target for anti-cancer therapies, as demonstrated with the antibody-drug conjugate mirvetuximab soravtansine, recently approved by the FDA for the treatment of FRα-positive ovarian cancer. We report herein the discovery and preclinical characterization of [177Lu]Lu-EVS459 (alternative name GIZ943), a novel radioligand therapeutic targeting the FR, as well as [68Ga]Ga-EVS459, an associated PET radioligand for detection of FR-positive solid tumors. ***Materials and Methods:*** The drug precursor EVS459, composed of DOTA conjugated to a folic acid derivative via an optimized spacer, was radiolabeled with either lutetium-177 or gallium-68. Both [177Lu]Lu-EVS459 and [68Ga]Ga-EVS459 were evaluated in vitro in IGROV-1 cells for their binding affinity to FRα and specific cell uptake. The biodistribution, dosimetry, and anti-tumor activity of [177Lu]Lu-EVS459 was tested in two NSCLC PDX mouse models expressing different levels of FRα. SPECT/CT imaging was performed, and anti-tumor activity was measured over a 12-week period. In addition, the biodistribution of [68Ga]Ga-EVS459 was evaluated in tumor-bearing mice using PET imaging. ***Results:*** [177Lu]Lu-EVS459 and [68Ga]Ga-EVS459 demonstrated similar binding affinity and specificity to FRα in vitro. In tumor-bearing mice, [177Lu]Lu-EVS459 showed significant tumor uptake as visualized by SPECT imaging (24 hrs p.i.) and achieved tumor regression at a dose of 37 MBq q6w. The treatment was well tolerated, and all animals were still alive at the end of the 12-week observation period. PET images obtained 2 hrs after injection of [68Ga]Ga-EVS459 showed significant uptake in tumors and kidney, where FRα is expressed in the renal proximal tubules. ***Conclusion:*** We disclose the discovery and identity of lutetium-177 or gallium-68 radiolabeled EVS459, a novel low-molecular weight FR-targeting radiopharmaceutical. Preclinical evaluation of [177Lu]Lu-EVS459 supports its clinical development as a radioligand therapy targeting FR-positive tumors in patients. A phase 1 study is ongoing to evaluate the safety, tolerability, dosimetry, and preliminary anti-tumor activity of [177Lu]Lu-EVS459, as well as the safety and PET imaging properties of [68Ga]Ga-EVS459, see reference. ***References:*** Study Details | A Phase I Study of [177Lu]Lu-EVS459 in Patients With Ovarian and Lung Cancers | ClinicalTrials.gov

OP-672

Targeted radionuclide therapy of ovarian cancer stem cells with Terbium-161

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Aim/Introduction: Previously we have shown that the L1 cell adhesion molecule (L1CAM) in combination with CD133 defines a new ovarian cancer stem cell population (OCSC) with high resistance towards ionizing radiation. L1CAM was mainly responsible for the radioresistance of this cell population (1). Based on these results, we asked whether the in vivo efficacy of an anti-L1CAM radioimmunotherapy (RIT) against human OCSC using terbium-161 (161Tb) is sufficient, to eradicate these cells. We compared the 161Tb anti-L1CAM RIT with Lutetium-177 (177Lu) RIT in an OCSC xenograft model. Furthermore, to investigate L1CAM-associated radioresistance we explored L1CAM-regulated signalling pathways in OC cells. ***Materials and Methods:*** Immunofluorescence staining for L1CAM and CD133 was performed to confirm the presence of L1CAM+/CD133+ CSC in HGSOC patient samples. Cell uptake, and radiocytotoxicity of 161Tb- and 177Lu-labelled anti-L1CAM mAb chCE7 were analyse by MTT tests in OC cells. L1CAM+/CD133+ OCSCs were isolated via fluorescence-activated cell sorting (FACS) from OC cell lines and inoculated into CD-1 immunodeficient mice. Radioimmunotherapy with 80% MTD of [161Tb]Tb-DOTA-chCE7 and [177Lu]Lu-DOTA-chCE7 were performed to study the potential of 161Tb to eradicate CSCs compared to 177Lu. Proteomics and phosphoproteomics studies of L1CAM and L1CAM knockout OC cells were conducted to reveal L1CAM-associated signalling pathways, in particularly those involved in the radioresistance mechanisms. ***Results:*** In chemonaïve and relapse OC patient samples we found 0.3%-21% of L1CAM+/CD133+ cells. RICs showed similar uptake of 50%-75% in all tested OC cell lines. The 161Tb-labelled RIC resulted in significantly increased cytotoxicity in vitro with Log IC50 ± SD of -0.52 ± 0.61 (0.3 MBq/mL) for 161Tb, vs. 1.07 ± 0.13 (11.8 MBq/mL) for 177Lu in OVCAR8 and 0.68 ± 0.38 (4.8 MBq/mL) vs. 1.28 ± 0.23 (19.0 MBq/mL) in SKOV3ip cells. [161Tb]Tb-DOTA-chCE7 eradicated all tumour cells in vivo including the L1CAM+/CD133+ ovarian CSCs resulting in no tumour progression. In contrast, 177Lu was not sufficient to eradicate the CSCs. Phosphoproteomics profiling provided evidence, that L1CAM regulates phosphorylation of proteins involved in DNA damage response, and mTORC1-signalling pathways in OC cells. ***Conclusion:*** Anti-L1CAM 161Tb-based RIT represents a novel therapeutic option for CSC-targeted therapies and is a promising treatment strategy for clinical use. The higher radiotoxicity of 161Tb caused by the additional emission of Auger-electrons is sufficient to eradicate single cells. This property of 161Tb is an encouragement for the management of minimal residual disease. Further validation of the data related to L1CAM-mediated radioresistance regulation is underway. ***References:*** (1) Cancers 2020, 12, 217

OP-673

Preclinical characterization of a phage display derived MT1-MMP-specific bicyclic peptide for radiotheranostic application

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Aim/Introduction: Tumor-associated membrane type 1 matrix metalloproteinase (MT1-MMP) plays a particular role in extracellular matrix remodeling, resulting in metastatic dissemination. MT1-MMP expression is further associated with poor prognosis in a variety of cancers (e.g. non-small cell lung cancer, gastric and breast cancer). This study identifies and preclinically characterizes a phage display-derived MT1-MMP-targeting bicyclic peptide to investigate the clinical potential as theranostic agent. ***Materials and Methods:*** The MT1-MMP-targeting bicyclic peptide BCY25286 was radiolabeled with Ga-68 or Lu-177, respectively, and preclinically characterized with regard to stability, binding affinity to MT1-MMP and internalization properties. Subsequently, an organ distribution study (up to 24 h post injection (p.i.)) and µPET/MR imaging were performed using MT1-MMP+ HT1080 tumor-bearing nude mice. ***Results:*** Radiolabeling of BCY25286 resulted in radiochemical yields and radiochemical purity >99 % for both radionuclides, Ga-68 and Lu-177. The compound showed proteolytic stability in human and mouse serum up to 72 h. Besides MT1-MMP specific internalization a high binding affinity to MT1-MMP of 7.2 ± 1.6 nM was detected in vitro. Organ distribution studies revealed a significant MT1-MMP-specific tumor uptake of 10.6 ± 1.1 %ID/g at 1 h p.i. which was persistent up to 24 h p.i.. BCY25286 exhibited fast background clearance (< 1 %ID/g for all organs except the kidneys) resulting in high imaging contrast in µPET/MRI as early as 30 minutes p.i.. ***Conclusion:*** Aiming at tailor therapeutic strategies, MT1-MMP targeting bicyclic peptides might be a valuable tool for advanced radiotheranostic applications. Thus, the bicyclic peptide BCY25286 presenting high and specific tumor uptake with fast pharmacokinetic properties encourages further translational research for future clinical PET imaging and therapeutic management of patients.

OP-674

^{225}Ac-labeled anti-EGFR antibody drug radioconjugate elicits durable anti-tumor responses in mouse models of colorectal cancer

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Aim/Introduction: Overall survival of colorectal cancer (CRC) is poor because almost half of patients present with metastatic disease (stage III - IV) at initial diagnosis. About 85% of colorectal cancer (CRC) patients overexpress epidermal growth factor receptor (EGFR) with about 40% or 10% having KRAS or BRAF mutation, respectively. Here, we propose a theranostic approach that uses an anti-EGFR antibody-drug conjugate (ADC) radiolabeled with either 225Ac or 89Zr for therapy and imaging of KRAS-mutant/BRAF mutant EGFR-positive CRC mouse models. ***Materials and Methods:*** The ADC was developed by conjugating nimotuzumab to PEG6-DM1. Eighteen-membered macrocyclic bifunctional chelator p-Bz-SCN-macropa or deferoxamine (DFO) were used to conjugate nimotuzumab-PEG6-DM1 or matuzumab for radiolabeling with 225Ac and 89Zr, respectively. The immunoconjugate and radioimmunoconjugates were characterized by flow cytometry, bioanalyzer, radioligand binding assays, HPLC and internalization rate (live-cell imaging). In vivo

efficacy of [225Ac]Ac-Macropa-nimotuzumab-PEG6-DM1 was evaluated in mice bearing KRASG13D mutant DLD-1 or BRAFv600E mutant HT-29 xenografts. Dosimetry of [225Ac]Ac-Macropa-nimotuzumab-PEG6-DM1 was studied in healthy Balb-c mice. Tumor growth was monitored using digital caliper. Mice were treated with three doses of 350 nCi/dose administered 10 days apart. In vivo study endpoint was tumor volume >= 1500 mm3. ***Results:*** [225Ac]Ac-Macropa-nimotuzumab-PEG6-DM1 showed enhanced in vitro cytotoxicity compared with nimotuzumab-PEG6-DM1. [225Ac]Ac-Macropa-nimotuzumab-PEG6-DM1 extended the survival of mice in all tested xenografts compared to the control groups. For HT-29, the median survival was not reached for the 225Ac treated group while it was 24.5 and 39 days for the saline and nimotuzumab-PEG6-DM1 treated groups, respectively. Similar trends were observed for other xenografts. PET imaging before and after treatment of the orthotopic xenograft showed that 1/5 mice from the treatment group had complete remission and the agent prevented metastatic spread in the other mice (4/5), as compared with untreated mice. The results showed [225Ac]Ac-nimotuzumab-PEG6-DM1 was effective against KRASG13D and BRAFV600E mutant CRC models. ***Conclusion:*** [225Ac]Ac-Macropa-nimotuzumab-PEG6-DM1 is very effective against EGFR-positive CRC models and warrants further investigation. ***References:*** 1. Wang, J. et al. Metastatic patterns and survival outcomes in patients with stage IV colon cancer: A population-based analysis. Cancer Med 9, 361-373, doi:10.1002/cam4.2673 (2020).2 Matsuda, T. et al. Recent updates in the surgical treatment of colorectal cancer. Ann Gastroenterol Surg 2, 129-136, doi:10.1002/ags3.12061 (2018)

OP-675

Evaluation of Anti-uPAR Antibody as a Radiopharmaceutical for Imaging and Treatment of Solid Tumors

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Aim/Introduction: MNPR-101 is a humanized monoclonal antibody to the urokinase plasminogen activator receptor (uPAR). uPAR is over-expressed in multiple aggressive cancers, while it is rarely expressed in healthy tissue. uPAR has a pivotal role in cancer growth, invasion, and metastasis, rendering it a promising target for cancer diagnosis and therapy. MNPR-101 has high selectivity and affinity for uPAR. We conducted preclinical evaluation of MNPR-101 as a radiopharmaceutical agent for imaging and therapy in solid tumors. A first-in-human Phase 1 PET imaging study in advanced cancer patients was recently initiated. ***Materials and Methods:*** MNPR-101 was conjugated to a bifunctional chelator and labeled with zirconium-89 (89Zr) for PET imaging, and with lutetium-177 (177Lu) or actinium-225 (225Ac) for therapy. For preclinical evaluation, human cell lines of triple-negative breast and pancreatic cancer were cultured and injected subcutaneously in athymic nude mice to grow xenograft tumors. After administration of 89Zr labeled agent (~250 µCi), PET scans were performed at multiple time points. Ex-vivo biodistribution was measured using a gamma counter after the terminal imaging time point. Human absorbed dose estimates were predicted using data from this pre-clinical mouse study. After single dose administration of 177Lu (~100 - 250 µCi) or 225Ac (~100 nCi) labeled MNPR-101, mice were monitored for tumor growth and survival for 90 days. SPECT imaging of mice receiving 177Lu labeled agent was performed at multiple time points after drug administration. ***Results:*** MNPR-101 is highly specific for uPAR. Whole-body PET imaging of mice bearing uPAR expressing tumors showed high and selective uptake of the 89Zr-labeled antibody in the tumors. Ex-vivo distribution analysis confirmed that the tumors exhibited high uptake relative to blood and other organs. The animals did not show any reaction to the antibody or radiation-induced toxicities, and the absorbed dose estimates in humans are well within safety limits. Efficacy data using 177Lu or 225Ac labeled MNPR-101 showed near complete elimination of established tumors after a single injection of the agents. SPECT imaging of 177Lu labeled agent showed high specificity and durable tumor uptake relative to normal tissue. ***Conclusion:*** These preclinical studies support the development of MNPR-101-89Zr as a radio-diagnostic and the recently initiated first-in-human PET imaging study in various cancers. It also serves as a basis for future therapeutic studies using an actinium-225 (225Ac) or lutetium-177 (177Lu) labeled version of MNPR-101. Overall, the data show that MNPR-101 is a promising theranostic anti-cancer candidate for cancer treatment.

OP-676

Preclinical development of FL-091, a novel NTSR1 targeting radionuclide drug conjugate for the treatment of NTSR1-positive cancers

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Aim/Introduction: Neurotensin receptor 1 (NTSR1) belongs to the family of neurotensin receptors, which is the primary mediator of neurotensin signaling due to its sub-nanomolar affinity to its natural ligand. Overexpression of NTSR1 is associated with disease progression of multiple types of cancers, making it a promising target for diagnostic imaging and radionuclide drug conjugate (RDC) therapy. This study evaluated the preclinical characteristics of a novel NTSR1-targeted RDC, 177Lu-FL-091, which demonstrated favorable biodistribution profiles and encouraging anti-tumor activity in various tumor models. ***Materials and Methods:*** Protein expression of NTSR1 was evaluated by immunohistochemistry in tissue microarrays from tumor biopsies covering a variety of cancer types. Binding affinity against NTSR1 and internalization of 111In-labeled compounds were evaluated in NTSR1-epxressing HCT116 cells. The biodistribution profiles of 177Lu-labeled compounds were characterized by SPECT/CT and ex vivo biodistribution assays in mice bearing AsPC1 pancreatic cancer xenografts. The anti-tumor activities of 177Lu-labeled compounds were assessed in a set of NTSR1 expressing cancer xenograft models. ***Results:*** The NTSR1 positive rate ranged from 10.7% to 54.3% across different indications, with the highest rate in head and neck cancer and highest H-score in colorectal cancer. 111In-FL091 potently bound to NTSR1-expressing HCT116 cells with high internalization rate observed. High and sustained tumor uptake was shown for 177Lu-FL-091 in AsPC1 xenograft model with a fast clearance in normal organs. 177Lu-FL-091 demonstrated an improved biodistribution profile compared with industry reference 177Lu-3BP-227, with a 2-fold higher tumor radiation load and 2 to 4-fold higher tumor to normal organ ratios. Moreover, 177Lu-FL-091 exhibited promising in vivo anti-tumor activity in multiple xenograft models. In the PC-3 model (AR and PSMA expression negative), a single dose of 177Lu-FL-091 at 37 MBq induced >30% tumor shrinkage in all treated mice. In AsPC-1 and HT-29 models, a single dose of 177Lu-FL-091 at 37 MBq resulted in superior anti-tumor activity compared with 177Lu-3BP-227 ($p<0.05$) at the same dose level.

Efficacy in all models was achieved without negatively affecting body weight and the treatment was well tolerated at dose levels up to 148 MBq, suggesting a favorable safety profile of 177Lu-FL-091. ***Conclusion:*** NTSR1 was highly expressed across multiple types of cancers, especially in head and neck and colorectal cancer. These data, along with the encouraging anti-tumor activity observed across in vivo models, suggest that 177Lu-FL-091 is a promising RDC candidate for the treatment of NTSR1-positive cancers. Studies to investigate FL-091 conjugated to the radionuclide Actinium-225 are in progress.

1505

Tuesday, October 22, 2024, 15:00 - 16:30
Hall Y4-Y9

Cutting Edge Science Track - TROP Session: Physics Committee: Radiomics

OP-677

Enhanced Lung Cancer Survival Prediction via Semi-Supervised Learning and Pseudo-Labeling Applied to Diverse PET/CT Data Sources

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Aim/Introduction: The high mortality and low survival rates associated with lung cancer (LCa) highlight the critical need for precise survival predictions to customize treatment plans. This study explores using diverse datasets from various diseases, like head and neck cancer (HNCa), in a semi-supervised model employing pseudo-labeling to enhance prediction accuracy by addressing dataset size limitations. It contrasts these methods with traditional models that only use LCa data. The study applies machine learning (ML) techniques to both Handcrafted and Deep Radiomic Features (HRF and DRF) from PET and CT images to improve survival predictions for LCa patients. ***Materials and Methods:*** 221 LCa patients with both PET & CT images, obtained from The Cancer Imaging Archive (TCIA) and our local database, alongside 408 HNCa with PET & CT images from TCIA, underwent registration, SUV correction, clipping, and normalization. We enhanced risk modeling with two frameworks implemented within ViSERA software (visera.ca): 215 HRFs from PySERA, and 1024 DRFs from an Autoencoder's bottleneck layer, applied to primary tumors. Supervised and semi-supervised techniques were used to predict overall survival outcomes, categorizing them into two classes: class 1, alive after two years (averaged death time in LCa dataset), and class 2, deceased within two years of diagnosis. The supervised approach employed a Principal Component Analysis (PCA) algorithm combining three classifiers—Multilayer Perceptron (MLP), Support Vector Machines, and K-nearest neighbors (KNN)—on both HRF and DRF sets. Meanwhile, the semi-supervised method expanded the dataset by incorporating 408 pseudo-labeled HNCa cases alongside 221 LCa cases, applying identical ML methods. A Random Forest algorithm was used to label the HNCa cases based on training data, which were then included in the training dataset for further use. Datasets were divided into 80% for five-fold cross-validation (FFCV) and 20% for external nested testing, optimizing algorithms through grid search. ***Results:*** ML systems employed in the semi-supervised approach significantly outperformed the supervised approach (p-value<0.05, paired t-test). In semi-supervised approach, the best averaged FFCV accuracy of 0.85±0.05 with external nested testing of 0.80±0.01 was obtained by DRFs extracted from PET, linked with PCA+MLP. By contrast, in supervised approach, the highest averaged FFCV accuracy of 0.65±0.08 with external nested testing of 0.64±0.06 was obtained by DRFs extracted from CT, linked with PCA+KNN. ***Conclusion:*** We showed that semi-supervised approach integrating HNCa datasets with labeled LCa data, linked with HRFs/DRFs from PET/CT images significantly outperformed traditional supervised learning in predicting LCa patient survival (p-value<0.05, paired t-test)

OP-678

Are early and delta radiomic features more useful to predict prognosis in locally advanced cervical cancer patients than baseline radiomic features?

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Aim/Introduction: This study investigated whether radiomic features extracted from $^{[18F]}$FDG PET scans acquired before treatment (baseline) and after 2 weeks of neoadjuvant treatment (early), and the variation between the two timepoints (delta), could predict prognosis in locally advanced cervical cancer (LACC) patients treated with neoadjuvant chemo-radiotherapy (CRT) followed by surgery. ***Materials and Methods:*** We retrospectively reviewed medical records of patients with LACC referred to the Gynaecologic Oncology Unit of Gemelli IRCCS between July 2010 and July 2016. The following patients' characteristics were retrieved: age, FIGO stage, histotype, tumour grade, pathological residual disease after surgery and pelvic nodal involvement. $^{[18F]}$FDG-PET/CT was performed before neoadjuvant CRT (baseline) and 2 weeks after the start of treatment (early). Radiomic features were extracted after semi-automatic delineation of the primary tumour, on baseline and early PET images, with a background-corrected 50% isocontour of the SUVpeak. In addition, delta radiomics were calculated as the relative differences between baseline and early features. Patients were split into a training (n=76, 80%) and test cohort (n=19, 20%). We performed 5-fold cross validation stratified for the outcomes (recurrence and cancer-specific death), integrating dimensionality reduction of the radiomic features using redundancy filtering (threshold: 0.8) and variable hunting with importance within the folds. After supervised feature selection, we built for each timepoint a radiomic model with the best-performing features; clinical models (based on patients' clinical characteristics) and combined

clinico-radiomic models were also built. Model performances are presented as test cohort C-indices, for prediction of recurrence/progression (disease-free survival, DFS) and cancer-specific death (overall survival, OS). ***Results:*** 95 patients were included. With a median follow up of 76.0 months (95% CI: 59.5-82.1), 31.6% of patients had recurrence/progression and 20.0% died of LACC. None of the models could predict DFS (C-indices ≤ 0.70). Model performances for OS yielded slightly better results, with mean C-indices of 0.75 for both the radiomic and combined model based on early features, 0.79 and 0.78 for the radiomic and combined model derived from delta features, and 0.74 for the clinical models. ***Conclusion:*** $^{[18F]}$FDG PET early and delta radiomic features could not predict DFS in patients with LACC treated with neoadjuvant CRT followed by surgery. Although slightly improved performances for the radiomic and combined models were observed in the prediction of OS compared to the clinical model, the added value of these information seems to be limited, compared to the challenging process of feature extraction.

OP-679

A new evaluation of whole-mount Gleason grading in prostate cancer for identifying radical prostatectomy candidates: a multiomics study using machine learning

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Aim/Introduction: In the clinical setting, the decision on whether prostate cancer (PCa) patients undergo the radical prostatectomy (RP) depends on the whole mount Gleason grading (GG) predicted by biopsy proven Gleason Score (bxGS). However, there is a huge discrepancy between bxGS and whole mount GG after RP. Therefore, a more effective approach for evaluating whole-mount GG is essential to accurately determine candidates for RP. Our study aims to evaluate the accuracy of a multiomics-based machine learning (ML) model in grading GG in PCa and compare its effectiveness against bxGG. ***Materials and Methods:*** In this side study, 146 PCa patients from a prospective clinical trial (NCT02659527) were analyzed. These patients had undergone integrated 68Ga-PSMA-11 positron emission tomography (PET)/magnetic resonance (MR) prior to RP from May 2014 to April 2020. The multiomics ML model was developed using radiomics features from PET/MR images, genomics features from whole exome sequencing, and pathomics features from immunohistochemical staining of 11 biomarkers. Five ML models were then built and tested through 100-fold Monte Carlo cross-validation. ***Results:*** Of the five ML models, the random forest (RF) model achieved the highest area under the curve (AUC). It outperformed the bxGG in AUC (0.87 vs. 0.75), specificity (0.72 vs. 0.61), positive predictive value (0.79 vs. 0.75), and overall accuracy (0.78 vs. 0.77), although it had a slightly lower sensitivity (0.83 vs. 0.89) and negative predictive value (0.80 vs. 0.81). In terms of feature importance, bxGG was the most critical, followed by pathomics, clinical, radiomics, and genomics features. The top individual features were bxGG, PSA staining, and an intensity-related radiomics feature. A surrogate model was developed to create a simplified diagnostic process that mirrors the more complex ML model (Randdom Forest). This streamlined diagnostic approach incorporated three features—GLCM_Joint Energy, PSAmax_IHC, and bxISUP—achieving an area under the curve (AUC) of 0.89 in approximating the output of the intricate ML model. ***Conclusion:*** The multiomics-based ML model proved more effective than traditional bxGG in assessing whole-mount GG in PCa, enhancing the ability to tailor management strategies for low-risk patients to avoid unnecessary treatment. ***References:*** 1. Yeldir N, Yildiz E, Dündar G: Gleason Score Correlation Between Prostate Needle Biopsy and Radical Prostatectomy Materials. Turk Patoloji Derg 35:185-192, 2019 2. Mansouri N, Msakni I, Gargouri F, et al: Evaluation of concordance of Gleason score between prostate biopsy and radical prostatectomy. Tunis Med 96:430-436, 2018

OP-680

Predicting PD-L1 expression and survival in NSCLC through deep learning incorporating non-invasive measurements and multi-modal PET/CT fusion

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Aim/Introduction: The approved diagnostic biomarker for immunotherapy in lung cancer is Programmed Death-Ligand 1 (PD-L1), assessed through immunohistochemical assays. However, challenges arise from the invasive sampling and intertumoral heterogeneity associated with the tumor proportion score (TPS) of PD-L1. There is therefore a significant interest for the non-invasive measurement of PD-L1 expression signature using imaging techniques. We have previously shown that artificial intelligence (AI) models using a combination of computed tomography (CT) and positron emission tomography (PET) images can predict the status of PD-L1. Our hypothesis in this work is that combining deep learning features and hand-crafted radiomics can improve the model's performance. ***Materials and Methods:*** We used the PET and CT scans of 189 non-small cell lung cancer (NSCLC) patients with PD-L1 status and employed three (PET/CT early fusion features, radiomics features and the combination of both) data pipelines as separate inputs in the constructed classifier for the prediction and evaluation tasks. The deep learning multi-modal early fusion features were obtained using a 3D ResNet model. Models were assessed utilizing areas under the receiver operating characteristic curves (AUCs) considering 95% confidence interval (CI). ***Results:*** The combined model demonstrated the best performance with an AUC of 0.89 (95% CI, 0.88-0.94) for PD-L1 prediction in the testing cohort. Moreover, training the combination model on multi-source features yielded superior overall survival evaluation performance (C-index: 0.86) compared to using radiomics (C-index: 0.81) and deep features features (C-index: 0.76). ***Conclusion:*** A non-invasive assessment leveraging deep learning with multi-modal PET/CT fusion combined with the use of hand-crafted radiomics features provides the best performance in non-invasive image based PD-L1 expression prediction in NSCLC. ***References:*** Toshiaki Takahashi, Akiko Tateishi, Andrey Bychkov,and Junya Fukuoka, "Remarkable alteration of PD-L1expression after immune checkpoint therapy in patientswith non-small-cell lung cancer: two autopsy case re-ports," International Journal of Molecular Sciences,vol. 20, no. 10, pp. 2578, 2019.and Junya Fukuoka, "Remarkable alteration of PD-L1expression after immune checkpoint therapy in patientswith non-small-cell lung cancer: two autopsy case re-ports," International Journal of Molecular Sciences,vol. 20, no. 10, pp. 2578, 2019.

OP-681

Predictive Efficacy of a Radiomics Random Forest Model to Characterize Growth Potential of Neuroendocrine Cancer Lesions on 68Ga-DOTATATE PET

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Aim/Introduction: Neuroendocrine tumors (NETs) are a rare, but increasingly incident contingent of cancers. Their growth and prognosis vary widely according to their pathological grading obtainable via invasive methods. This study aims at using radiomics on 68Ga-DOTATATE PET scans to build a random forest (RF) machine learning model that predicts NET lesions growth potential. ***Materials and Methods:*** Patients with NETs who have undergone two or more 68Ga-DOTATATE studies within a 2-year interval were retrospectively randomly selected, for a total of 298 individual NET lesions across 53 patients. For each patient, semi-automatic lesion segmentation was performed on the first study using the software MIM Encore, whereas the second study was used to assess individual lesion growth based on a modified RECIST 1.1 scale. 108 radiomic features were extracted from each lesion's volume of interest (VOI) using PyRadiomics. VOIs were then randomly split in training and validation sets (8:2 ratio). Using Python's scikit-learn library, the training data was used to build RF prediction models and perform hyperparameter tuning using 5-fold cross-validation to optimize area under curve (AUC). This step was iterated 1000 times, building different RF models by changing the random seed used to generate the decision trees and to perform the randomized search necessary for hyperparameter optimisation. The model that scored the highest AUC on the validation group was retained and its final performance was also assessed using accuracy, sensitivity, and specificity. ***Results:*** The final RF model had a high AUC of 0.93 coupled with a predictive accuracy of 0.85 on the training group. When tested on the validation group, AUC was 0.77 and accuracy was 0.72, along with a sensitivity of 0.66 and a specificity of 0.74 at predicting progressive NET lesions. Among the most important radiomic features used by the RF's decision trees, we note gray-level co-occurrence correlation, gray-level size zone variance and least axis length, which were all significantly superior in progressive NETs ($p<0.05$). Interestingly, while the shape elongation feature was not a significant predictor when considered individually ($p=0.69$), it had the highest feature importance score when used in conjunction with other features as a part of the RF model. ***Conclusion:*** This study showcases the potential of combining radiomics and machine learning to easily and non-invasively assess for NET lesions growth potential. An optimized RF model trained on extensive data could eventually help physicians plan localized treatment selection for patients suffering from NETs, improving their prognosis.

OP-683

Evaluation of PET-CT scans radiomics features in NSCLC patients with metastatic hilar/mediastinal lymph nodes.

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Aim/Introduction: Accurate identification of Lymph Node Metastasis (LNM) is essential for optimal therapy selection and prognosis in Non-Small Cell Lung Cancer (NSCLC) patients. While complete excision and histopathology of lymph nodes (LN) are highly accurate, they increase patient trauma. Thus, developing a non-surgical approach using radiomic biomarkers from PET/CT images could significantly enhance the clinical diagnosis of nodal metastasis in NSCLC (1). This study hypothesizes that radiomics will accurately predict LNM in NSCLC and aims to develop and validate a prognostic radiomics model for this purpose. ***Materials and Methods:*** The study analyzed 383 patients with NSCLC, extracting 158 RFs from each tumor. Variable selection was performed using the Mann-Whitney U test to discern RFs with significant differences between the LNM group and the non-LNM group. Multicollinearity among these RFs was assessed using the variance inflation factor. Thirteen RFs showing significant associations ($p < 0.05$) were incorporated into the final logistic regression model, alongside age, gender, radiological stage, and PET-derived predictors. The model's robustness was quantified through regression coefficients, hazard ratios, and confidence intervals, and validated using 10-fold cross-validation. ***Results:*** In the predictive model, age was identified as a significant risk factor, indicating that younger patients with NSCLC are more prone to LNM. Furthermore, both tumor volume and maximum standardized uptake value (SUVmax) were significantly associated with an increased risk of LNM, with larger tumor volumes and higher SUVmax serving as predictors of LNM. The model also underscored important Gray Level Co-occurrence Matrix features, such as inverse difference and correlation. A reduced inverse difference within the LNM group suggests heightened tumor heterogeneity, whereas an elevated correlation reflects more complex non-linear relationships among the grey-level values of the tumor. Moreover, an increase in zone variance among the LNM group was indicative of more pronounced heterogeneity relative to the non-LNM group, further characterizing the textural differences observed between the two groups. ***Conclusion:*** A predictive model using radiomics was developed to non-invasively assess LN status in NSCLC patients, potentially enhancing precision oncology and influencing treatment decisions. Future work will extend our analysis to include RFs from metastatic LNs and explore their potential as predictors of overall survival and prognosis in primary tumors, enhancing disease understanding and treatment strategies. ***References:*** Liu Y, Kim J, Balagurunathan Y, Hawkins S, Stringfield O, Schabath MB, et al. Prediction of pathological nodal involvement by CT-based Radiomic features of the primary tumor in patients with clinically node-negative peripheral lung adenocarcinomas.

OP-684

Comparative machine learning approach to evaluate the role of [18F]FDG PET radiomics for preoperative characterization of endometrial cancer

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Aim/Introduction: Comparative analyses of machine learning (ML) models performance is limited in literature. This study aims at investigating the role of radiomics in assisting the presurgical characterization of endometrial cancer (EC), by comparing several ML approaches. ***Materials and Methods:*** Retrospective study including 169 EC patients who underwent [18F]FDG PET for preoperative staging. Post-surgical assessment of lymph nodal (LN) metastases, p53 immunohistochemical analysis, and post-surgical administration of adjuvant therapy (AT) were used as reference standards. Primary EC tumors were manually segmented; images were resampled, normalized and discretized, and radiomic features (RFs) were extracted. RFs were selected for their robustness against inter-observer segmentation variability. The cohort was split into training (70%) and test (30%) in a stratified manner; in the training set, RFs were selected using the minimum redundancy maximum relevance (mRMR) algorithm and used to train different ML models, including linear discriminant analysis (LDA), logistic regression (LR), support vector machine (SVM) and k-nearest neighbour (KNN). In case of imbalanced classes, synthetic data were generated to oversample the minority class in the training set. Area under the curve (AUC), balanced accuracy (bACC), sensitivity (SN), specificity (SP), positive and negative predictive values (PPV, NPV) were collected on the test set for each model and compared using mcNemar test. ***Results:*** LN histological examination was available for 150/169 patients (85% LN-; 15% LN+), p53 data was available for 122/169 patients (37% p53abn; 63% p53 wild-type), and in 84/166 patients adjuvant therapy was administrated. Oversampling of the minority class was performed for LN and p53 predictions. ML models were first trained using the complete radiomic signature, and then features were iteratively removed based on the mRMR ranking, each time repeating model's training. Entropy and Metabolic Tumour Volume (MTV) parameters were overall selected in the radiomic signature of each outcome. Models achieved AUC=79% (bACC=76%, SN=82%, SP=71%, PPV=47%, NPV=92%) for LN, AUC=77% (bACC=78%, SN=92%, SP=64%, PPV=55%, NPV=94%) for p53, and AUC=77% (bACC=74%, SN=76%, SP=72%, PPV=73%%, NPV=75%) for AT; according to mcNemar test, no statistical significance was found among the 4 investigated classifiers for each outcome (p>0.05). ***Conclusion:*** Application of radiomics for presurgical EC characterization appears to provide comparable promising results, regardless of the specific ML model employed.

OP-685

The role of ^{18}FPSMA-1007 PET/MRI radiomics in the diagnosis of malignant prostate lesion and clinically significant prostate cancer

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Aim/Introduction: Prostate cancer (PCa) is a malignant tumor with high heterogeneity, which creates a challenge for early diagnosis. Positron emission tomography (PET) imaging with the tracer of prostate specific membrane antigen (PSMA) is used for staging and biochemical recurrent PCa. Radiomics has demonstrated superiority over visual image interpretation for making a precise diagnosis. Herein, the purpose of this study was to evaluate the application value of 18FPSMA-1007 PET/MRI-T2-derived radiomics in distinguishing malignant prostate lesion and clinically significant prostate cancer (cPCa) from benign prostatic disease in newly diagnosed patients. ***Materials and Methods:*** Patients (n= 176) with suspected PCa, who underwent 18FPSMA-1007 PET/MRI and pathological biopsy within 1 month after 18FPSMA-1007 PET/MRI, were retrospectively analyzed. 74 patients were found malignant prostate lesion, and 30 patients were diagnosed as cPCa, cPCa was defined as ISUP GG (the International Society of Urological Pathology grade group) ≥ 3. PET and MRI-T2 radiomic features were extracted by using LIFEx (7.3.0) according to the image biomarker standardization initiative (IBSI) guidelines. Clinical data were collected, including age, tPSA, PSA density (PSAD) and miPSMA expression score. Five different models were developed and calculated their performances, including 1) clinical model, 2) PET radiomic model, 3) MRI-T2 radiomic model, 4) PET+MRI-T2 radiomic model, 5) PET+MRI-T2+clinical model. A cross-validation approach was used to evaluate the internal validity of the models. ***Results:*** The best performed radiomic model was PET+MRI-T2 radiomic model, showing high showing sensitivity, specificity, accuracy, AUC of 0.797, 0.892, 0.852, 0.888 and 0.733, 0.884, 0.858, 0.890 for diagnosing malignant prostate lesion and cPCa respectively. PET+MRI-T2 radiomic model outperformed both the PET radiomic model and MRI-T2 radiomic model (all P< 0.05). PET radiomic model was superior to MRI-T2 radiomic model (P= 0.018), when distinguishing malignant prostate lesion from benign prostatic disease, but not for diagnosing cPCa (P= 0.654). However, an addition of the clinical model to the radiomic model did not improve the diagnostic performance for diagnosing malignant prostate lesion (P= 0.067) and cPCa (P= 0.060). The performances of PET+MRI-T2 radiomic model and PET+MRI-T2+clinical model as per the cross-validation scheme yielded an accuracy of 0.837 (AUC=0.853) and 0.837 (AUC=0.890) for diagnosing malignant prostate lesion, as well as 0.838 (AUC=0.860) and 0.801 (AUC=0.891) for cPCa. ***Conclusion:*** The combination of PET+MRI-T2 radiomic model outperformed single radiomic model of PET and MRI-T2 for diagnosing malignant prostate lesion and cPCa, and there was no significant difference after an addition of clinical data.

1506

Tuesday, October 22, 2024, 15:00 - 16:30
Hall Z

Clinical Oncology Track - TROP Session: Oncology & Theranostics Committee: Prostate Cancer Therapy and Gynaecolgical Tumours

OP-686

Safety and Efficacy of Short Intensive Treatment with Two Cycles of 7.4GBq [^{177}Lu]Lu-PSMA-I&T in Two Weeks for Patients with mCRPC

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Aim/Introduction: Peptide radio ligand therapy (PRLT) is gaining ground in the treatment of metastatic castration resistant prostate cancer (mCRPC). Based on the VISION trial, most centres administer

PRLT cycles six weeks apart (4-6 cycles) with intermittent clinical assessment, biochemical assessment and sometimes imaging. However, the best timing and criteria for on-treatment assessment are yet unclear. Ideally non-responders are identified before they have undergone the standard 4-6 cycles. Another published strategy involves two cycles with a two-week interval. [1] This condensed treatment regimen may deliver more radiation dose in the first and most potent phase of treatment, and it allows standardized response evaluation prior to continued treatment. We therefore opted to administer the first two cycles of 7.4 GBq [177Lu]Lu-PSMA-I&T only two weeks apart. Safety and efficacy are reported. ***Materials and Methods:*** All patients who started this regimen in the first two years at our centre are included in this retrospective analysis. Clinical, biochemical and imaging response are reported, as well as haematological toxicity. ***Results:*** The 112 patients were extensively pre-treated, with median 4 prior lines of therapy for mCRPC. Only one did not receive either androgen receptor-targeted agents (low PSA) or chemotherapy (refused) prior to PRLT. Baseline ECOG score was 0-1 in 65%, score 2 and 3 in 32% and 3%, respectively. CTCAE grade 3 anaemia was seen in four patients and grade 3 thrombocytopenia in three patients. There was no grade 4 haematotoxicity. No grade 3-4 xerostomia was reported. At four weeks post-treatment, a PSA decrease ≥50% was seen in 41%, and ≥90% in 10% of patients. Thirty-six patients (32%) stopped after the first or second cycle due to either biochemical progression (15%), progression on CT only (3%) or because they became clinically/biochemically unfit (14%). Of the 63 patients who had a contrast enhanced CT at baseline and four weeks post-treatment, 33% did not have RECIST 1.1 measurable disease. Of the 42 patients with measurable disease, 26% showed partial remission. Stable disease and progressive disease were seen in 55% and 19% respectively. ***Conclusion:*** Two cycles of 7.4 GBq [177Lu]Lu-PSMA-I&T two weeks apart can be safely administered, with haematological toxicity within an acceptable range. Biochemical response at four weeks after only 2 cycles is promising. ***References:*** [1] Tagawa et al. JCO 35 (2017)

OP-687

Targeted radionuclide therapy in metastatic prostate cancer using a new PSMA ligand radiolabelled with terbium-161 ([^{161}Tb]Tb-SibuDAB) - dose identification/ escalation Phase Ia/b study

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Aim/Introduction: PROGNOSTICS phase Ia study (NCT06343038) aims to determine the absorbed doses in tumors and relevant organs after test injection of [161Tb]Tb-SibuDAB in comparison to [177Lu]Lu-PSMA-I&T in patients with metastatic castration resistant prostate cancer (mCRPC). SibuDAB is a novel peptidomimetic, developed at PSI, derived from a urea-based PSMA-binding entity which is conjugated to (S)-ibuprofen to provide albumin-binding properties with potential for enhanced tumor accumulation. ***Materials and Methods:*** In this prospective randomized, cross-over, single-blind phase Ia study, 10 patients will receive 1 GBq [161Tb]Tb-SibuDAB and 1 GBq [177Lu]Lu-PSMA-I&T over a 3-week interval. Quantitative SPECT/CT imaging will be performed (~3, 24, 48, and 168 h) after infusion of both radiopharmaceuticals to calculate tumor and organ absorbed doses (3D dosimetry using a Monte Carlo-based OSEM algorithm). Additionally, multiple "omics" (clinical-/ biochemical-/ imaging-/ cellular-/ transcriptomes) as well as circulating tumor cells and tumor-cell clusters will be evaluated as potential predictive biomarkers for RLT response and toxicity. ***Results:*** So far, 4 of 10 patients have been enrolled. Of them, 2 patients have received both the [161Tb]Tb-SibuDAB test injection and the [177Lu]Lu-PSMA-I&T comparator. After injection of only 1 GBq [161Tb]Tb-SibuDAB, SPECT/CT revealed excellent image quality with intense tumor uptake. To date, dosimetry results (including all four imaging time points) are available for the first patient. The mean absorbed tumor doses after [161Tb]Tb-SibuDAB and [177Lu]Lu-PSMA-I&T test injections were 8.6 and 4.0 Gy/GBq, respectively. The mean absorbed kidney doses were 2.5 vs 1.4Gy/GBq, respectively. The mean absorbed parotid doses were 0.29 vs 0.16 Gy/GBq, respectively. Blood derived bone marrow dosimetry revealed 0.107 vs 0.021 Gy/GBq, respectively. The tumor-to-kidney and tumor-to-parotid ratios were slightly higher for [161Tb]Tb-SibuDAB: 3.4 vs 2.9, respectively and 30 vs 25, respectively; while the tumor-to-marrow ratio was lower for [161Tb]Tb-SibuDAB, likely reflecting the longer circulation time: 80 vs 188, respectively. The effective tumor half-life was clearly superior for [161Tb]Tb-SibuDAB compared to [177Lu]Lu-PSMA-I&T: 120 vs 64 hours, respectively. No drug induced adverse events (according to CTCAE 5) have been recorded. ***Conclusion:*** Preliminary data of PROGNOSTICS study showed promising results with high tumor dose after [161Tb]Tb-SibuDAB test injection without adverse events. Complete data, including comparative dosimetry of the entire cohort, will be presented.

OP-688

A Decline in Alkaline Phosphatase After First Dose of Radium-223 and Outcomes in Patients With Metastatic Castration-Resistant Prostate Cancer

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Aim/Introduction: Validated predictive biomarkers of response to radium-223 dichloride (223Ra) therapy would help identify patients with metastatic castration-resistant prostate cancer (mCRPC) most likely to benefit from treatment. In patients treated with 223Ra, ALP levels have been shown to decline throughout treatment. We evaluated whether ALP decline after first 223Ra injection can predict longer OS, using data from the prospective, multicentre, real-world REASSURE study (NCT02141438). ***Materials and Methods:*** This descriptive analysis investigated associations between ALP decline after first 223Ra cycle and OS in patients with mCRPC and bone metastases who received ≥1 223Ra dose. Baseline ALP (normal [≤147 U/L] or high [>147 U/L]) and extent of ALP decline 4 weeks after first 223Ra injection (<10% [no decline] or ≥10% [decline]) were used to divide patients into five subgroups: normal ALP/decline (group 1), normal ALP/no decline (group 2), high ALP/decline (group 3), high ALP/no decline (group 4) and a combined group (5), which included groups 1-3. ***Results:*** 811 patients were analysed; 238 (29%) in group 1, 209 (26%) in group 2, 258 (32%) in group 3, 106 (13%) in group 4 and 705 (87%) in group 5. Median duration of observation was 13.4 months (range 1.1-48.7). Median ALP levels at baseline were 92.5 (group 1), 76.0 (group 2), 298.5 (group 3) and 269.0 (group 4) U/L. More patients in groups 1 and 2 received ≥5 223Ra injections (84% and 77%, respectively) than in groups 3 and 4 (68% and 49%, respectively). Median OS was 21.5 months (95% CI, 18.5-23.6), 19.4 months (16.0-21.0), 12.2 months (10.8-14.1), 9.0 months (7.6-10.7) and 17.0 months (16.0-18.2) in groups 1-5, respectively. ***Conclusion:*** Patients with a decline in ALP following first 223Ra dose showed improvements in OS versus those who did not, with this finding being more pronounced in those with high ALP at baseline than in those with normal ALP. Patients in group 4 had worse OS versus all other groups (1-3 and 5). As in other reports, patients with normal ALP at baseline had a longer OS than those with high ALP, perhaps limiting the benefit of ALP decline for patients with normal ALP at baseline. Longer survival may be due in part to the higher rates of 223Ra completion among patients with normal ALP at baseline or an ALP decline. These results, along with other clinical features, may be of benefit when monitoring patients during therapy.

OP-689

Results of phase 2 study of [^{177}Lu]Ludotadipep for metastatic castration-resistant prostate cancer

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Aim/Introduction: [177Lu]Ludotadipep is a radiopharmaceutical developed for prostate specific membrane antigen (PSMA) targeting radioligand therapy (RLT) and contains albumin binders to increase the circulation time. The phase 1 clinical trials were completed in South Korea and the United States [1, 2]. The phase 2 trial with up to 6 cycles of [177Lu]Ludotadipep (3.7 GBq each cycle) completed enrollment, and the last subject has received the second dose at the time of writing (clinical trial number NCT05579184). This phase 2 trial is the first multi-cycle RLT performed in metastatic castration-resistant prostate cancer (mCRPC) patients of Korean ethnicity, who as an ethnic group had not been well-represented in previous clinical trials, and aimed to evaluate the efficacy of repeat doses of [177Lu] Ludotadipep. ***Materials and Methods:*** In this open-label, phase 2 trial, participants with mCRPC who had been previously treated with at least one second-generation hormonal agent or standard taxane-based chemotherapy but progressed were enrolled. Both PSMA and FDG PET/CT were obtained, and the metastatic lesions had to be PSMA positive (>liver activity) without any lesion showing higher FDG uptake than PSMA uptake. Scheduled for up to 6 cycles at 8-week intervals with fixed dose of 3.7 GBq of [177Lu]Ludotadipep, the subjects were assessed with PSMA PET/CT and laboratory follow-up after each cycle. ***Results:*** Total 60 patients were screened, and 23 were considered ineligible due to higher FDG uptake than PSMA uptake in metastatic lesion(s). For the 20 enrolled patients, the baseline PSA was 228.7±239.6 ng/dl (mean±standard deviation). After average number of 3 cycles at the time of writing, 12/20 of participants achieved a ≥50% reduction in PSA levels. Three patients so far have attained complete response with undetectable PSA levels (two after 3 cycles, one after 4 cycles). Grade 3 or 4 adverse events were observed in 5 patients: thrombocytopenia (n=2), pathologic fracture, sepsis and weakness in both legs. ***Conclusion:*** Interim results signal that multiple cycles of 3.7 GBq [177Lu] Ludotadipep could be an effective radiopharmaceutical for RLT in mCRPC patients of Korean ethnicity. ***References:*** 1. Ha, S., et al., Dosimetric Analysis of a Phase I Study of PSMA-Targeting Radiopharmaceutical Therapy With [(177)Lu]Ludotadipep in Patients With Metastatic Castration-Resistant Prostate Cancer. Korean J Radiol, 2024. 25(2): p. 179-188. 2. Shin, D., et al., A Single Dose of Novel PSMA-Targeting Radiopharmaceutical Agent [(177) Lu]Ludotadipep for Patients with Metastatic Castration-Resistant Prostate Cancer: Phase I Clinical Trial. Cancers (Basel), 2022. 14(24).

OP-690

Investigating Combination Therapy: The Impact of [^{177}Lu]Lu PSMA and Androgen Receptor Pathway Inhibitors in Metastatic Castration Resistance Prostate Cancer

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Aim/Introduction: Androgen deprivation therapy (ADT) and androgen receptor pathway inhibitors (ARPis) are among the most important treatment options in metastatic castration-resistant prostate cancer. Despite these therapies, most patients develop resistance to castration. The aim of this study is to investigate the efficacy of [177Lu]Lu PSMA therapy, alone or in combination with androgen inhibitors such as abiraterone and enzalutamide, prostate cancer patients who are resistant to previous systemic therapies. ***Materials and Methods:*** In our study, 104 patients with mCRPC who had received [177Lu]Lu PSMA at Yeditepe University Hospital were retrospectively analyzed. The mean age of the patients was 65.7 ± 12.5 years. In this study, 60% of the patients also received ADT. Thirty-four patients (33%) received ARPi treatment in combination with [177Lu]Lu PSMA therapy. The remaining patients received [177Lu]Lu PSMA therapy after discontinuing ARPIs (74%). The median number of [177Lu]Lu PSMA cycles administered was 4 (range: 1-8). ***Results:*** According to the results of the univariate analysis, progression-free survival (PFS) was significantly prolonged in patients who received ARPI

treatment in combination with [177Lu]Lu PSMA. The median PFS was 11 months (4.9-17) for patients receiving combined therapy, compared to 5.9 months (3.4-8.4, p=0.013) for those receiving [177Lu]Lu PSMA therapy alone. The median PFS for all patients receiving [177Lu]Lu PSMA therapy was 6.8 months. In our evaluation of median overall survival (OS) among patients receiving the combination therapy of [177Lu]Lu PSMA and ARPi, we noted a numerically enhanced OS compared to those administered [177Lu]Lu PSMA as monotherapy. Although the observed difference did not achieve statistical significance (p=0.06, 20.3 vs. 15.9 months; HR: 0.58, 95% CI: 0.33-1.02), multivariate analysis indicated a significant improvement in OS favoring the combination therapy (p=0.01, HR: 0.58, 95% CI: 0.25-0.86). Further scrutiny revealed a strong association between age and superior OS outcomes (p<0.001, 21.2 vs. 12.4 months; HR: 0.50, 95% CI: 0.30-0.83). For patients receiving [177Lu]Lu PSMA therapy as second-line therapy, PFS was 8.6 months compared to 6.7 months for the others, but this did not reach statistical significance (p=0.44; Table 1). Regarding the side effect profile, grade 3 myelotoxicity occurred in 8 patients (9%) and grade 1-2 nephrotoxicity according to CTCAE v 5 occurred in 12 patients (13%). ***Conclusion:*** In conclusion, [177Lu]Lu PSMA therapy in combination with systemic antiandrogen therapy has the potential to prolong PFS time with an acceptable side effect profile. Additional prospective studies are needed to further substantiate these results.

OP-691

Added Value of Interim FDG PET/CT Imaging for Patients with Metastatic Prostate Cancer Undergoing ^{177}Lu-PSMA Radioligand Therapy

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Aim/Introduction: Radionuclide therapy with 177Lu-PSMA has revolutionized the treatment of advanced metastatic castration-resistant prostate cancer (mCRPC). Baseline PET imaging with PSMA and FDG is pivotal in confirming patient eligibility and providing prognostic value. The value of interim FDG PET/CT however remains elusive in the literature. We assessed the added value of interim FDG PET/CT imaging in patients undergoing 177Lu-PSMA-RLT. ***Materials and Methods:*** This retrospective monocentric analysis included mCRPC patients who received at least 2 cycles of 177Lu-PSMA-RLT and underwent FDG PET/CT at baseline and after 2 cycles of 177Lu-PSMA-RLT (interim). SUVmax, and tumor SUVmean were calculated contouring total tumor volume using a fixed threshold based on liver SUVmean + 2SD. The delta of PET parameters and PSA values between baseline and interim were calculated. PSA response was defined as a decrease of >50% (PSA50). FDG response was defined using best cut-off based on ROC curve analysis of PSA50. The association between interim parameters and overall survival (OS) was evaluated using univariate and multivariate Cox Proportional Hazards model. Kaplan Meier curves were performed. ***Results:*** Sixty-eight patients were included with 64 having FDG mesurable disease. After a median follow-up of 10.6 months, median PFS and OS were 6.7 and 16.6 months, respectively. 44% of patients presented PSA response. Parameters showing significant association with OS were delta SUVmax (p=0.03), delta SUVmean (p=0.01), and delta PSA (p<0.001). Delta SUVmax -40% cutoff defined FDG-responders and non-responders. FDG-responders presented longer OS than FDG non-responders (11.76 months versus not reached, respectively), HR of 0.390 (95%CI 0.164 - 0.932, p=0.03), as well as PSA50 responders vs non-responders (9.59 months versus not reached, respectively), HR of 0.271 (95%CI 0.121 - 0.608, p=0.002). When combining both PSA and FDG response status, patients with PSA and FDG responses presented better outcome than those with any of both PSA or FDG non-response HR=0.199 (95%CI 0.065 - 0.606, p=0.003). This remained significant in a multivariate analysis (p=0.05). ***Conclusion:*** This analysis demonstrates the value of interim FDG PET/CT imaging to assess response to 177Lu-PSMA-RLT. Assessing FDG response using delta SUVmax is simple and provides key prognostic information, particularly for patients who are classified as responders per PSA criteria. These findings hold potential implications in terms of therapeutic management but should be validated in prospective clinical trials.

OP-692

Volume based parameters of pre-treatment F^{18} FDG PET/CT images in patients with Endometrial carcinoma: Is there any relation with histopathological features of the tumour and survival outcomes?

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Aim/Introduction: Endometrial cancer (EC) is the most common invasive gynaecological malignancy. This study aimed to evaluate the association of F^{18} FDG PET/CT parameters with postoperative pathology and to determine the relation between survival outcomes in patients with EC. ***Materials and Methods:*** A total of 79 patients with EC, aged between 44 and 87 years (mean 67.86 years) were included in the study. Between 2012 and 2022, patients diagnosed with EC who underwent F^{18} FDG PET/CT for staging were evaluated retrospectively. SUVmax, SUVmean, metabolic tumour volume (MTV), and total lesion glycolysis (TLG) of the lesions were noted. FIGO2023 classifications, histopathology, the depth of myometrial invasion (MI), lymph node metastasis (LNM), cervical stromal invasion (CSI), low uterine segment invasion, extrauterin involvement (EUI), lymphovascular invasion, nuclear grade, p53 mutation and microsatellite instability, tumour sizes and extra uterine involvement were noted. Ethic committee was approved. ***Results:*** Eleven cases were at FIGO2023 stage I, 22 at stage II, 9 at stage III, and 14 stage IV. The surgery was performed in 50 of 79 patients. FDG uptake was avid in all cases, and the median SUVmax, SUVmean, MTV40 and TLG40 were 15.44 (range, 4.51-37.92), 8.96 (range, 2.94-21.10), 156.60 (range, 3.88-4710.0) and 8.2 (range, 0.9-790.3), respectively. SUMmax was significantly associated with both LNM and peritoneal implant (p=0.045). There were significant association between MTV40 and MI (p=0.002), EUI (p=0.016). There was also significant correlation between TLG and MI (p=0.022), EUI (p=0.002). AUC of MTV40 for MI were 0,779 (p=0,0004), TLG for 0,710 (p=0,008). For MTV>7.43 cut-off, sensitivity in detecting MI was 84% and specificity was 64%. TLG>115 cut-off, sensitivity in detecting MI was 67% and specificity was 71%. AUC of MTV40 for EUI were 0,791 (p=0,0001), TLG for 0,850 (p=0,0001). The other 29 patients who did not undergo surgery were diagnosed by biopsy. Overall (OS) and Progression free survey (PFS) were calculated for all 79 patients. Significantly shorter OS was noted in patients with higher MTV (p< 0.001) and TLG (p< 0.001). Significantly shorter PFS was also noted in patients with higher MTV (p= 0.01) and TLG (p = 0.03). In the multivariate analysis, both MTV and TLG were independent predictors of PFS and OS (p = 0.001, p = 0.001). ***Conclusion:*** Both MTV and TLG of primary lesions are related in myometrial invasion and extrauterin involvement of EC, also independent predictors of PFS and OS in patients with EC.

OP-693

Diagnostic accuracy and molecular characterization of endometrial cancer using hybrid [18F]FDG PET/MRI

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Aim/Introduction: The outcome of patients affected by endometrial cancer (EC) may vary according to several factors, including regional lymph node (LN) involvement. Moreover, recent focus has turned to EC molecular profiling, revealing alterations such as DNA mismatch repair deficiency (MMRd) and p53 mutation (p53abn). This study aims at investigating the utility of hybrid [18F] FDG PET/MRI in EC staging, exploring its diagnostic accuracy and potential of derived parameters in predicting LN, MMRd, and p53abn. ***Materials and Methods:*** Prospective study including 61 patients with biopsy-proven EC who underwent preoperative [18F]FDG PET/MRI for staging . Histological examination following surgical intervention and immunohistochemical analysis served as gold standards. [18F]FDG PET/MRI scans were blindly reviewed by a nuclear medicine physician and a radiologist, evaluating the diagnostic balanced accuracy (bACC), sensitivity (SN), and specificity (SP), and deriving imaging parameters. Mann-Whitney U test, Fisher's exact test, Logistic regression and ROC analysis were used for the statistical analysis. ***Results:*** Median age was 64 years (range:36-87). LN histological examination was available for 53/61 patients (19% LN+; 81% LN-); MMRd immunohistochemical analysis was available in 31/61 patients (61% MMR proficient-MMRp; 39% MMRd), and p53 data was available for all 61/61 subjects (80% p53 wild-type; 20% p53abn). [18F]FDG PET/MRI accurately identified the primary EC in all patients (bACC=100%,SN=100%). bACC of [18F]FDG PET in detecting LN was 92.5% (SN=90%,SP=95%), while MRI's metrics were bACC= 85.50% (SN=80%,SP=91%). Higher values of parameters describing tumor volume on T1 post-contrast, ADC, and T2 sequences (volume index-VI, total tumor volume-TTV, tumor volume ratio-TVR) and PET scans (metabolic tumor volume-MTV, total lesion glycolysis-TLG) were observed in patients with LN ($p<0.05$), as well as a higher frequency of myometrial infiltration ($p=0.031$) and cervical stroma invasion ($p=0.033$) observed on MRI scans. T1-derived TTV provided the highest prediction (AUC=75%, SN=80%, SP=70%, cut-off=13mm). In MMRd patients, SUVmax, SUVmean, and TLG PET parameters, and the frequency of LNs detected on PET and MRI were significantly higher compared to MMRp patients ($p<0.05$); the cut-off of 11.35 of SUVmean showed the highest prediction ability (AUC=73.2%, SN=83%, SP=63%). [18F]FDG LN uptake on PET, and MRI-derived TVR, ADCmean, and ADCmin allowed to discriminate patients presenting p53abn ($p<0.05$), with the best performance provided by ADCmin (AUC=80.78%, SN=83.33%, SP=75.55%, cut-off=618). ***Conclusion:*** [18F]FDG PET/MRI showed good accuracy in the staging of EC patients. Given their promising predictive capabilities, PET and MRI-derived parameters could enhance the characterization of tumor aggressiveness and molecular alterations, including DNA MMRd and p53 hyperexpression.

OP-694

The value of [18F]-FDG PET/CT in the evaluation of early treatment response in cervical cancer patients

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Aim/Introduction: To study the usefulness of [18F]-FDG PET/CT to evaluate the early response to treatment in patients with IB2-IVA stage cervical cancer who received QT/RT+brachytherapy. ***Materials and Methods:*** Retrospective descriptive review of patients with cervical cancer who underwent [18F]-FDG PET/CT scan between January 2020-January 2023 after 3 month of treatment with QT/RT+ brachitheraphy. Age, size, HPV subtype, FIGO, clinical symptoms, physical examination, cytology, [18F]-FDG PET/CT, MRI at 3, 6, 12 months and current global situation (follow-up 12 months-3 years) were collected. The results of [18F]-FDG PET/CT and MRI were studied at 3 months post-treatment, correlating it with clinical/radiological follow-up. [18F]-FDG PET/CT and MRI results were graded as negative, positive, or indeterminate. S, E, PPV and NPV of both techniques were evaluated. For statistical analysis, indeterminate results were assumed positive. ***Results:*** 101 patients(p) were included. 56p (56% 56/101p) were excluded due to: stage IVB (24/56p), lack of follow-up (20/56p), suspicion of recurrence (10/56p) or minimally invasive disease (2/56p). The remaining 45p (44% 45/101p) were treated with QT/RT+brachytherapy. 3-month post-treatment [18F]-FDG PET/CT (3m) showed the following ***results:*** negative 86.6%(39p), positive 8.8%(4p), indeterminate 4.4%(2) while MRI-3m was negative in 42.2%(19), positive in 26.6 %(12) and indeterminate in 31.1%(14). [18F]-FDG PET/CT demonstrate a S 100%, E95%, PPV 71% and NPV 100%. On the other hand, RM obtained a S 100%, E 47.5%, PPV 19%, NPV 100%. Indeterminate MRI results were subanalyzed (14n) comparing them with those obtained with [18F]-FDG PET/CT (10/14 negative, 2/14 positive, 2/14 indeterminate). The success in the right diagnosis of [18F]-FDG PET/CT was confirmed after one year of follow-up. Moreover, the success rate of post-treatment [18F]-FDG PET/CT-3m in patients with indeterminate 3m-MRI, was 85%. In 100% of cases, the [18F]-FDG PET/CT result was confirmed after one year of follow-up. ***Conclusion:*** [18F]-FDG PET/CT is an excellent tool on the assessment of early treatment response in patients with cervical cancer, gaining an especial relevance in those cases with indeterminate MRI and thus offering the possibility to allowing an early evaluation to treatment.

1507

Tuesday, October 22, 2024, 15:00 - 16:30
Hall Y10-Y12

TROP Session: Inflammation & Infection Committee: More on Inflammation & Infection Imaging

OP-695

Safety, pharmacokinetics, radiation dosimetry and preliminary diagnostic performance of [^{68}Ga]Ga-deferoxamin in patients with bacterial infections - results from a Phase I/IIa study

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Aim/Introduction: Molecular imaging has the potential for specific and sensitive detection of bacterial infections, thereby allowing timely and accurate diagnosis. Targeting the siderophore iron acquisition system of bacteria, not existing in mammalian cells, allows to access one of the few microbe specific targets. In recent studies we could show that the siderophore deferoxamine, established for treating iron overload diseases (as Desferal®), can be radiolabelled with 68Ga and used for imaging of bacterial infections by PET [1]. In preclinical studies excellent targeting of various clinically relevant bacteria such as Pseudomonas, Staphylococcus and Streptococcus ssp. resulting in high contrast imaging in Micro-PET/CT studies with high specificity. We here report initial results of a Phase I/IIa study (EudraCT Nr: 2020-002868-31) on safety, tolerability, pharmacokinetics, radiation dosimetry and preliminary diagnostic performance in patients with bacterial infections using [68Ga]Ga-deferoxamine. ***Materials and Methods:*** [68Ga]Ga-deferoxamine was prepared using an automated module and released based on defined quality criteria. In the initial Phase 4 patients with joint implant infections were included. Sequential PET imaging (0-15min dynamic, 30, 60, 120 and 180min whole body) was performed after injection of 3MBq/kgBW of [68Ga]Ga-deferoxamine for assessment of safety, tolerability and to calculate radiation absorbed doses. Pharmacokinetics were assessed by sequential imaging, measuring activity in blood and urine and HPLC-analysis of blood and urine metabolites. In 3 patient comparative FDG imaging was available. ***Results:*** [68Ga]Ga-deferoxamine production resulted in high radiochemical yields and purity. No sign of metabolic degradation was seen in blood samples, with slow rate of blood elimination, in urine variable amounts of metabolites were detected. Effective dose was calculated to be below 0.01mSv/MBq. PET imaging revealed rapid and stable accumulation in the infected area in 3 patients up to 3hr. p.i., one patient showed a mismatch of positivity in FDG and negative [68Ga]Ga-deferoxamine uptake after initiation of antibiotic therapy. ***Conclusion:*** This clinical study provided pharmacokinetics and dosimetry data of [68Ga]Ga-deferoxamine and a first proof of concept for infection imaging with radiolabelled siderophores. High blood pool activity and slow rate of elimination, however, has been identified as a specific limitation of [68Ga]Ga-deferoxamine in humans.

References: [1] Petrik M, et al. 68Ga-labelled desferrioxamine-B for bacterial infection imaging. Eur J Nucl Med Mol Imaging. 2021 Feb;48(2):372-382.

OP-696

Clinical Significance of the Relationship Between FDG PET/CT, PSMA PET/CT, Salivary Flow Rate and USG Findings in Sjögren's Syndrome

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Aim/Introduction: The diagnosis of Sjögren's Syndrome (SjS) is based on dryness symptoms/autoantibodies, and histopathological examination (2016 ACR/EULAR criteria). USG has a high accuracy in diagnosing SjS. FDG-PET assesses autoimmune inflammation and salivary glands show intense PSMA uptake. This prospective study aims to investigate the relationship between FDGPET/68GaPSMA PET, USG, and salivary flow rate (SFR), and also the clinical significance of this relationship and its possible contribution to treatment management in SjS. ***Materials and Methods:*** FDG-SUVmax, SUVmean, PSMA-SUVmax, SUVmean, PSMAbased Functional Glandular Volume (PSMAGlVol) and PSMAbased Total Glandular Activity (PSMATotGlAct: PSMASUVmean x PSMAGlVol) were calculated for Parotid/Submandibular glands. Homogeneity/hypoechoic areas/hyperechoic bands/glandular boundaries and OMERACT scores for each gland were evaluated on USG. SFR was measured. ***Results:*** OS was 2-3 in 57% of submandibular and in 38% of parotid glands. Hyperechoic appearance indicating fibrotic changes was more prominent in submandibular glands (42%-33%). Statistically significant lower levels of PSMA-SUVmax, SUVmean, PSMATotGlAct in parotid/submandibular and PSMAGlVol in submandibular glands presumed to be more severely affected by SjS with higher OS were observed. Higher OS were associated with statistically higher FDG-SUVmax and SUVmean in parotid glands, whereas no such relationship was observed for submandibular glands. Parotid with higher OS exhibited higher FDG-SUVmax compared to submandibular glands (p=0.004-indicating ongoing inflammation in parotid glands affected at a later stage). A positive correlation was found between SFR and FDG-SUVmax/SUVmean for submandibular glands. FDG-SUVmax/SUVmean in patients with SFR ≥0.1 ml/min were higher than in patients with low SFR for only submandibular glands (in favor of a relative higher SFR in patients with inflammation persisting in submandibular glands while a decrease in comparison to normal). No statistical correlation was found between SFR and OS, or SFR and PSMA parameters. ***Conclusion:*** If FDG uptake indicating autoimmune inflammatory changes persists in submandibular glands and SFR is ≥0.1 ml/min, these patients may benefit from anti-inflammatory treatment. However, the effectiveness of treatment may be limited or absent in patients with a concomitant decrease in FDG and PSMA. To the best of our knowledge, our study is the first to address this issue. PSMA uptake in parotid/submandibular glands more severely affected by Sjs with higher OS decreases. FDG uptake in parotid glands, which are affected in later stages, with high OS suggests that inflammation may still continue at recent stage. A decrease in SFR in patients whose PSMA parameters remain stable may possibly be related to glandular epithelial dysfunction reported in the literature.

OP-697

First-in-human HIV imaging using I-123-3BNC117 broadly neutralizing antibodies SPECT/CT

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Aim/Introduction: HIV is known to hide in cells as a provirus integrated into cellular DNA to form the latent HIV-reservoir against which antiviral drugs are ineffective. Our aim was to demonstrate the feasibility of molecular imaging with antibodies in a first-in-human study to image HIV reservoirs and compare uptake before and after HIV antiretroviral therapy (ART). ***Materials and Methods:*** We labelled the broadly neutralizing antibody 3BNC117 with [123I]-iodine and performed quantitative SPECT/CT imaging in 5 patients with chronic HIV-1 infection at diagnosis and 3-6 months after ART initiation. We administered a human IgG preparation to saturate unspecific immunoglobulin targets within two hours prior to the injection of 200MBq of [123I]-I-3BNC117 and potassium iodide was administered to prevent thyroid radioactive exposure. Whole-body scans were performed 30min, 1, 3 , 6 and 23h after injection. SPECT with low-dose CT were performed 6 and 23h after injection. Dosimetry was performed on this first session in 3 patients. A second imaging session, was performed 3-6 months after antiretroviral therapy at undetectable viremia, 23h after [123I]I-3BNC117 injection under the same conditions. ***Results:*** 5 patients underwent the imaging protocol. A dosimetry based on 3 patients gave an effective radiation dose from the [123I]-3BNC117 of 26±6µSv/MBq. Visually, no obvious changes in the biodistribution were observed between both sessions. Individually, some changes were observed in the lymphatic tissue in the oropharyngeal region. Quantitative image analysis shows a significant tracer uptake decreases in the oropharynx (mean±SEM -28%±11%), testes (-9%±5%), posterior cervical lymph nodes (-18%±10%) and a tracer uptake increase in the liver (20%±5%) and muscles (+19%±10%). ***Conclusion:*** In this first-in-human imaging study with broadly neutralizing antibody [123I]I-3BNC117 performed in 5 individuals with chronic HIV infection at diagnosis and after ART initiation, we observe small but significant reductions in uptake in the oropharynx region, cervical lymph nodes, and testes after effective ART, suggesting specific uptake due to HIV in these tissues. Despite the limitations of the current study, molecular imaging with direct labelling of HIV-targeting antibodies is feasible and could contribute to a better understanding of the anatomical compartmentalization of HIV reservoirs.

OP-698

The Role of ^{68}Ga-Pentixafor PET/CT in The Diagnosis of Chronic Bone and Soft Tissue Infections

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Aim/Introduction: Leukocyte distribution is variable in chronic infections, potentially leading to false negative results on HMPAO white blood cell scintigraphy (WBC scan). 68Ga-Pentixafor PET/CT, targeting CXCR4 receptors predominantly expressed on lymphocytes, may be effective in detecting chronic infections. This study aims to investigate the diagnostic efficacy of 68Ga-Pentixafor PET/CT in suspected chronic bone and soft tissue infections. ***Materials and Methods:*** Patients with suspected chronic bone and soft tissue infections, who underwent three-phase bone scintigraphy with SPECT/CT, WBC (+/- bone marrow) scan, and concurrent 68Ga-Pentixafor PET/CT, were analysed. Asymptomatic orthopaedic material and diabetic foot areas served as the control group. Two nuclear medicine specialists visually and quantitatively evaluated images. Patients' biochemical, clinical, and microbiological results and other imaging findings were documented. The final diagnosis was confirmed by microbiological examination in addition to clinical and radiological findings. ***Results:*** In a cohort of 20 patients, 9 had chronic periprosthetic infections (PPI), 5 had diabetic foot infections (DFI), and 6 were under investigation for other chronic bone and soft tissue infections (Table 1). A total of 25 infection-suspicious foci were assessed, compared with 13 lesions observed in the control group, which comprised 6 asymptomatic prosthesis, 4 orthopaedic materials, and 3 diabetic foot regions. The final diagnosis was confirmed through surgical pathology and tissue culture in 7 patients, bacteriology in 10 patients, and clinical-radiological findings in 3 patients, while in the control group, diagnosis relied solely on clinical-radiological findings. A total of 21 out of 25 focal infection diagnosys were made, with no evidence of infection observed in any of the lesions within the control group. Scintigraphy detected 19/21 infection foci, resulting in 2 false negatives, 3 false positives, and 15 true negatives. 68Ga-Pentixafor PET/CT yielded positive results in all 21 infection foci, with 2 false positives and 16 true negatives. Respective sensitivity, specificity, accuracy, PPV, and NPV were found to be 90%, 83%, 87%, 86%, and 88% for scintigraphy, and 100%, 89%, 95%, 91%, and 100% for 68Ga-Pentixafor PET/CT. In ROC comparison analysis, PET was found to be as good as scintigraphy(p:0.07), also AUC analysis showed that PET provides more reliable results (AUC for PET and WBC scan; 0.94 and 0.86). ***Conclusion:*** 68Ga-Pentixafor PET/CT seems highly sensitive and accurate for diagnosing chronic infections with the added benefits of low radiation dose and shorter acquisition time. Its potential to replace standard imaging modalities deserves further investigation.

OP-699

Deep-learning noise reduction algorithms advantageously replace the spatial filters previously required for bone tomoscintigraphy analysis

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Aim/Introduction: When added to conventional spatial filters (CSF), deep-learning noise reduction algorithms (DLNR) further decrease the noise level of tomoscintigraphies, enabling reduction of injected activities and recording times. This study aimed to determine whether CSFs are still required when a dedicated DLNR is applied to the bone tomoscintigraphies recorded on a whole-body 360° CZT camera. ***Materials and Methods:*** The CSF recommended for bone tomoscintigrapy with this CZT camera (a median post-filter associated with a 0.2 kernel inter-iterative filter) was used. Quantitative activity parameters (maximum activity concentration recovery coefficient (RCmax) and SUVmax) and a lesion detectability parameter (contrast-to-noise ratio (CNR)), were obtained with DLNR applied on phantom spheres and patient bone lesions. Comparisons were made between parameters obtained using CSF alone, DLNR alone, and using DLNR plus

CSF. The comparisons were performed on (i) bone lesions from whole-body acquisitions recorded in 10 polyarthritis patients (5 men, mean age: 62.7±15.5 years, mean body mass index: 25.4±6.0 kg/m2), 3 to 4 hours after the injection of 544±21.8 MBq [99mTc] Tc-HDP, and (ii) hot spheres from an IEC body phantom filled-in with a 99mTc solution, a 10/1 spheres/background activity ratio, and a global activity equivalent to that recorded during bone tomoscintigraphy. ***Results:*** The CNR, measured in a total of 49 diseased joints in patients, were equivalent between images with only DLNR applied and images with DLNR plus CSF (12.8±9.7 and 12.6±10.8, respectively), and they were both improved when compared with the CNR obtained with CSF alone (11.8±9.3, $p < 0.001$ for both comparisons). However, the addition of DLNR to CSF has the disadvantage of further decreasing the SUVmax from diseased joints (from 9.0±3.7 to 8.2±3.7, $p< 0.001$), whereas this decrease was not observed when using DLNR alone (9.2±4.0). Comparable results were obtained on medium (6 mL) and small (1.3 mL) volume phantom spheres, with the RCmax being better preserved with DLNR alone (46.6% and 78.9%, respectively) than with DLNR plus CSF (33.6% and 69.9%, respectively). However, only the small sphere exhibited a clear CNR improvement when only DLNR was used, rather than DLNR plus CSF. ***Conclusion:*** When assessed by contrast to noise ratios, this DLNR algorithm better preserves the absolute activity values of bone lesions and hot spheres when used alone than when associated with conventional spatial filters, and provides at least equivalent lesion detectability. Therefore, such algorithms could advantageously replace the spatial filters previously required for bone tomoscintigraphy analysis.

OP-700

Extracerebral [18F]DPA-714 binding in individuals with and without post-COVID syndrome: associations with complaints

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Aim/Introduction: While the underlying pathophysiology of post-COVID is still unclear, altered immune-activation is a potential disease mechanism. The PET tracer [18F]DPA-714 binds with high affinity to translocator protein (TSPO) expressed on activated microglia and macrophages, reflecting (neuro)inflammatory activity. The aim of this study is to investigate extracerebral [18F] DPA-714 uptake in individuals with and without post-COVID syndrome using a long axial field of view (LAFOV) PET scanner and to relate binding levels to the degree of complaints. ***Materials and Methods:*** Individuals who were high-affinity binders according to their TSPO genotype were included. Post-COVID related complaints (primarily fatigue and pain related quality of life) were measured with the Checklist-of-Individuals-Strength (CIS; for fatigue), and RAND-36 item Health Survey pain and physical subscales. Each participant received ~250 MBq [18F]DPA-714 directly followed by a 60 minutes acquisition on the Siemens Quadra PET/CT scanner. One volume of interest (VOI) was manually defined in skeletal muscle, lung and myocardium (as these were considered the organs most likely to be linked to fatigue and pain related complaints) for all participants. After assessment of organ-specific time-activity-curves, Patlak linearization was applied to estimate the net influx rate (Ki) in skeletal muscle, and Logan linearization was performed to estimate the distribution volume (VT) in lung and myocardium. Differences between groups were assessed using ANOVA, and associations between organs-specific [18F]DPA-714 binding and questionnaire scores were assessed using regression models, adjusted for age, sex and time since infection. ***Results:*** We included 30 individuals who suffered a SARS-CoV-2 infection, of whom 20 suffered from post-COVID syndrome (age 49±8, 60% female, 27±8 months post-infection), and 10 did not (age 45±10, 20% female, 25±10 months post-infection). In line with group definition, CIS score, Rand36 physical and -pain scores were indicative of more severe complaints in individuals with post-COVID syndrome (103±16, 58±21, 57±25, respectively) compared to individuals without (40±23, 97±6, 96±10, respectively; all $p<0.001$). Although some individuals showed organ-specific high binding, on group level binding in skeletal muscle (Ki 0.037±0.015 vs 0.032±0.014), lung (VT 6.3±3.6 versus 4.9±2.6) and myocardium (VT 27.0±6.4 versus 30.9±10.3) did not differ between individuals with and without post-COVID syndrome. No associations between [18F]DPA-714 binding and questionnaire scores were found. ***Conclusion:*** Using [18F]DPA-714, we found no group-level associations between inflammatory activity in skeletal muscle, lung and myocardium, with (severity of) post-COVID syndrome, although individual cases showed increased organ specific binding. Further research assessing other organs and organ-type specific complaint-questionnaires is warranted.

OP-701

Initial Results of [68Ga]Ga-DOTA-Siglec-9 PET/CT to Assess Pulmonary Sarcoidosis

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Aim/Introduction: Sarcoidosis is a multisystem inflammatory disorder characterized by the formation of non-caseating granulomas. Pulmonary involvement is common, accounting for one of the major causes of death associated with the disease. Positron emission tomography (PET) utilizing Gallium-68-labeled 1,4,7,10-tetraazacyclododecane-N,N',N",N"-tetra-acetic acid conjugated sialic acid-binding immunoglobulin-like lectin 9 motif-containing peptide ([68Ga]Ga-DOTA-Siglec-9) specifically targets vascular adhesion protein-1 (VAP-1), a molecule crucial for Leukocyte recruitment to inflammatory sites. This study aimed to assess the feasibility of using [68Ga]Ga-DOTA-Siglec-9 PET for detecting pulmonary sarcoidosis. ***Materials and Methods:*** We enrolled six patients diagnosed with active pulmonary sarcoidosis (3 females, 3 males; age: 51 ± 13 years), as confirmed by histological examination, diagnostic high-resolution computed tomography (HRCT), and elevated serum angiotensin-converting enzyme

concentration (> 60 U/L; normal range < 40 U/L). Six healthy male volunteers (age: 37 ± 10 years) served as controls. Standardized uptake values (SUV) were determined from the [68Ga]Ga-DOTA-Siglec-9 PET in combination with CT imaging. ***Results:*** The tracer uptake was significantly higher in the lungs of sarcoidosis patients compared to healthy controls (SUVmean 1.82 ± 0.52 vs. 0.61 ± 0.17 g/mL, p = 0.0003). Additionally, uptake in lymph nodes was higher in the patient than in controls (SUVmean 5.3 ± 0.44 vs. 3.76 ± 0.60 g/mL, p = 0.00005). ***Conclusion:*** Our findings demonstrate the potential of [68Ga]Ga-DOTA-Siglec-9 PET imaging for detecting pulmonary inflammation and associated lymphadenopathy in sarcoidosis patients. ***References:*** • Grunewald J et al. (2019) Nat Rev Dis Primers 5:49. • Trivieri MG et al. (2020) J Am Coll Cardiol. 76:1878-1891. • Jahandideh A et al. (2023) J Nucl Cardiol. 30:2760-2772. • Gerke AK et al (2014) Curr Opin Pulm Med. 20(5):472-8.

OP-702

Macrophage activation imaging using total-body ^{18}F-DPA714 PET/CT for detecting large vessel vasculitis: a pilot study

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Aim/Introduction: Large vessel vasculitis (LVV) is a serious autoimmune disease that includes giant cell arteritis (GCA) and Takayasu arteritis (TAK). 18F-FDG PET as a tool for imaging inflammation has already proven to be useful for early diagnosis of LVV, but it shows limited value due to an inability to differentiate long lasting vessel wall remodeling with active vasculitis. The radiotracers targeting translocator protein (TSPO) of macrophage have been used in PET imaging for neuroinflammatory and rheumatic inflammatory diseases. This study aims to investigate the feasibility of 18F-DPA714 for LVV imaging on total-body PET/CT in a small cohort of patients with LVV. ***Materials and Methods:*** Six adult patients with LVV before glucocorticoids treatment and four healthy controls (HC) were enrolled in this prospective study. All participants underwent both 90-minutes dynamic total-body 18F-DPA714 PET/CT and 10-minutes static 18F-FDG PET/CT. Dynamic two-compartment model (2TCM), Simplified Reference Tissue Model (SRTM) model, and static standard uptake value (SUV) mapping were applied for quantitatively assessing the inflammation level of arterial walls on 18F-DPA714 PET/CT. PET vascular activity score (PETVAS) was used for quantitative assessment of inflammatory activity of vessel wall on 18F-FDG PET/CT. The uptake intensity of both 18F-DPA714 and 18F-FDG in the involved vessel walls was compared. ***Results:*** A total of 6 patients with LVV (mean age, 51.83 ± 19.49 years; 4 females and 2 males; 3 GCA and 3 TAK) and 4 HCs (mean age, 53.25 ± 9.46 years; 2 females and 2 males) were included. Our pilot study found that 2TCM, and using the cerebellum or muscle as the reference tissue for SRTM, as well as a simplified static 50-70-minute SUV (SUV50-70) mapping, might effectively quantify abnormal uptake of 18F-DPA-714 in the large arterial wall. On the TAC curve, the SUV50-70 of 18F-DPA714 in the arterial walls of the thoracic aorta or subclavian arteries, which are mainly affected large vessels in all 6 patients, were significantly higher than those in HC (1.05 ± 0.29 vs 0.54 ± 0.15, p = 0.006). The SUVmax of involved vessels walls on 18F-FDG PET were higher than those of 18F-DPA714 PET in 5 of 6 patients with PETVAS of grade 2-3, but one patient with PETVAS of grade 1 still showed significantly positive uptake of 18F-DPA714 in the thoracic aorta wall. ***Conclusion:*** 18F-DPA-714 PET might have potential value in supplementing 18F-FDG PET for the detection of LVV.

OP-703

Potential Role of Bone SPECT/CT in Early Diagnosis of Calciphylaxis. Pilot Study in Ukraine

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Aim/Introduction: Calciphylaxis is a rarely understood phenomenon disturbance of vascular calcification with subsequent necrosis skin and soft tissue affecting patients with end-stage renal disease. Three-year mortality from sepsis ranges from 55% to 75%. In this regard, early diagnosis and subsequent treatment is necessary. The purpose of this study is to determine sensitivity of bone SPECT/CT as a diagnostic method in patients with skin lesions indicating calciphylaxis ***Materials and Methods:*** Completed descriptive cross-sectional retrospective study performed at the Department of Nuclear Medicine of the Shupik National University Healthcare of Ukraine. A total of 42 consecutive patients with cutaneous lesions suggestive of calciphylaxis treated with 99mTc-MDP bone SPECT/CT from 2015 to 2023 year were included in this is a pilot study. Sensitivity, specificity and accuracy of 99mTc-MDP SPECT/CT bones were identified. The results have been confirmed histological analysis and response to treatment sodium thiosulfate ***Results:*** 42 patients (64.8% women, 35.2% male) were included in this study with a mean of 62.3 ± 10.2 years. 89.7% of patients had end-stage renal disease and were in hemodialysis, 10.3% of them did not have kidney disease. There were defeats localized in the lower extremities in 78.5% of cases (33 of 42). Hybrid imaging was performed an average of 140 days after appearance of rashes (range 18-650 days). Histological analysis was performed in 52.4% of cases (22 out of 42). The sensitivity of the test was 100% with a specificity of 29.55% (PPV: 71%; NPV 100%). The diagnostic accuracy was 74%. Histopathology was positive in 68% of cases (15 of 22) ***Conclusion:*** Bone SPECT/CT is a non-invasive tool with high sensitivity to diagnosis of calciphylaxis. Its indication in the early stages diseases can improve early diagnosis and specific care. This also avoids skin biopsies, which may have serious complications such as septicemia

1508

Tuesday, October 22, 2024, 15:00 - 16:30
Hall G2

Joint Symposium 7- Neuroimaging Committee / EANO - Advances in Meningioma Diagnosis and Therapy

OP-704

Classification and molecular pathology of meningiomas

F. Sahm;
Department of Neuropathology, University Hospital Heidelberg, Heidelberg, GERMANY.

OP-705
Treatment standards of meningiomas - current standard and future avenues
M. Preusser;
Medical University of Vienna, Division of Oncology Department of Medicine I, Vienna, AUSTRIA.

OP-706
Theranostics in meningiomas - from rationale to evidence
N. Albert;
LMU University Hospital, Department of Nuclear Medicine, Munich, GERMANY.

1509

Tuesday, October 22, 2024, 15:00 - 16:30
Hall F

e-Poster Presentations Session 11: Physics Committee: Data Analysis, Image Recon, Hardware Developments

EPS-211
Design and Development of a Dual Energy Scatter Correction on Animal SPECT List Mode Data
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Aim/Introduction: Scattered photons present a significant challenge in SPECT imaging, leading to reduced contrast, resolution, and quantitative accuracy. Scatter correction methods play a crucial role in addressing these issues. One common approach involves using energy window-based methods, such as Dual-Energy Window (DEW) or Triple-Energy Window (TEW) techniques. These methods utilize sub-windows to approximate the scatter distribution in the main photopeak window, allowing for the estimation and correction of scatter events. In this study, we aimed to implement and evaluate the DEW scatter correction method using Animal SPECT list mode data. ***Materials and Methods:*** Raw data is transmitted to the computer using the User Datagram Protocol (UDP). A multi-threaded acquisition pipeline is initialized to process the received data packets and generate calibrated projections, including linearity, uniformity, and energy calibration. Simultaneous acquisition of photopeak and scatter window projections was performed using a 30% energy window centered on the 140 KeV photopeak of Tc99m, along with a 20% scatter window below it. Scatter projections were subtracted from the photopeak using a k-value of approximately 0.57, assuming a similar scatter distribution in both windows. The corrected projections were then reconstructed using the Maximum Likelihood Expectation Maximization (MLEM) algorithm with 20 iterations. To evaluate the effectiveness of the correction method, reconstructed images were compared with non-corrected ones, focusing on data acquired from a NEMA IQ phantom in Animal SPECT studies. ***Results:*** To assess the effectiveness of scatter correction methods, we calculated two key parameters influenced by scatter photons, Contrast-to-Noise Ratio (CNR) and Spill-Over Ratio (SPR), within the cold spheres of the IQ phantom. The SPR was calculated within two cold spheres of a phantom containing air and water. The SPR values were reduced after scatter correction, in the air sphere decreasing from 0.38 to 0.31 and the water sphere decreasing from 0.4 to 0.34. Additionally, CNR was computed for hot rods and cold spheres within the phantom, revealing a notable increase of approximately fivefold in both regions following scatter correction. ***Conclusion:*** scattered photons can harm the quality of medical images and reduce their diagnostic accuracy. Our research demonstrates that by effectively removing scattered photons from the primary image, we can enhance image quality, as evidenced by improvements in Contrast-to-Noise Ratio (CNR) and reduced Spill- Over Ratio (SPR). This indicates that photons that were erroneously detected in false positions can be identified and eliminated, leading to more accurate results.

EPS-212
Design and development of a resolution recovery algorithm on Animal SPECT List mode data
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Aim/Introduction: The demand for dedicated small animal imaging systems is increasing, driven by their extensive use in the molecular imaging field for achieving superior resolution and sensitivity. Recent developments have concentrated on improving both hardware and software components to elevate spatial resolution in small animal SPECT imaging. In this study, our objective was to develop an iterative image reconstruction algorithm incorporating CDRF modeling to restore lost resolution. ***Materials and Methods:*** We developed an iterative reconstruction method using Maximum Likelihood Expectation Maximization (MLEM), which employs a system matrix to represent the imaging system in each iteration. A plastic capillary source containing 1 mCi of Tc99m was positioned parallel to the detector head at distances of 30 mm, 45 mm, 60 mm, 75 mm, and 90 mm. The Collimator-Detector Response Function (CDRF) was measured at each distance during planar image analysis. Subsequently, this data was fitted to a Gaussian function to determine specific mean and standard deviation parameters. These parameters were then utilized in generating the system matrix to model the response of every voxel in the object across each cell of the detector array. Finally, the reconstructed image underwent analysis for resolution recovery ***Results:*** The images were reconstructed using an MLEM algorithm with 20 iterations. Prior to applying resolution recovery, the Full Width at Half Maximum (FWHM) analysis indicated values of 2.11 mm, 3.29 mm, 3.99 mm, 4.3 mm, and 4.9 mm at distances of 30 mm, 45 mm, 60 mm, 75 mm, and 90 mm, respectively. After implementing resolution recovery, the FWHM values improved to 2.078 mm, 2.12 mm, 2.22 mm, 2.25 mm, and 2.31 mm at the corresponding distances. ***Conclusion:*** The finite dispersion of detected photons due to collisions with the collimator results in an increased number of detector cells detecting counts, thereby leading to resolution degradation. Modeling the dispersion related to distance with a Gaussian function enables more precise system modeling, facilitating the recovery of lost resolution.

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Exploring the Earliest and Optimal Imaging Time for PET/CT Imaging after [18F]FDG Injection: An Evidence-based Study

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Aim/Introduction: The recommended interval between 2-[18F] fluoro-2-deoxy-D-glucose ([18F]FDG) administration and positron emission tomography (PET) acquisition is 60 min (acceptable range: 55-75 min), according to the procedure guidelines. To accommodate patient waiting times, additional space is required when the number of patients is high. Based on this, the aim of this study was to investigate whether the waiting time after [18F] FDG injection could be shortened while meeting diagnostic needs. ***Materials and Methods:*** In total, 44 oncological patients with pathological results who underwent 60-min total-body dynamic PET imaging with full activity (3.7 MBq/kg) of [18F]FDG were retrospectively included. The raw data was reconstructed into 55 frames: 5 s/frame for the initial 3 min, and 180 s/frame for the last 57 min (55th frame served as reference). Time-to-activity curves (TACs) were obtained by drawing volumes of interest in the background tissues and lesions in all image frames. Lesion-to-background ratios (LBRs), in terms of lesion-to-blood ratio (LBR), lesion-to-liver ratio (LLR), lesion-to-muscle ratio (LMR), and lesion-to-non-tumour ratio (LNR) of different image frames were calculated and compared. The data from 40-50 min and 58-60 min were then reconstructed into six groups of static images (G40-42, G42-44, G44-46, G46-48, G48-50, and G58-60). The differences in image quality (standardized uptake value [SUV], signal-to-noise ratio [SNR], and LBRs) and lesions detectability (lesion-detection rate) between G58-60 and the other groups were further evaluated. ***Results:*** In the TACs analysis, the average LBRs of all lesions gradually increased over time and achieved no significant difference from those of the 55th image frame at 51th image frame (derived from 45-48 min data, all $p \geq 0.34$). There were no significant differences in the SUVmean of all background tissues between G48-50 and G58-60 (all $p \geq 0.09$). As for the background SNRs, the differences between G58-60 and the remaining groups were insignificant (all $p \geq 0.19$). The SUVmax and LBRs of all lesions did not differ significantly between G48-50 and G58-60 (all $p \geq 0.12$). Pathological results served as reference, the lesion-detection rate was 86.0% (49/57) in G40-42 and 87.7% (50/57) in the remaining groups, with no significant difference between groups ($p > 0.99$). ***Conclusion:*** By advancing the imaging time point to 40 min after [18F]FDG injection, PET images still maintain the lesion detectability for diagnostic needs. If relaxed to 48 min, the image quality can be further improved. ***References:*** Boellaard R, Delgado-Bolton R, Oyen WJ, et al. FDG PET/CT: EANM procedure guidelines for tumour imaging: version 2.0. Eur J Nucl Med Mol Imaging. 2015;42(2):328-54.

EPS-215

Acquisition and reconstruction protocol for [89Zr] Z-DFO-girentuzimab studies on BGO based PET/CT system

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Aim/Introduction: The monoclonal antibody targeting carbonic anhydrase IX (CA-IX), [89Zr]Zr-DFO-girentuzimab (GTB) demonstrated high accuracy for clear cell renal cell carcinoma (ccRCC). Aim of this study was the optimization of the GTB acquisition and reconstruction parameters with a BGO based PET/CT system, using phantom and patient data. ***Materials and Methods:*** We acquired phantom and patient data on a digital BGO based PET-CT system with 32-cm axial field-of-view, in list mode. Data from the NEMA image quality phantom were acquired using a lesion-to-background ratio of 4.1 in a single bed position for 30 min. Images from 3 patients with renal masses suspicious for ccRCC were acquired 5.2 days after the administration of 37 MBq of GTB. Total body images were acquired from the skull to the feet (5 min x bed plus an additional 15 min bed on the kidneys). The mean counts for the additional bed with high statistics were used to rescale the phantom data in list mode and obtain comparable statistics with patients' data. The images of each patient were reconstructed using the full and shorter acquisition time (3min x bed, 15 min in the upper abdominal region). Phantom and patient data were reconstructed using Bayesian penalized likelihood reconstruction algorithm with different β values (100,1500,2000,2500,3600) and different matrix size (256, 384). Contrast recovery (CR) and background variability (BV) were measured on phantom images obtained with the different β values. In patients, liver signal-to-noise ratio (S/N) was obtained as the pixel mean/SD within the ROI. ***Results:*** Phantom: as β increases CR and BV decrease. The matrix size of 384 performs better than 256 for CR for all β. For the smallest sphere, CR ranged from 31,4 to 14,3 and from 34,6 to 15,9 for matrix size of 256 and 384 respectively. BV showed a similar behavior for the two considered matrix. Patients: Focusing on the target bed with 15 min of acquisition, an acceptable quality corresponding to a liver S/N of 10 was obtained with β values of 1500 and 2000. Acquisition with 3 min/bed and β=3600 showed the better image quality from a clinical point of view. ***Conclusion:*** The 32 cm field of view of the Omni Legend PET system and the implemented reconstruction algorithm allow to obtain high quality GTB clinical images with an acceptable acquisition time.

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Comparison of Early Dynamic Patlak-Rutland Influx Rate Constant (K_i) Images from [^{68}Ga]PSMA Compared with Conventional Delayed Static Images

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Aim/Introduction: To use a long axial field-of-view (LAFOV) PET/CT scanner (Siemens Biograph Vision Quadra) to examine the ability of early (0-10 min after injection) whole body (WB) [68Ga] PSMA parametric images of influx rate constant (Ki) generated by the Patlak-Rutland graphical analysis at the voxel level to detect the full extent of disease compared to conventional static images acquired at 60 mins post-injection. ***Materials and Methods:*** Subjects for routine early dynamic with later delayed static scanning protocol were recruited and administered ~125 MBq of [68Ga]PSMA-11 while in the scanner with imaging for 10 mins commencing upon injection. Images in the dynamic sequence were reconstructed for 20 secs per frame resulting in 30 frames in total and compared to the 5 min static images acquired at 60 mins post-injection. The dynamic sequence generated two WB parametric images: influx rate constant (Ki in units %/min) and volume of distribution (Vd - unitless). The left ventricular contents were used to generate the time-activity curve for the input function. The Ki images and the delayed static images were assessed independently by an experienced nuclear medicine

physician who had full access to the clinical history and all prior and contemporary imaging. ***Results:*** Twenty-one subjects were recruited. The Ki images and the static images were fully concordant in 16 of the 21 subjects. Three of the 21 scans were read as normal on both the delayed images and the Ki images. A further 3 subjects showed a single abnormal focus on the delayed images not seen on the Ki images while two scans showed foci present in the Ki images only and hence must be presumed to be false positive results at this stage. The absence of radioactivity in the bladder was noted on the majority of the Ki images. ***Conclusion:*** The LAFOV PET/CT systems provide whole body coverage providing new approaches to imaging. In this study, a 10 min dynamic from injection was investigated as a potential alternative to the routine 60 min uptake and delayed imaging protocol by using a parametric imaging approach to remove the early blood pool component from the early phase image. In the majority of cases the Ki images could be used as an alternative to conventional delayed imaging. This protocol could reduce the time burden on subjects referred for scans and the need for dedicated uptake rooms.

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First clinical trials on positronium as a biomarker in the assessment of neuroendocrine tumors

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Aim/Introduction: Neuroendocrine tumors (NETs) are a highly heterogeneous group of malignancies that are biologically characterized by the overexpression of somatostatin receptors [1]. Detection, staging, and therapy monitoring of NETs are often difficult due to their varied localization and cellular heterogeneity. Conventional PET/CT imaging using somatostatin analogues with 68Ga is a current method of choice for evaluating the NETs [2]. During PET examination about 40% of positron annihilations occur through the creation of positronium [3]. Positronium is an exotic atom composed of an electron from tissue and the positron emitted by the radionuclide. Positronium decay in a patient's body is sensitive to the nanostructure and metabolism of human tissues [3]. The first ex-vivo and in-vivo positronium images have shown differences in the positronium mean lifetime in healthy and cancerous tissues, indicating that positronium lifetime may be used as an indicator for in-vivo cancer classification [4,5,6]. ***Materials and Methods:*** The studies (approved by bioethics committees, agreement: 1072.6120.92.2023 (NCT06242119) and. KB16/2022 (NCT06211803)) were conducted at the University Hospital in Cracow and in the Medical University of Warsaw. In total, 13 patients were examined. After administration of [68Ga]-Ga-DOTA-TATE, each patient was first examined with a standard PET/CT system and then with the novel PET prototype constructed at the Jagiellonian University which is the first multi-photon system capable of simultaneous PET and positronium imaging [7,8,9]. The method used for positronium imaging is described in detail in recent works [4,7,8,9]. ***Results:*** We demonstrate the first positronium images of 13 patients with indications for NETs tumors. We determine the lifetime of positronium in different organs including liver, spleen, and pancreas, and correlate it with the result of standard PET/CT diagnosis and clinical assessments. ***Conclusion:*** We demonstrate the feasibility of positronium imaging, a novel type of diagnosis, that is becoming available with the advent of high-sensitivity PET systems [7]. The correlation between the positronium lifetime and the neuroendocrine tumor stage will be presented and discussed. ***References:*** [1] F. Panzuto et al., J Neuroendocrinol. 2023;35(8):e13306. [2] E. Fortunati et al., Curr Treat Options Oncol. 2022;23(5):703. [3] P. Moskal et al., Nature Reviews Physics 2019;1:527. [4] P. Moskal et al., Science Advances 2021;7:eabh4394. [5] P. Moskal, ..., E. Ł. Stępień, EJNMMI Phys. 2023;10:22. [6] P. Moskal, ..., E. Ł. Stępień, https://doi.org/10.1101/2024.02.01.23299028 [7] P. Moskal, E. Ł. Stępień, PET Clinics. 2020;15:439. [8] P. Moskal et al., Phys. Med. Biol. 2019;64:055017. [9] P. Moskal et al., EJNMMI Physics. 2020;7:44.

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Performance in detecting metabolic pulmonary lesions with PET/CT system using OSEM and Deep Learning reconstruction techniques.

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Aim/Introduction: PET/CT systems utilize advanced image reconstruction techniques, such as Ordered Subset Expectation Maximization (OSEM), known for its precision but challenged by noise issues due to multiple iterations. Alternatively, techniques like Hyper Iterative Reconstruction and Deep Progressive Hyper Reconstruction (HYPER DPR), the latter employing artificial intelligence, are being explored. This research focuses on comparing the effectiveness of OSEM versus HYPER Iterative and HYPER DPR in detecting metabolic pulmonary micronodules (μNPs). ***Materials and Methods:*** Acquisitions were performed on 35 patients with oncological lung lesions, following 60 minutes after the administration of fluorodeoxyglucose activity labeled with Fluor-18 (18F-FDG). Ten-minute acquisitions were triggered in the lung, and standard OSEM reconstruction was performed in 2 minutes, while the other Hyper techniques were reconstructed at 2, 4, 6, 8, and 10-minute intervals. Volumes of interest (VOIs) were placed in the lung parenchyma and nodules, measuring maximum SUV, average SUV, and standard deviation (SD). Using these values and the axial anatomical size of the lesions, contrast-to-noise ratio (CNR) values were quantified across different reconstructions and times. ***Results:*** 55 pulmonary nodules (NPs) were obtained with diameters ranging from 3.8 to 11.9 millimeters, and the range of 4 to 7 mm was selected within the μNPs category. In this range, the HYPER DPR technique began with a CNR value of 40.69 at 2 minutes, significantly surpassing OSEM, which achieved values of 27.42 at the same time. Furthermore, the CNR values of HYPER DPR showed steady growth, reaching 68.33 at 10 minutes. On the other hand, HYPER Iterative started with a value of 34.52 at 2 minutes, and although it began lower than HYPER DPR, it demonstrated notable improvement over time, surpassing HYPER DPR in the longer intervals, culminating in maximum CNR values of 76.25 at 10 minutes. ***Conclusion:*** HYPER Iterative stands out as the most effective technique in terms of CNR improvement over time, while HYPER DPR also demonstrates good performance, especially in shorter intervals. OSEM, although limited to a single data point, lags behind in comparative performance in the detectability of μNPs.

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Exploration the Feasibility and Additional Value of ^{18}F-FDG/^{68}Ga-FAPI-04 Dual-low-activity-tracer One-stop Total-body PET Imaging after ^{68}Ga-FAPI-04 Injected at 34min

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Aim/Introduction: Currently, a widely used 2-day protocol combined with the use of 18F-FDG and 68Ga-FAPI can be completed on various conventional PET devices, exhibiting excellent general applicability. However, there are drawbacks in this protocol. Our team developed a one-stop FDG-FAPI dual-low-activity-tracer imaging protocol using a total-body PET[1] and confirmed that satisfactory images can be obtained at 34-minute after the injection of 68Ga-FAPI-04 in the 2-day protocol [2]. In this study, we aimed to further validate the feasibility of one-stop FDG-FAPI PET/CT after injection of 68Ga-FAPI-04 at 34min and explore its additional value. ***Materials and Methods:*** Thirty pairs of patients with suspect malignancies who underwent dual-tracer PET were enrolled in this retrospective study. The images were reconstructed at 34-39 and 50-60min after additional injection of 68Ga-FAPI-04 (named PETFDG, PETD34-39, and PETD50-60 in one-stop FDG-FAPI PET, named PETFDG', PETF34-39, and PETF50-60 in the 2-day protocol, respectively). Tumor-to-normal ratios (TNRs) of lesions in PETFDG, PETD34-39, and PETD50-60 and TNRs of lesions in PETF34-39 and PETF50-60 were evaluated separately. To evaluate the potential added value of one-stop FDG-FAPI PET over the 2-day protocol, TNRs of PETFDG, PETD34-39, and PETD50-60 were compared with PETF34-39. The lesion detectability of two imaging protocols was evaluated by chi-square test. ***Results:*** Comparing dual-tracer imaging (PETD34-39 and PETD50-60) and single-tracer imaging (PETFDG) in one-stop FDG-FAPI PET, TNRs of dual-tracer imaging were higher than those of PETFDG. PETD34-39 and PETD50-60 showed similar performance in lesion detectability and TNRs (all $P > 0.05$). In the 2-day protocol, there are no statistically significant differences in TNRs of all lesions at PETF34-39 and PETF50-60. Comparing one-stop FDG-FAPI PET with the 2-day protocol, TNRs of PETF34-39 were significantly higher than those of PETFDG but lower than those of PETD34-39 and PETD50-60. Lesion detectability in the one-stop FDG-FAPI PET was higher than that in the 2-day protocol. The average radiation dose in one-stop FDG-FAPI PET was significantly lower than that in the 2-day protocol ($P<0.001$). ***Conclusion:*** One-stop FDG-FAPI PET at 34 min could provide sufficient information to meet clinical diagnosis and showed better lesion detectability than that in the 2-day protocol. ***References:*** 1. Liu G, Mao W, Yu H, et al. One-stop [^{18}F]FDG and [(68)Ga]Ga-DOTA-FAPI-04 total-body PET/CT examination with dual-low activity: a feasibility study. Eur J Nucl Med Mol Imaging. 2023;50(8):2271-81 2. Zheng Z, Gao H, Lin Y, et al. The optimum earliest total-body 68Ga-FAPI-04 PET scan timing: An evidence-based single-centre study. European Radiology. https://doi.org/10.1007/s00330-023-10264-4.

EPS-220

Voxel-Wise Delay Correction in Whole-Body Parametric Perfusion Imaging - Application in Metastatic Prostate Cancer

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Aim/Introduction: Tumour perfusion serves as a versatile biomarker for assessing cancer metabolic activity, regardless of nutrient type. With the advent of long-axial field-of-view (LAFoV) PET scanners, primary tumours and metastases can be visualized and quantified in a single scan. However, the injected tracer arrives at different times in different parts of the body and quantification of fast phenomena, such as perfusion, is sensitive to this time delay. Thus, it is necessary to correct for time delay when calculating parametric images. We propose a method where voxel-wise delay estimation is combined with a basis-function approach to obtain robust and quantitative parametric images of perfusion. ***Materials and Methods:*** Ten metastatic prostate cancer patients underwent dynamic [15O]H2O PET (5 min) followed by [^{18F}]PSMA-1007 PET in the same session on a LAFoV PET/CT scanner (106 cm FoV). Parametric images of perfusion were made automatically with no user interaction: The blood input function (BIF) was automatically extracted from the images by cluster analysis on a reduced FoV corresponding to the heart. The signal delay in each voxel relative to the BIF was estimated using a leading-edge approach (1), creating a map of delays. The dynamic image series was then corrected for the delay and whole-body parametric images were calculated using a basis-function approach (2) and exported as DICOM series. To validate the parametric images, values of perfusion were compared to those obtained by standard 1-tissue compartment modelling with time delay included in the model using volume-of-interest (VOI) averaged time-activity-curves. VOIs were produced by delineating primary tumours and metastases on the [^{18F}]PSMA-1007 PET scan and transferring the VOIs to the [15O]H2O dynamic series and parametric images. ***Results:*** Parametric perfusion images were successfully produced for all patients with visualization of all delineated primary tumours (n=8), lymph node metastases (n=64), and bone metastases (n=85). Median perfusion were 19, 16 and 26 mL/min/100mL, respectively. There was excellent linear correlation between parametric images and VOI-based modelling (r=0.99) with a slope close to unity (0.98). ***Conclusion:*** Quantitative parametric images of whole-body tumour perfusion can be calculated from a single, short [15O]H2O PET scan using voxel-wise delay correction and a basis-function approach. ***References:*** 1) Christensen et al. EJNMMI Res 14, 11 (2024). 2) Harms et al. Eur J Nucl Med Mol Imaging 38, 930-939 (2011).

EPS-221

Diagnostic value of AL^{18}F-NOTA-FAPI PET/CT in patients with colorectal cancer in comparison with enhanced CT

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Aim/Introduction: This study aims to compare the diagnostic performance of AL18F-NOTA-FAPI positron emission tomography computed tomography (PET/CT) and enhanced CT in preoperative staging and postoperative local recurrence and distant metastases in patients with colorectal cancer. ***Materials and Methods:*** This prospective study analyzed patients with confirmed colorectal cancer who underwent concurrent AL18F-NOTA-FAPI PET/CT and contrast-enhanced CT between July 2023 and January 2024. PET/CT and enhanced CT findings were confirmed by histopathology or radiographic follow-up.The diagnostic accuracy of PET/CT in preoperative staging and detection of postoperative local recurrence and distant metastases were analyzed. ***Results:*** In this study,a total of 30 patients colorectal cancer (including one case of

ileocecal carcinoma) were enrolled.Pathological findings showed that 29 patients were adenocarcinomas of different differentiation degrees, and one patient was mucinous adenocarcinoma. Among them,27 underwent PET/CT for initial staging and 3 for recurrence detection.Regarding lesion-based diagnostic accuracy, The sensitivity of AL18F-NOTA-FAPI PET/CT and enhanced CT for primary tumor detection was 100% ([28/28];P>0.05). AL18F-NOTA-FAPI PET/CT and enhanced CT showed no signs of tumor recurrence in 3 postoperative patients.AL18F-NOTA-FAPI PET/CT showed higher sensitivity for lymph node metastasis (98.4%[61/62]vs.80.6%[50/62];p<0.05), liver metastasis (94.6%[35/37]vs.67.6%[25/37];p<0.05), peritoneal metastasis (100%[48/48]vs.86.0%[40/48];p<0.05) and bone metastasis (100%[1/1]vs.0%[0/1]; P>0.05).For lung metastasis, the sensitivity of AL18F-NOTA-FAPI PET/CT and enhanced CT was 100% ([66/66]; P>0.05). ***Conclusion:*** Both AL18F-NOTA-FAPI PET/CT and enhanced CT are very accurate for the detection of primary tumors.AL18F-NOTA-FAPI PET/CT is superior to enhanced CT in detecting metastatic lesions,involving lymph nodes,liver, peritoneal and bone,and there is no difference in lung metastasis.Thus AL18F-NOTA-FAPI PET/CT can provided a more accurate TNM staging,prompting the optimisation or adjustment of treatment decisions.

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Evaluation of normalization and random coincidences corrections of clinical images obtained with the first PET from plastic scintillators

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Aim/Introduction: J-PET is the first Positron Emission Tomography, PET, scanner constructed from organic scintillator strips [1]. Currently, clinically available PET tomographs are predominantly based on inorganic crystal scintillators operating on the photoelectric effect principle [2]. However, the principle of operation of a plastic-based scanner is inherently distinct and focuses on the Compton interaction [3]. The axial arrangement of the organic strips compels scintillation light transfer along the scanner, hence, changing the read-out method [4]. Employment of such approaches reduces the costs of a device, opens the prospect of improving accessibility of PET imaging [2] and allows for adaptivity of the tomograph to various conditions and facilitation of handling [5]. In this study, we evaluate first clinical images determined with the modular J-PET prototype in view of normalization and random coincidences corrections. ***Materials and Methods:*** The study was approved by the bioethics committee of the Collegium Medicum of the Jagiellonian University No. 1072.6120.92.2023 (NCT06242119). In the presented trial we performed a single-bed imaging of a patient administered with ^{18F}-Fluorodeoxyglucose. This procedure was preceded by the standard PET/CT imaging session. Normalization corrections were estimated using the component-based approach. There, normalization coefficients can be decomposed and each component can be evaluated separately [6]. Correction for random coincidences was applied based on the delayed time window method [7]. This algorithm requires the preparation of coincidences within a time window shifted with respect to the initial interaction, traditionally forcing a second, parallel data acquisition. However, utilization of the J-PET's singles-mode acquisition (saving each interaction) allows for storage of both information simultaneously. ***Results:*** We developed correction algorithms for normalization and random coincidences. Next, we applied them during the reconstruction of clinical images obtained with the plastic-based PET tomograph and evaluated their impact. ***Conclusion:*** We demonstrated random coincidences and normalization corrections of clinical PET images for patients administered with ^{18F}-Fluorodeoxyglucose performed with the novel J-PET tomograph. J-PET is a cost-effective light and portable scanner based on plastic scintillators. ***References:*** [1] P. Moskal et al., Bio-Algorithms and Med-Systems 7 (2011) 73-78[2] S. Vandenberghe et al., EJNMMI Physics 7 (2020) 35[3] P. Moskal et al., Nuclear Instruments and Methods A 764 (2014) 317-321[4] P. Moskal et al., Physics in Medicine & Biology 66 (2021) 175015[5] P. Moskal, E. Ł. Stępień, PET Clinics 15 (2020) 439-452[6] A. Coussat et al., Acta Physica Polonica A 142(3) (2022) 414-417[7] D. Brasse et al., Journal of Nuclear Medicine 46(5) (2005) 859-867

EPS-223

Quantitative error analysis of injection time recording in Patlak parametric imaging with population-based input function

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Aim/Introduction: Parametric imaging using a population-based input function (PBIF) has demonstrated its feasibility in reducing the duration of dynamic acquisition compared to the full dynamic protocol that uses an image-derived input function (IDIF). However, the PBIF method's accuracy is prone to errors related to the recording of tracer injection times, unlike the IDIF method. Specifically, discrepancies between the PBIF template and the actual input function lead to errors in parametric images. In clinical settings, instances of inaccurate recording of injection times are common. This study aims to conduct a quantitative error analysis for both simulated and actual injection time points. ***Materials and Methods:*** Whole-body 60-min dynamic 18F-FDG (2.5-11.4 mCi) scans of 10 participants (6/4 M/F, 26-69 yrs, 49-79 kg) were performed on a long axial field-of-view PET/CT scanner. The image-derived input function (IDIF) was extracted from the descending aorta. Analysis of IDIF allowed us to estimate the recorded injection time errors (ITE), which ranged from -70.2 minutes to 0.9 minute (recorded time minus the correct time). The correct time was estimated from the last time point with zero IDIF value. PBIF templates were created from the corrected IDIFs using the leave-one-out criterion. We simulated ITEs from -10 minutes to +10 minutes using the corrected injection time. Patlak parametric imaging was performed on the final six frames (5 minutes/frame) using PBIF, with IDIF serving as the reference. We calculated the relative error of the input function's area under the curve (AUC), as well as the normalized mean square error (NMSE) and relative error of the Ki image. ***Results:*** The relative error of the input function's area under curve (AUC) exhibited a negative correlation with the simulated ITE, while the relative error of Patlak Ki images showed a positive correlation. For ITE within 30 seconds

(3 minutes), the absolute relative error of input function AUC was less than 1.5% (8.0%), the NMSE was less than 5.0×10-4 (2.0×10-3) and the absolute relative error of Ki images was less than 1.0% (5.0%); Consistent results were observed with real patient data as well. ***Conclusion:*** The relative error of Patlak Ki images exhibited a positive correlation with ITE. Differences in Ki images were negligible when ITE was within 30 seconds. The absolute error of Ki images remained below 5% when ITE was within 3 minutes.

EPS-224

Validation and Clinical Impact of Motion-Free PET Imaging Using Data-Driven Respiratory Gating and Elastic PET-CT Registration

A. H. Dias[1], *J. Schaefferkoetter[2], J. R. Madsen[1], T. Ø. Barkholt[1], A. B. Rodell[3], N. Birge[2], P. Schleyer[2], O. L. Munk[1,4];*
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Aim/Introduction: Clinical whole-body (WB) PET images can be compensated for respiratory motion using data-driven gating (DDG) [1]. Still, DDG PET images can have respiratory motion artefacts at the diaphragm, such as the "banana artefact", if the CT is acquired in a different respiration phase than the PET image. In this work, we explore the combined use of DDG PET and a novel deep-learning (DL) model that performs elastic registration of CT to an uncorrected PET image (WarpCT) [2], which enables reconstruction of PET and DDG PET images using WarpCTs for improved attenuation- and scatter correction. ***Materials and Methods:*** Our validation cohort consisted of 20 patients referred for clinical FDG WB examination on a PET/CT scanner (26.3cm FOV, 214ps TOF) that performed two CT scans: a free respiration CT (CTfree) and an additional end-expiration breath-hold CT (CTex). The novel DL model was used for elastic registration of each CT to the uncorrected PET and DDG PET images. Then, PET and DDG PET image sets were reconstructed using both CTs and both WarpCTs. These data were used to verify the robustness of the DL algorithm. Finally, the clinical impact cohort consisted of 10 selected clinical patients with FDG avid malignant foci around the diaphragm and/or large "banana artefacts" was evaluated for improvement in image quality and tumor to background ratios. ***Results:*** We evaluated visually that WarpCTs had a better anatomical match to the PET than the original CTs. When evaluating the difference image of the original CTs (CTfree - CTex), and of both the ungated and gated WarpCTs (WarpCTfree - WarpCTex or DDGWarpCTfree - DDGWarpCTex), we found a WB mean reduction of ~40%, of the error in Hounsfield units per mL ($p<0.001$) for both WarpCT difference images. Thus, the DL model makes similar WarpCTs when registering two different CTs to the same PET. In the 10 selected clinical patients, we observed a clear reduction of "banana artefacts" when combining DDG PET and the new DL model. A cumulative improvement in lesion-to-background ratios around the diaphragm was also observed when applying the DL model together with DDG. ***Conclusion:*** The application of the novel elastic PET/CT registration DL model, combined with DDG PET, results in motion-free PET images, reduced respiratory motion artefacts and enhanced lesion-to-background ratios around the diaphragm. ***References:*** 1. Dias AH et al. EJNMMI Research. 2022;12. 2. Schaefferkoetter J et al. EJNMMI. 2023;50.

EPS-225

Head-to-head comparison of the detection performance and tumor uptake of ^{68}Ga-FAPI-04 and ^{18}F-FDG PET/CT in liver metastases from cancers of different type

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Aim/Introduction: We sought to compare the detection performance and tumor uptake of 68Ga-FAPI-04 and 18F-FDG in liver metastases from cancers of different type. ***Materials and Methods:*** Total of 76 patients were included between May 2020 and April 2023.The detection performance of 18F-FDG and 68Ga-FAPI-04 PET/CT was determined via visual evaluation. Differences in the maximum standardized uptake value (SUVmax) and tumor-to-background ratio (TBR) were also analyzed between 18F-FDG and 68Ga-FAPI-04 PET/CT. ***Results:*** For detecting liver metastases, the sensitivity (94.80% vs. 69.94%, $p<0.001$) and accuracy (91.53% vs. 70.37%, $p<0.001$) of 68Ga-FAPI-04 PET/CT were significantly greater than that of 18F-FDG PET/CT in total of cancer (with 76 patients), the sensitivity (97.87% vs. 73.05%, $p<0.001$) and accuracy (96.05% vs. 74.34%, $p<0.001$) of 68Ga-FAPI-04 PET/CT were significantly greater than that of 18F-FDG PET/CT in carcinoma (with 65 patients), and the sensitivity (94.96% vs. 69.75%, $p=0.021$) of 68Ga-FAPI-04 PET/CT was significantly greater than that of 18F-FDG PET/CT in sarcoma (with 11 patients). In addition, in the digestive system cancer (54 out of 76 patients), the sensitivity (94.96% vs. 69.75%, $p<0.001$) and accuracy (92.31% vs. 70.00%, $p<0.001$) of 68Ga-FAPI-04 PET/CT were significantly greater than that of 18F-FDG PET/CT. On semiquantitative analysis, the SUVmax of 68Ga-FAPI-04 was significantly greater than that of 18F-FDG for digestive system cancer (mean, 6.45 vs. 5.20; $p=0.002$) and carcinoma (mean, 6.33 vs. 5.39; $p=0.017$). The TBR of 68Ga-FAPI-04 was significantly greater than that of 18F-FDG for total of cancer (median, 4.60 vs. 1.67; $p<0.001$), digestive system cancer (median, 4.80 vs. 1.67; $p<0.001$), carcinoma (median, 4.83 vs. 1.69; $p<0.001$), and sarcoma (median, 3.25 vs. 1.49; $p<0.001$). ***Conclusion:*** 68Ga-FAPI-04 PET/CT has a significantly greater detection performance than 18F-FDG PET/CT in detecting liver metastases in digestive system cancer and carcinoma.

EPS-226

Assessment of fully quantitative and simplified methods for analysis of [^{68}Ga]Ga-FAPI-46 uptake in patients with bile duct or pancreatic duct cancer using LAFOV PET/CT

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Aim/Introduction: Fibroblast activation protein, characterized as a type II transmembrane glycoprotein, emerges as a significant target for radiolabeled imaging due to its increased expression in various cancer and inflammatory diseases. This research employed pharmacokinetic modeling to verify the effectiveness of simplified parameters for measuring [68Ga]Ga-FAPI-46 uptake. ***Materials and Methods:*** Ten patients with bile duct or pancreatic duct cancer were prospectively included (PANSCAN-1 study part A). Scans were performed on LAFOV PET/CT Biograph Quadra from 0 to 90 minutes post-injection (p.i) of ~200 MBq of [68Ga]Ga-FAPI-46. Arterial blood samples were drawn to establish calibrated

plasma input function extracted from both continuous arterial sampler and image derived input function from ascending aorta (IDIF). The kinetics of FAPI-positive lesions were characterized using conventional plasma input tissue-compartment models and simplified quantification methods were validated against the most preferred conventional model and outcome. ***Results:*** Data from 1 patient were not included due to discontinued scan acquisition over time and missing arterial sampling. Five patients had cholangiocarcinoma, 3 patients had pancreatic ductal adenocarcinoma and 1 patient had ampullary carcinoma. Twenty-one FAPI-positive lesions were evaluated. Blood sampling showed relatively stable plasma-to-whole blood ratio and no radiometabolites were detected. Time-activity curves (> 10 min p.i.) showed almost plateau for 12 uptakes and a declining shape for 9 lesions. Reversible 2-tissue-compartment showed most preferrable fits (81% based on Akaike information criteria). Volume of distribution using Logan linearization (VT_Logan) at 30-90 min p.i., target-to-whole blood activity concentration ratio (TBR) and weight-normalized standardized uptake value (SUVbw) at 80-90 min p.i. were highly correlated to VT obtained with full kinetic analysis using IDIF (respectively R2 = 0.97, R2 = 0.94 and R2 = 0.87). TBR and SUVbw at 60-70 min p.i. were also highly correlated to VT (respectively R2 = 0.93 for TBR and R2 = 0.86 for SUVbw), however correlation decreased with earlier intervals (respectively R2 = 0.79 for TBR and R2 = 0.82 for SUVbw at 20 to 30 minutes p.i). ***Conclusion:*** The kinetics of FAPI-positive lesions are most accurately depicted by a reversible 2-tissue-compartment model. SUVbw can be used as a simplified method to quantify [68Ga]Ga-FAPI-46 uptake with a start of acquisition time at 60 minutes p.i.

EPS-227

High Blood Glucose During F^{18} FDG PET CT - Is there a Sweet Solution?

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Aim/Introduction: High blood glucose level (BGL) can reduce ^{18}F FDG uptake in tumours and may reduce sensitivity of ^{18}F FDG PET CT studies. Patient preparation prior to the study includes at least 6 hours of fasting and ensuring the BGL is less than 8mmol /l or 144mg/l prior to ^{18}F FDG injection. BGL significantly >10mmol/l are encountered regularly, due to poor preparation or difficult glycaemic control in chronic diabetics, posing significant challenges with adverse impact of diagnostic delays and inconvenience of rescheduling patients. There are conflicting reports regarding the impact of high BGL on the diagnostic quality of the study and subsequent impact on management. This study assesses the impact of high BGL on the final report of the PET CT study. This was compared with histopathology, follow up imaging and consultations. ***Materials and Methods:*** 50 patients referred for ^{18}F FDG PET CT scans having high blood glucose level (>8mmol/l) prior to the study were included. The average uptake time was 64minutes. ^{18}F FDG uptake (SUVMax) within the primary, metastases, brain and liver were assessed. The report was reviewed for diagnosis and any inconclusion due to high BGL and its impact on patient management. Follow up was available for >6 months post imaging. Clinical indications included lung nodule assessment(14/50), colorectal cancer(10/50), Lymphoma and Melanoma(4/50). ***Results:*** The mean BGL was 11.4mmol/L (range 9 -29.1). The mean SUVMax in the primary tumour was 7.4 (0.76 -33) and for the metastases was 5.8 (1.4 - 17.8). The mean SUVMax Liver- 3.6 (2.6-5.46) and Brain - 7.2 (2.6-25.6). In 7 /50 patients (2 colorectal cancer, 1 Lymphoma, 1 GIST, 1 Myeloma, 1 Lung nodule and 1 Ureteric), tumour ^{18}F FDG uptake was reduced due to high BGL, whilst in the rest, 43/50, there was no effect. In the 7 patients, the uptake was of diagnostic level and did not affect the report, confirmed on patient follow-up. ***Conclusion:*** High BGL can affect ^{18}F FDG uptake in the tumour with potential to reduce sensitivity of the study. No significant impact seen regarding high BGL on the PET CT study report and patient management. Results are in keeping with the EANM guidelines which states FDG PET-scan's value outweighs concerns about fasting hyperglycaemia. ***References:*** Boellaard, R.,Delgado-Bolton, R., Oyen, W.J.,Giammarile, F., Tatsch, K.,Eschner, W., Verzijlbergen, F.J., Barrington, S.F., Pike, L.C.,Weber,W.A. and Stroobants, S., 2015. FDG PET/CT: EANM procedure guidelines for tumour imaging:European journal of nuclear medicine and molecular imaging.

EPS-228

Estimation of LVEF and LV Volumes from Cardiac Gated ^{18}F-FDG PET Using Different Commercially Available Software

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Aim/Introduction: Positron emission tomography (PET) is a sensitive, accurate, non-invasive diagnostic tool. The use of PET has been increasing for cardiac patients, especially those with myocarditis, endocarditis, and sarcoidosis. PET also helps determine inflammation and infection and assess myocardial viability in patients with heart failure and coronary artery disease considered for revascularization. PET can discriminate viable from scarred tissue in damaged myocardium. Gated ^{18}F-fluorodeoxyglucose (^{18}F-FDG) PET enables the study of metabolic properties of myocardial tissues and provides further information about global left ventricular function, wall thickening, and regional wall motion. This study aimed to quantify and compare left ventricular (LV) volume and ejection fraction (EF) using different commercially available software to assess myocardial viability in heart failure patients. ***Materials and Methods:*** Fifteen patients underwent electrocardiographically gated ^{18}F-FDG cardiac PET/CT in order to determine myocardial viability. Three commercially available software packages were used to obtain the left ventricular end-diastolic volume (EDV), end-systolic volume (ESV), and left ventricular ejection fraction (EF). The software packages used were Cedars-Sinai's Quantitative Automated Gated SPECT (QGS - Cedars-Sinai Medical Center), the Corridor4DM (4DM - INVIA, LLC) application (formerly known as 4DM-SPECT), and CardIQ (GE Healthcare) software. ***Results:*** The LVEF measured by QGS and CardIQ was not significantly different, while the values obtained from 4D-MSPECT were relatively higher. Among the various parameters analysed, the reconstruction algorithms Q.Clear with β-value = 1000 resulted in the highest LVEF variations, while Q.Clear with β-value = 300 had the lowest. ***Conclusion:*** Significant differences were found among the three image post-processing software packages, which could affect the prognostic results of the cardiac exam and patient management.

EPS-229

[18F]-piflufolastat used for PSMA-PET/CT imaging of patients presenting with first biochemical recurrence of prostate cancer: assessment of the agreement of per-region reading between an experienced nuclear medicine physician and a deep-learning-based software

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Aim/Introduction: Artificial intelligence-aided imaging is of increasing interest since it might improve diagnostic reading performance. We tested the per-region agreement in reading of [18F]-piflufolastat used for PSMA-PET/CT imaging of prostate cancer (PCa) patients presenting with first biochemical recurrence (1stBCR) between an experienced nuclear medicine physician (ENMP) and a deep-learning-based automated software (AI). ***Materials and Methods:*** PET/CTs from the phase III "PYTHON" study were used. Details on the AI and its automatic-detection-function, which has been developed to standardize quantification and reporting in PCa patients and not to flag lesions, have been previously published [1]. First, an ENMP read all the PET/CTs, blinded to the clinical data, and quoted the abnormal foci in agreement with the e-PSMA guidelines' 5-point scale, for several anatomical regions. Second, the AI automatic-detection-function was performed on the PET/CTs. Automatically detected foci were noted for the same anatomical regions as those in the ENMP reading. Uptakes in urinary, digestive or vascular structures, degenerative/traumatic bone lesions and ganglia were considered obvious irrelevant foci and excluded from the analysis. Uptakes whose volume was below 0.1 ml defined according to the PET/CTs acquisition parameters were also not considered. The per-region agreement between ENMP and AI readings was assessed using Cohen's kappa k-coefficient. Analysis was performed by considering equivocal findings by ENMP (e-PSMA score 3) positive for PCa. ***Results:*** Overall, 192 PET/CTs were analyzed. From AI-reading, a median of 17 obvious irrelevant foci per patient were excluded. Per-patient positivity rate for ENMP and AI was 71% and 80% respectively. ENMP and AI concordantly classified 149/192 (78%) PET/CTs but disagreed on the number of positive regions in 66 of them. There was strong agreement for the prostate bed (k=0.65), pelvic lymph nodes (k=0.69), paraaortic lymph nodes (k=0.64) and viscera (k=0.92); moderate agreement for lymph nodes above the diaphragm (k=0.46), rib cage (k=45) and pelvis (k=0.48); weak agreement for spine (k=0.39). ***Conclusion:*** We demonstrated an encouragingly strong agreement in several anatomical regions between the separate PET/CT readings by an ENMP and an AI used like a computer-aided-design device in patients presenting with PCa 1stBCR. A further combined ENMP-AI reading will be compared to a standard of truth to demonstrate the improved diagnostic performance provided by AI-aided imaging reading. ***References:*** 1. Nickols N et al. aPROMISE: A Novel Automated PROMISE Platform to Standardize Evaluation of Tumor Burden in 18F-DCFPyL Images of Veterans with Prostate Cancer. J Nucl Med. 2022;63:233-9.

EPS-230

Development and validation of AI-driven PET/CT-based models and new imaging biomarkers to improve differential diagnosis of breast DLBCL and IDC

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Aim/Introduction: There is no effective way to differentiate breast lymphoma from breast cancer other than invasive pathology testing. We aimed to establish a multimodal artificial intelligence (AI) discrimination model and identified a robust predictive non-invasive digital imaging biomarker for the differential diagnosis of breast cancer and breast lymphoma. ***Materials and Methods:*** A total of 386 breast nodules from 279 breast diffuse large B-cell lymphoma (DLBCL) and invasive ductal carcinoma (IDC) patients with 18F-fluorodeoxyglucose (18F-FDG) positron emission tomography/computed tomography (PET/CT) were enrolled in our multi-center study. Patients with breast nodules from different centers were separated into internal and external cohorts. We have introduced a deep learning (DL) model extractor, which is trained on DLBCL and IDC datasets, combined with conventional radiomics workflow, to extract nodule-level features under different tumor slice views. Utilizing machine learning (ML) approaches, we integrated multimodal features into our models and employed local shapley and local interpretable model-agnostic explanations (LIME) to further interpret and gain clinician trust. ***Results:*** On the internal validation, our multimodal model (accuracy (ACC)=0.980, 95% confidence interval (CI)=0.957-0.991; area under the curve (AUC)=0.992, 95% CI= 0.946-0.998) outperformed unimodal models. On the external testing, the ACC and AUC were 0.975 (95% CI 0.913-0.993) and 0.996 (95% CI 0.972-0.999). Moreover, the optimal non-invasive digital imaging biomarker could distinguish between breast DLBCL and IDC, with an average ACC of 0.923±0.075 and 0.937±0.062 on the internal validation and external testing sets, respectively. ***Conclusion:*** Our study demonstrates that an AI-driven PET/CT based diagnostic differential model and non-invasive imaging biomarkers can effectively discriminate between DLBCL and IDC in the breast.

EPS-231

Enhancing Preoperative Diagnosis of Gliomas in 18F-FET PET-Negative Lesions: A Multiparametric MRI and MRS Approach Using Integrated PET/MR

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Aim/Introduction: This study aims to assess the potential utility of multiparametric MRI with magnetic resonance spectroscopy (MRS) in the diagnosis of gliomas within 18F-FET PET-negative isolated cerebral lesions. ***Materials and Methods:*** Participants with isolated cerebral lesions suspected of gliomas by conventional MRI were prospectively recruited to perform a hybrid 18F-FET PET/MRI scan between March 2022 and September 2023. The lesions with negative 18F-FET PET findings were included. Multiparametric MRI features, including conventional MRI characteristics, apparent diffusion coefficient, cerebral blood flow, and MRS parameters, were quantified within the regions of interest. Logistic regression was performed to combine conventional and advanced MRI parameters for glioma identification. Area under the curve (AUC) and net reclassification improvement (NRI) were used to determine the diagnostic efficacy of gliomas. Spearman's

tests examined correlations between PET/MRI parameters and WHO grades. ***Results:*** Fifty-one participants (44.35 ± 27.15 years old, 26 males) with 37 gliomas, 8 demyelination lesions, and 6 metastases were evaluated. choline to creatine (Cho/Cr) ratio in gliomas were significantly higher than those in non-gliomas (2.21, 1.30, $p < 0.001$). Multiparametric MRI (AUC, 0.88) outperformed conventional MRI (AUC, 0.72) in differentiating gliomas from non-gliomas (NRI = 0.29, $p = 0.02$). Ch/Cr ($r = 0.44$, $p = 0.006$), choline to acetylaspartate (Cho/NAA) ($r = 0.33$, $p = 0.047$), and metabolic tumor volume ($r = 0.47$, $p = 0.003$) correlated with WHO grades in PET-negative gliomas. ***Conclusion:*** Multiparametric MRI with MRS demonstrates significant promise in enhancing the diagnosis and overall clinical management for 18F-FET PET-negative gliomas.

1510

Tuesday, October 22, 2024, 15:00 - 16:30
Hall G1

CTE 7 - Technologists + Neuroimaging Committee - Brain PET Studies

OP-707
PET-CT neuroimaging – the state of the art
D. Van Weehaeghe;
UZ Gent, Nuclear Medicine, Gent, BELGIUM.

OP-708
Tracing the brain disease – radiotracers of choice
A. Rogeau;
Lille University Hospital, Lille, FRANCE.

OP-709
PET-MRI imaging: the next step in the future?
M. De Summa;
Fondazione Policlinico Universitario Agostino Gemelli IRCCS, Department of Radiological Sciences and Hematology, Rome, ITALY.

1511

Tuesday, October 22, 2024, 15:00 - 16:30
Hall Y1-Y3

EU Policy Symposium 1 - Policy & Regulatory Affairs Council - Bridging the Gap: EU Pharma Legislation & Basic Safety Standards - Navigating Legal Complexity across Europe

OP-710
Setting the scene
G. Simeonov;
European Commission, LUXEMBURG.

OP-711
Focus on SIMPLERAD: Recommendations and Proposed Measures to foster the interrelations between EU pharmaceutical legislation and Council Directive 2013/59/Euratom
B. Krause;
University Medical Center Rostock, Rostock, GERMANY.

OP-712
Dutch Case Study
M. Van Dok;
Dutch Ministry of Health, Welfare and Sport, The Hague, NETHERLANDS.

OP-713a
Solving the issue?
A. Sundlov;
Swedish Medical Products Agency, Uppsala, SWEDEN.

OP-713b
Switzerland: a role model for the Pharma & Radiation Protection interrelations?
R. Hesselmann;
Swiss Federal Office of Public Health, Zurich, SWITZERLAND.

1601

Tuesday, October 22, 2024, 16:45 - 18:15
Hall 1

CME 12 - Dosimetry Committee - Dose Response - How far have we come?

OP-714
How does individualization of benign thyroid therapy with 131I improve treatment?
E. Verburg;
Erasmus MC, Department Radiology & Nuclear Medicine, Rotterdam, NETHERLANDS.

OP-715
Lessons and improvements from dosimetry based 90Y-SIRT treatments
H. Levillain;
Department of Medical Physics, Institut Jules Bordet, Hôpital Universitaire de Bruxelles (H.U.B), Université Libre de Bruxelles (ULB), Brussels, BELGIUM.

OP-716
Improvements in PRRT of neuroendocrine tumours due to dosimetry based treatments
K. Sjögreen-Gleisner;
Department of Medical Radiation Physics, Clinical Sciences Lund, Lund University, Lund, SWEDEN.

OP-717
How can dosimetry help in PRRT treatments?
S. Peters;
Department of Medical Imaging, Radboud University Medical Center, Nijmegen, NETHERLANDS.

1602

Tuesday, October 22, 2024, 16:45 - 18:15
Hall 4

Special Track 12 - Oncology & Theranostics Committee - Debate: Long Axial Field of View: Value for Money?

OP-718
Point of View: LAFOV PET delivers on its promises and will do so even more in the future
B. M. Fisher;
Department of Clinical Physiology, Nuclear Medicine and PET, Copenhagen, DENMARK.

OP-719
Point of View: LAFOV PET is only for the happy few
R. Husinx;
Centre Hospitalier Universitaire de Liège, Liege, BELGIUM.

1603

Tuesday, October 22, 2024, 16:45 - 18:15
Hall X9-X12

LIPS Session 12 - Paediatrics Committee - Paediatric MSK: Pearls and Pitfalls

OP-720
Paediatric bone scintigraphy: when and how?
Z. Bar-Sever;
Schneider Children's Medical Center Israel, Petah Tikva, ISRAEL.

OP-721
Hybrid imaging in paediatric MSK: balancing Radiology and Nuclear Medicine
P. Zucchetta;
Padova University Hospital, Padova, ITALY.

OP-722
Hybrid imaging in paediatric MSK: balancing Radiology and Nuclear Medicine
C. Giraudo;
Padova University Hospital, Padova, ITALY.

1604

Tuesday, October 22, 2024,16:45 - 18:15
Hall X1-X4

M2M Track - Featured Session: Radiopharmaceutical Sciences + Translational Molecular Imaging & Therapy Committee: Imaging Non Oncological Targets

OP-723 - please see Addendum at page 1026

OP-724
PET/CT Imaging of a_vB_6 Integrin to Monitor Radiation-Induced Pulmonary Fibrosis
C. Wieczorek Villas Boas, *W. C. Y. Lo, R. Clifford, L. Strong, A. Klaas, F. Grogan, C. Bergom, B. E. Rogers;*
Washington University School of Medicine, St. Louis, MO, UNITED STATES OF AMERICA.

Aim/Introduction: Cancer patients treated with radiation therapy in the thoracic region can develop radiation-induced pulmonary fibrosis (RIPF) [1]. The αvβ6 integrin plays a central role in RIPF pathogenesis by the activation of transforming growth factor-beta after radiation injury. We hypothesize that αvβ6 is an early marker of RIPF and that PET imaging of αvβ6 can predict RIPF onset or determine the efficacy of therapeutic interventions using [64Cu]Cu-DOTA-A20-K16R. ***Materials and Methods:*** C57BL/6 female mice (N=4) were administered 14 Gy in a single fraction to the right lung using an image-guided small animal radiation research platform, which is a model that leads to RIPF. Sham-treated mice were used as controls (N=4). At four, five, and six months post-irradiation, animals were administered 11.1 MBq of [64Cu]Cu-DOTA-A20-K16R, which has shown high affinity binding to αvβ6 [2]. Mice were imaged one hour after injection using a small animal PET/CT system (Mediso). Images were reconstructed, and the SUV mean was calculated. Lungs were harvested for immunohistochemistry (IHC) to determine fibrosis (trichrome) and expression of αvβ6 integrin. ***Results:*** PET images demonstrate radioactive uptake in the right lung at the site of irradiation, with increased uptake from four to six months. At month four, there was no statistical significance (P=0.08) between sham (SUV 0.13 ± 0.03) and irradiated mice (SUV 0.15± 0.01). At month five, the irradiated lung had greater uptake (0.18 ± 0.05) than the sham (0.11 ± 0.01) (P = 0.03). At month six, uptake in irradiated lung increased to 0.28 ± 0.02, while the sham had an SUV of 0.14 ± 0.05; this difference was significant (P = 0.0003). IHC demonstrated a low level of expression of αvβ6 integrin at month four that increased at months 5 and 6, thus matching the PET imaging. Additionally, fibrosis was mild in month four, with diffuse fibrosis in month six. ***Conclusion:*** We demonstrated that PET imaging of αvβ6 integrin using [64Cu]Cu-DOTA-A20-K16R is feasible for detecting RIPF, although we were not able to show αvβ6 expression prior to fibrosis. Nevertheless, this approach could be used to determine the efficacy of anti-RIPF therapies. ***References:*** 1.Puthawala, K., et al., Inhibition of Integrin αvβ6, an Activator of Latent Transforming Growth Factor-β, Prevents Radiation-induced Lung Fibrosis. American Journal of Respiratory and Critical Care Medicine, 2008. 177(1): p. 82-90. 2.Ganguly, T., et al., Evaluation of Copper-64-Labeled αvβ6-Targeting Peptides: Addition of an Albumin Binding Moiety to Improve Pharmacokinetics. Molecular Pharmaceutics, 2021. 18(12): p. 4437-4447.

OP-725
In vivo SPECT imaging of Fibroblast Activation Protein as a non-invasive biomarker of anti-fibrotic efficacy of Gp96 inhibition in idiopathic pulmonary fibrosis
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Aim/Introduction: Idiopathic pulmonary fibrosis (IPF) is a progressive disease characterized by excessive production and deposition of extracellular matrix (ECM), leading to respiratory failure in patients. Under the influence of pro-fibrotic cytokines such as TGF-β1, lung cells acquire a myofibroblastic phenotype characterized by expression of Fibroblast Activation Protein (FAP)

and overproduction of ECM. Treatment options for IPF are limited, and can only delay disease progression without stopping it. Gp96 is an endoplasmic reticulum chaperone protein overexpressed during fibrosis, promoting membrane expression of numerous receptors involved in fibrogenesis. Inhibition of Gp96 appears to be an interesting therapeutic strategy in IPF, and we hypothesize that in vivo imaging of myofibroblasts via a probe targeting FAP could enable the monitoring of the efficacy of this type of treatment. ***Materials and Methods:*** C57BL/6 mice (male, 8 weeks old) received a single intratracheal administration of bleomycin (BLM, 1.5 mg/kg, n=14) or NaCl (n=14) as a control, then were treated or not with a Gp96 inhibitor (PU-WS13, 12.5 mg/kg, daily gavage, n=17)) or NaCl (n=16) from D8 to D22. Fibrosis was followed longitudinally by CT imaging at D8, D15 and D22. At D22, lungs and broncho-alveolar lavages (BALs) were recovered for collagen quantification (Sirius Red, Sircol and Ashcroft score), FAP immunostaining (IHC) and TGF-β1 assay (ELISA). In vitro, A549 cells stimulated with TGF-β1 (2 ng/mL, 24h) were treated or not with PU-WS13 (25/50 µM, 24h) to study FAP protein expression (WB) and protein-protein interactions between Gp96 and FAP (PLA). A FAP-specific imaging probe was developed from an anti-FAP antibody fragment (Fab) coupled to a bifunctional chelating agent (DOTAGA) for radiolabeling with indium-111 for single-photon emission computed tomography (SPECT) imaging. The [111In]In-DOTAGA-Fab-FAP probe was injected intravenously into C57BL/6 mice (100µL, 10MBq, 25µg). Mice underwent SPECT imaging at 1h, 4h and 24h post-injection. ***Results:*** In vitro, PU-WS13 decreased the interaction between Gp96 and FAP inducing its degradation. In vivo, our results demonstrated that PU-WS13 induced an inhibition of collagen accumulation, fibrous lesions on CT imaging, FAP and TGF-β1 expression induced by BLM. SPECT imaging showed a significant increase in [111In]In-DOTAGA-Fab-FAP uptake in the lungs of control fibrotic mice when compared to the PU-WS13 treated group. ***Conclusion:*** Gp96 inhibition represents an innovative anti-fibrotic strategy. In vivo imaging of myofibroblasts via the FAP protein appears capable of monitoring the efficacy of this therapy in our animal model.

OP-726

Autotaxin-Specific PET/CT Imaging using [18F]ATX-1905 for Progression Monitoring and Efficacy Evaluation in Preclinical Models with Pulmonary Fibrosis

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Aim/Introduction: Idiopathic pulmonary fibrosis (IPF) poses a lethal threat with unpredictable advancement and scarce treatment avenues. Current diagnosis via high-resolution computed tomography (HRCT) may overlook initial deterioration signs of IPF, necessitating precise early-stage detection methods and continuous monitoring. Autotaxin (ATX) emerges as a crucial target due to its high expression in IPF-afflicted lungs, holding potential for positron emission tomography (PET) tracers to track fibrosis progression. This study aimed to assess the efficacy of [18F]ATX-1905 compared to [18F]FDG in diagnosing early fibrosis, monitoring disease evolution, and evaluating treatment response in a bleomycin-induced pulmonary fibrosis (BPF) mouse model. ***Materials and Methods:*** To establish a BPF mouse model, a single dose of bleomycin was administered via intratracheal delivery. To assess treatment efficacy, mice received oral administration of two commonly used drugs for IPF, pirfenidone or nintedanib, from Day 9 to Day 23 post-bleomycin administration. Lung tissues were collected from the mice for evaluation of pulmonary inflammation using hematoxylin-eosin (HE) staining, as well as assessment of fibrosis degree using Masson staining. ATX expression in the lungs of BPF mice was examined through enzyme-linked immunosorbent assay (ELISA). PET imaging with [18F]FDG and [18F]ATX-1905 was conducted at various disease stages or treatment phases. ***Results:*** The level of pulmonary fibrosis observed in the BPF mouse model corresponded with changes in ATX expression levels. Throughout the study, particularly evident at the early stage (Day 9), PET imaging showed that the uptake of [18F]ATX-1905 in the lungs of BPF mice surpassed that of the control group and remained consistently high, reflecting the sustained presence of severe pulmonary fibrosis. This heightened lung uptake was mitigated by pretreatment with the ATX inhibitor, PF-8380. Conversely, the lung uptake of [18F]FDG markedly increased, peaking at Day 15 (mid-term), and subsequently declined, potentially indicating reduced levels of inflammation. A two-week treatment regimen using either pirfenidone or nintedanib resulted in notable reductions of ATX expression levels and fibrosis degrees within lung tissues, based on ELISA and Masson staining, as evidenced by PET imaging with [18F]ATX-1905. Furthermore, uptakes of [18F]FDG also decreased following the treatment period. ***Conclusion:*** PET imaging with [18F]ATX-1905 demonstrated outstanding capabilities in early fibrosis detection, disease monitoring, and treatment assessment within the lungs of BPF mouse models. Its notable specificity for ATX expression and sensitivity to ATX alterations indicate its potential for monitoring diverse ATX expression levels in the lungs of IPF patients.

OP-727

In vivo detection of C. difficile infection by immunoPET imaging using toxin-selective radiotracers

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Aim/Introduction: Clostridioides difficile infection (CDI) is the main leading cause of hospital acquired infections, increasing morbidity, hospitalization length and mortality of patients1,2. Conventional diagnostic tools, especially with low biomarker concentrations, may prove insufficient3,4. Our goal is to create a specific radiotracer to assess the diagnosis of CDI by Nuclear Imaging. We describe the labeling of the commercial antibody Bezlotoxumab5 (Bez), which is selective for ToxinB released by the bacteria, with clinical [89Zr]Zr to accurately identify active infectious foci in a CDI animal model ***Materials and Methods:*** Bezlotoxumab was conjugated with a 20-fold molar excess of p-SCN-Bz-DFO (30min, 37ºC, PD-10 column), and radiolabeled with 1.5 mCi of [89Zr]Zr (1h, RT, 100kDa-Amicon). In C57BL/6J mice (N=6), CDI was induced with a 10-day antibiotic regimen (cefoperazone 0.5mg/mL) followed by IP clindamycin (10mg/kg). Then, 106 CFUs C. diff (ribotype 027) were administered orogastrically. Animals with antibiotics but uninfected (N=5) and wild-type (WT) animals (N=5) served as dysbiosis (Dysb) and healthy controls respectively. 89Zr-DFO-Bez radiotracer was IV administered 24h post-infection (100 µCi), and PET/CT imaging was performed at 24h and 4d post-injection. Colons were harvested post-imaging for H&E histology and ex vivo biodistribution. ***Results:*** The synthesis of 89Zr-DFO-

Bez was successfully accomplished, with a high radiochemical yield of 67.9±18.3%, a purity level of 100% and a specific activity of 5.8±0.3 mCi/mg. PET/CT imaging confirms a specific and localized uptake of the radiotracer in the lumen of sections of the digestive system associated with the colonization of the bacteria (included colon), of the infected animals. In contrast, control groups exhibited uptake solely in excretion organs and circulatory system. Reduction of the longitude of the colon was observed only in CDI and Dysb animals. H&E histopathology confirmed a moderate CDI. Ex vivo biodistribution showed 2-fold higher uptake in CDI colons (4.0±0.9%ID/g) compared to WT (2.0±0.5%ID/g) and Dysb (2.0±1.7%ID/g). ***Conclusion:*** We have synthesized and characterized a C. difficile specific radiotracer based on commercial antibody Bezlotoxumab, 89Zr-DFO-Bez, with high radiochemical yield, purity and stability, which supports its use in in vivo studies. PET/CT imaging of 89Zr-DFO-Bez revealed a distinct and specific uptake in the colon of CDI animals, not observed in the other groups, and further confirmed by ex vivo biodistribution higher colon uptake in CDI models ***References:*** 1. Bartlett, J.G.; et al, New England journal of medicine 1978, 298, 531-534. 2. Magill SS, et al. New England Journal of Medicine. 2018;379(18):1732-44. 3. Debast SB, et al. Clin Microbiol Infect.

OP-728

Novel reporter approach for highly specific longitudinal T-cell tracking via PET

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Aim/Introduction: Cell-based immunotherapies (CART-cells, TILs) have shown great promise in the clinic, but the kinetics of distribution and expansion and the fate of transferred cells in patients are largely unknown. Non-invasive, longitudinal T-cell imaging can provide this missing information, given that the reporter system meets the following prerequisites: non-immunogenic human(ized) reporter protein, no physiological expression, high and stable expression on T-cells, and, ideally, availability of a clinically established reporter-targeted tracer with suitable in vivo characteristics. The h679-scFv/[68Ga]Ga-IMP288 system, previously employed in the context of a pretargeting strategy [1,2], combines all these features and was thus evaluated as a reporter system for longitudinal T-cell tracking using [68Ga]Ga-IMP288-PET. ***Materials and Methods:*** Jurkat T-cell lymphoma cells were transduced with a chimeric T-cell tracking receptor (CTTR-1) containing the h679-scFv using a lentiviral construct. CTTR-1 expression was confirmed using flow cytometry and in vitro [68Ga]Ga-IMP288 binding (1 nM, 37°C, 30 min). CTTR-1 expressing Jurkat cells (10 Mio) were injected both subcutaneously (SC) and intravenously (IV) into NSG mice, and [68Ga]Ga-IMP288 PET/CT was performed at different time points after cell transfer (SC: 1, 5 and 14d; IV: 28d). Moreover, a retroviral construct was used to transduce primary human T-cells with the h679-scFv (CTTR-2). ***Results:*** Transduction efficiency of Jurkat cells with CTTR-1 was >90%, resulting in in vitro binding of 64.7±3.2% of added [68Ga]Ga-IMP288 activity per 1Mio cells. In vivo [68Ga]Ga-IMP288 PET/CT allowed high-contrast visualization of SC and IV injected CTTR-1-Jurkat cells at all time points investigated. Complete absence of tracer accumulation in SC WT Jurkat tumors demonstrated the CTTR-1 specificity of [68Ga]Ga-IMP288 PET. In the IV model, extensive infiltration of the liver and bone marrow with CTTR-1-Jurkat cells after 28d was observed in [68Ga]Ga-IMP288 PET/CT and confirmed by ex vivo analyses. The retroviral transduction of primary human T-cells with CTTR-2 (3 donors) yielded transduction efficiencies of app. 35 and 20% in CD4 and CD8 T-cells, respectively, with in vitro binding of 53-69% and 8-23% of added [68Ga]Ga-IMP288 activity per 1Mio cells. ***Conclusion:*** Our proof-of-concept data clearly demonstrate the general feasibility of exploiting the established h679-scFv/[68Ga]Ga-IMP288 pretargeting approach as a reporter system for sensitive, high contrast imaging of CTTR-transduced T-cells. Its implementation in a preclinical CART-cell model to corroborate its great potential for clinical T cell tracking is currently ongoing. ***References:*** [1] C. Bodet-Milin et al., J. Nucl. Med. 2016, 57:1505-11 [2] Y. Touchefeu et al., EJNMMI. 2021, 48:874-82

OP-729

Total body [18F]FDG PET/CT imaging in lung cancer mouse models links inflammation and shifts in brain metabolism to worse disease outcome

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Aim/Introduction: In cancer metabolism studies, the circadian rhythm and chronic stress have been recognized as contributing factors to cancer development [1]. Two articles linked poor prognosis in head and neck cancer patients with stress [2] and lung cancer patients with high levels of chronic emotional stressors, such as anxiety and depression, through [18F]FDG neuroimaging [3]. This work investigates how inflammation and stress from disease burden manifests in brain uptake and is linked with a worse disease outcome in lung cancer mouse models. ***Materials and Methods:*** Lung cancer models were created in C57BL/6J (Wt) mice using orthotopic transplantation of KrasG12D mutated, p53 (KP) and A20 (KPA) deficient mouse lung cancer cells [4]. [18F]FDG was administered 30 days post-engraftment, following a 60-minute awake distribution, mice underwent µPET/CT scans under isoflurane anesthesia. Whole-body image segmentation and data analysis were conducted using PMOD and Ma-Benveniste-Mirrione brain atlas, normalising brain SUV values to total brain uptake. ***Results:*** KPA mice showed significant alterations in brain [18F]FDG metabolism: increase in basal forebrain septum and brain stem, and decrease in cortex region. Notably, decreases in brown adipose tissue (BAT) [18F]FDG uptake and white adipose tissue (WAT) volume was observed in KPA mice alongside of increases in thymus uptake and lymph node volume. Advanced disease state in KPA mice was confirmed by the significant increase in total lung uptake, increased lung and metabolic tumor volumes, lung weights and total lesion glycolysis (TLG). ***Conclusion:*** Higher inflammatory burden in KPA mice is associated with worse outcomes and impacts body composition and brain metabolism. The altered brain regions suggest a metabolic shift favoring survival functions over higher brain functions. This highlights the severe consequences of chronic inflammation on disease progression, showcasing metabolic and immune system adjustments as pivotal under stress. ***References:*** [1] Swanton C, Bernard E et al. Embracing cancer complexity: Hallmarks of systemic disease. Cell. 2024; 187(7):1589-1616. Published 2024 March 28. doi: https://doi.org/10.1016/j.cell.2024.02.009[2] Hassan MZO, Tawakol A, Wang Y, et al. Amygdalar activity measured using FDG-PET/CT at head and neck cancer staging independently predicts survival. PLoS One. 2023;18(8):e0279235. Published

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OP-730

Impact of sex and ageing on OATP function: a PET imaging study using ^{11}C-glyburide in humans

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Aim/Introduction: Sex and age may account for pharmacokinetic (PK) variability. However, corresponding molecular determinants remain misunderstood. Organic anion-transporting polypeptides (OATPs) transporters are key determinants of the liver uptake and hepatobiliary elimination of many drugs. OATPs are also expressed in other tissues where their pharmacokinetic importance is not known. 11C-glyburide is a metabolically stable probe developed to study the hepatic OATP function in humans1. The objective of this study was to assess whether OATPs account for PK variability related to sex and ageing. ***Materials and Methods:*** The study was conducted in 16 healthy humans undergoing an 11C-glyburide whole-body PET acquisition in baseline condition. Ten of them underwent a second 11C-glyburide PET scan after infusion of rifampicin, a potent OATP inhibitor. Subjects were sorted according to their age and sex: males<30y (24.0±3.2y, n=7), males>50y (57.5±5.6y, n=4), and females>50y (60.6±2.4y, n=5). The transfer rate of 11C-glyburide (kuptake) from blood to the liver was estimated to describe OATP function. Tissue exposure was expressed as the area under the curve (AUC) of 11C-glyburide kinetics in selected organs and blood. Tissue distribution was expressed as AUCR=AUCtissue/AUCblood. ***Results:*** Rifampicin drastically decreased kuptake (-73±13%, $p<0.001$) and liver exposure (-50±10%, $p<0.001$) while significantly increasing blood exposure (+24±24%, $p<0.01$). Liver exposure was 42.6±18.4% higher ($p<0.05$) in females>50y compared with age-matched males, consistent with higher kuptake values ($p<0.05$), with negligible and non-significant difference in blood exposure ($p>0.05$). Sex differences were abolished in the presence of rifampicin. In males, neither liver, blood exposures nor kuptake were changed by ageing ($p<0.05$). For all subjects, kuptake was positively correlated with liver exposure ($p<0.01$, $R2=0.78$) and negatively correlated with blood exposure ($p<0.01$, $R2=0.40$) with an impact of OATP function (kuptake) 4-fold more pronounced for liver compared with blood exposure. In other organs, no significant difference in AUCR was observed between groups. ***Conclusion:*** OATP function predominates in the liver where it may drive important sex-related differences in liver exposure, which was not discernible from blood-based data. Therefore, classical plasma PK may miss sex differences in liver exposure to OATP substrates that may account for the higher prevalence of drug-induced liver injury in females. Conversely, neither was kuptake, liver exposure nor blood kinetics of 11C-glyburide affected by ageing. This suggests no or limited decline of OATP-mediated elimination with age. ***References:*** 1Marie et al. [11C]glyburide PET imaging for quantitative determination of the importance of Organic Anion-Transporting Polypeptide transporter function in the human liver and whole-body. Biomed Pharmacother 2022.

OP-731

DNA-Encoded Chemical Library-derived high-affinity Prostatic Acid Phosphatase ligands for the delivery of radionuclides to prostate cancer

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Aim/Introduction: Lutetium (177Lu) Vipivotide Tetraxetan (PluvictoTM), a Prostate-Specific Membrane Antigen (PSMA)-targeted radioligand therapeutic, has recently gained marketing approval for the treatment of metastatic castration-resistant prostate cancer. Despite the clinical benefit observed in the VISION Phase III trial, all 831 patients treated with the drug eventually relapsed.[1] Moreover, uptake in healthy tissues, such as salivary glands and kidneys, resulted in dose-limiting toxicities. Prostatic Acid Phosphatase (ACP3), a non-specific phosphomonoesterase that is virtually absent in healthy organs, including salivary glands and kidneys, shows elevated expression levels in most prostate cancer lesions (www.proteinatlas.org). Technetium-99m and Indium-111 labeled anti-ACP3 antibody fragments successfully accumulated in metastatic prostate cancer lesions in patients when administered intravenously at high doses.[2] Highly potent and specific ACP3 ligands may provide ideal targeting moieties for the selective delivery of diagnostic and therapeutic radionuclides to prostate cancer lesions. ***Materials and Methods:*** Two DNA-Encoded Chemical Libraries comprising ~5.8 million members were screened against recombinant human ACP3. Resulting hits were synthesized as DOTAGA and fluorescein conjugates to characterize binding to recombinant and cellular ACP3. Lutetium-177-labeled ligands were injected in tumor-bearing mice to assess their in vivo targeting performance and anti-cancer activity. ***Results:*** Several ligands (named ProX1, ProX2, and ProX3) were identified as highly potent small organic binders and inhibitors of human ACP3 as observed by enzymatic inhibition, fluorescence polarization and surface plasmon resonance measurements. The best tumor accumulation and residence time after intravenous injections in mice bearing HT-1080.hACP3 or PC3.hACP3 cancer lesions was observed for ProX1, also named OncoACP3 (i.e., >35 %ID/g, 72 hours after administration). Single injections of 177Lu-OncoACP3 cured cancer at low and well-tolerated doses (i.e., 5 and 20 MBq/mouse). ***Conclusion:*** Given its exceptional tumor-targeting performance and the lack of salivary glands and kidney uptake, OncoACP3 may overcome current limits of PSMA-based ligands for pharmacodelivery applications in prostate cancer patients. ***References:*** [1] Sartor O. Lutetium-177-PSMA-617 for Metastatic Castration-Resistant Prostate Cancer. N Engl J Med. 2021;385,1091-1103. [2] Vihko P. Immunoscintigraphic evaluation of lymph node involvement in prostatic carcinoma. Prostate. 1987;11,51-7.

1605

Tuesday, October 22, 2024,16:45 - 18:15
Hall Y4-Y9

Cutting Edge Science Track - TROP Session: Physics Committee: Segmentation

OP-732

Multi-Organ Segmentation on CT-free Total-Body Dynamic PET Scans

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Aim/Introduction: The advancement of ultrasensitive, high-resolution, total-body (TB) PET/CT with an extended field of view has significantly broadened the scope of dynamic PET. However, discrepancies in temporal resolution between PET and CT pose challenges, potentially compromising quantitative accuracy. Moreover, the reliance on CT for organ segmentation can introduce errors in kinetic modelling. We aim to leverage the superior anatomical details provided by TB PET for attenuation correction (AC) and scatter correction (SC), coupled with frame-by-frame multi-organ segmentation, mitigating the effects of temporal resolution disparities and improving the precision of quantitative analyses. ***Materials and Methods:*** Deep learning algorithms were developed using static TB PET images from 430 patients scanned with the United Imaging uExplorer system. The algorithms were tested on twenty dynamic TB PET scans, each comprising 92 frames. A 3D UNet was initially trained using the nnU-Net framework [1] on non-attenuation and non-scatter corrected PET images to perform multi-organ segmentation. Ground-truth segmentation maps were generated from CT images with TotalSegmentator [2]. Subsequently, a dedicated decomposition-based network [3] was trained to handle AC and SC. For dynamic data, organ segmentations were predicted for each non-corrected frame using the segmentation network, followed by AC and SC using the decomposition network. The algorithms' performance was compared against manual segmentations refined by two physicians using Dice coefficients for each frame to assess the concordance between predicted dynamic organ segmentations and CT-based organ segmentations. ***Results:*** The trained model achieved an average Dice coefficient of 0.96 across all organs and dynamic frames. When applying the CT-based segmentation maps to the dynamic frames, an average Dice coefficient of 0.77 was attained in comparison. Table 1 depicts the Dice coefficients for each of the eight organs, comparing the outcomes from the trained model and the CT-based approach. ***Conclusion:*** The developed deep learning approach is effective for CT-free multi-organ segmentation, AC, and SC in dynamic TB PET scans, demonstrating potential to enhance accuracy and efficiency in dynamic PET imaging applications. ***References:*** [1] Isensee, Fabian et al. "nnU-Net: a self-configuring method for deep learning-based biomedical image segmentation." Nature Methods 18 (2020). [2] Wasserthal, Jakob et al. "TotalSegmentator: Robust Segmentation of 104 Anatomic Structures in CT Images." Radiology. Artificial intelligence 5 5 (2022). [2] Guo, Rui et al. "Using domain knowledge for robust and generalizable deep learning-based CT-free PET attenuation and scatter correction." Nature Communications 13 (2022).

OP-733

Fully Automated FDG and PSMA Lesion Segmentation in PET Imaging via Deep Learning

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Aim/Introduction: Metabolic tumour volume (MTV) represents an emerging biomarker for patient prognosis in oncology. However manual delineation is untenable in clinical routine. Therefore, we introduce LION (Lesion segmentatiON), an open-source, automated tool designed for tumour delineation in [18F] FDG and [68Ga]PSMA PET scans. ***Materials and Methods:*** All the PET images and tumour delineations used for this study originate from the AutoPET-III challenge dataset. Separate models for each tracer were trained. The FDG model was trained on 914 PET scans and model performance was assessed on 52 PET scans. The training data (517M/397F) included 449 cases of lymphoma, melanoma, or lung cancer, and 465 negative findings. For the PSMA model, 250 prostate cancer PET images were used for training, while 50 were used to evaluate the model performance. The models were trained on PET images only, using the nnU-Net framework [1]. Baseline models were created using tumours as the sole target class. Subsequently, models with organ context were trained with the rationale of avoiding physiological uptake in both FDG and PSMA. Organ delineations were obtained using an established CT delineation approach [2] and were subsequently verified. The so-derived tissues were incorporated as additional target classes. Model performance was evaluated using DICE score, tumour detection rate, and Spearman correlation between reference and predicted MTV. ***Results:*** The addition of organ context significantly improved the performance of both models, by preventing the segmentation of healthy organs with high tracer uptake as tumours. In the FDG model, the DICE score improved from 0.46 to 0.74, while in the PSMA model, the DICE score improved from 0.57 to 0.68. The FDG model with organ context accurately identified 691 out of 899 (77%) malignant lesions. This model also showed a strong Spearman correlation of 0.94 between the predicted and reference MTV. Likewise, the PSMA model with organ context yielded a good detection rate by correctly identifying 1118/1325 (84%) tumours, together with a strong Spearman correlation between reference and predicted MTV of 0.98. ***Conclusion:*** The incorporation of organ context achieved state-of-the-art performance in tumour segmentation for two commonly used tracers, using only the PET image as input. ***References:*** [1] Isensee, F. et al. (2021). nnU-Net: a self-configuring method for deep learning-based biomedical image segmentation. Nature Methods, 18(2), 203-211.[2] Shiyam Sundar, L. K. et al. (2022). Fully Automated, Semantic Segmentation of Whole-Body 18F-FDG PET/CT Images Based on Data-Centric Artificial Intelligence. Journal of Nuclear Medicine, 63(12), 1941-1948.

OP-734

Deep-learning-based fully automatic malignant lesions segmentation in whole-body [^{68}Ga]Ga-PSMA PET/CT scans originates comparable results as expert-based identification and segmentation

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Aim/Introduction: This work aims to assess the feasibility and robustness of deep-learning-based fully automatic malignant lesion detection and segmentation on whole-body [68Ga]Ga-

PSMA PET/CT scans and their influence on disease characterization. ***Materials and Methods:*** A dataset of 355 whole-body [68Ga]Ga-PSMA PET/CT scans from patients with prostate cancer was used for training and testing a deep-learning-based network using the nnU-Net framework [1]. The architecture was a 3D U-Net with two channels (PET-PSMA and CT). The scans were performed in two different PET/CT scanners: Philips Vereos Digital and Philips Gemini TF16. 53% of the cases were related to staging and the other 47% to re-staging/assessment of response to therapy. The mean injected activity was 1.90±0.32MBq/kg and the scans started approximately 88±31 minutes post-injection. The training dataset contained 285 scans from 147 patients (some patients underwent early and/or late scans with the same injection, or underwent two follow-up scans). The testing dataset contained 70 scans from 70 patients not included in the training dataset. Manual lesion identification was performed by experienced nuclear medicine physicians and semi-automatically segmented based on a Bayesian method [2]. This was considered the gold standard. ***Results:*** From the 70 test scans, 52 were identified by the physicians as having suspected malignant lesions: 33 in the prostate/prostate site, 9 in the bones, 14 in the lymph nodes, and 2 in the seminal vesicle. The network had a sensitivity and specificity, respectively, of 94% and 78% for the detection of scans with malignant lesions, 97% and 95% for the detection of prostate/prostate site malignant lesions, 100% and 97% for the detection of scans with bone metastases, and 100% for the detection of scans with malignant lymph nodes. Regarding the quality of the voxelwise segmentation on the 52 scans with suspected malignant lesions, the median Dice coefficient was 0.73 (interquartile range [IQR]:0.56-0.88), the sensitivity was 76% (IQR:40%-93%), and the predictive positive value was 94% (IQR:77%-100%). ***Conclusion:*** The deep-learning-based solution herein implemented showed potential to be used in clinics. The detection of prostate malignant lesions or recurrence at the prostate site, bone metastases, and malignant lymph nodes was similar to the physicians' detection. The use of this network alone would give similar conclusions on the majority of the scans. Nevertheless, experienced nuclear medicine physicians' supervision and quality control are, at the moment, considered mandatory. ***References:*** [1]Isensee et al. Nature Methods 2021, DOI:10.1038/s41592-020-01008-z; [2]Constantino et al. J Digit Imaging 2023, DOI:10.1007/s10278-023-00823-y.

OP-735

Fully automated segmentation of lymphoma manifestations in the GHSG HD16, HD17 and HD18 trials

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Aim/Introduction: PET/CT is routinely used for staging newly diagnosed Hodgkin Lymphoma (HL), with previous analyses emphasizing the value of baseline metabolic tumor volume (MTV) to predict outcome. However, manual segmentation is time-consuming and labor-intensive. Therefore, we aimed to develop a fully automatic segmentation model for HL. ***Materials and Methods:*** We analyzed baseline PET/CT images obtained within the German Hodgkin Study Group HD16 (early favorable), HD17 (early unfavorable), and HD18 (advanced stage) trials, collected from 103 different sites between August 2008 and December 2016. Lesion annotations were manually delineated by an experienced nuclear medicine expert using a cut-off of SUV > 4. We then developed a deep learning-based 3D segmentation model using ^{18}F-FDG PET/CT imaging for automatic lesion segmentation with the nnU-Net framework. The model was validated on test datasets using voxel-based Dice scores and lesion-based metrics, including sensitivity, precision, and F1 score. Spearman's rank correlations were calculated to assess the consistency between predicted and ground-truth MTVs. ***Results:*** The study included 550 patients (mean age 35.2 ± 12.6 years; 305 men) with available baseline imaging. The 3D Residual Encoder UNet model was trained on 459 patients using patch sizes of 144 x 288 x 144 voxels. Across the entire test dataset (n=91, 918 lesions), the model attained a mean Dice Score of 0.88, a lesion sensitivity of 0.84, a lesion precision of 0.78, and a lesion F1 score of 0.77. In the HD16 test subset (n=19, 61 lesions), the model reached a Dice score of 0.86, a lesion sensitivity of 0.92, a lesion precision of 0.76, and a lesion F1 score of 0.80. In the HD17 test subset (n=17, 109 lesions), it achieved a Dice score of 0.91, a lesion sensitivity of 0.87, a lesion precision of 0.78, and a lesion F1 score of 0.81. In the HD18 test subset (n=55, 748 lesions), it achieved a Dice score of 0.87, a lesion sensitivity of 0.80, a lesion precision of 0.79, and a lesion F1 score of 0.75. There was a high correlation between MTVs derived from manual measurements and automatic segmentations (HD16: rho=0.98, p=1.7e-13; HD17: rho=0.98, p=2.0e-12; HD18: rho=0.95, p=7.6e-28). ***Conclusion:*** The fully automated segmentation of HL demonstrates high accuracy and a very strong correlation between MTVs across both early and advanced stages. Future work will focus on expanding the scope of the model to predict treatment response by including follow-up scans.

OP-736

Segmentation of cerebrum grey matter in [18F]FDG PET imaging using convolutional neural networks

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Aim/Introduction: Precise quantification of grey matter uptake of [18F]FDG PET helps in the differential diagnosis of several neurological disorders. However, precise identification of grey matter typically requires an additional MRI scan. This study aims to assess the feasibility of fully automatic cerebrum grey matter segmentation based on [18F]FDG PET images and its influence on grey matter uptake quantification in the absence of MRI data. ***Materials and Methods:*** A dataset of 370 subjects was downloaded from the Alzheimer's Disease Neuroimaging Initiative (ADNI) database. For each subject, there is a brain [18F]FDG PET and a structural MRI. 300 subjects were selected for training resulting in the following disease distribution: 62 with Alzheimer's disease (AD), 163 with mild cognitive impairment (MCI), 4 with subjective memory concerns (SMC), and 71 cognitively normal (CN). The test dataset contains 70 subjects: 20 with AD, 29 with MCI, 2 with SMC, and 19 CN. For automatic segmentation, a 3D U-Net was trained using the nnU-Net framework [1]. The gold standard segmentation used for training and testing was obtained from the subject's MRI scans using the toolbox Statistical Parametric Mapping (SPM) running in MATLAB. Image registration and quality control tasks were performed in the 3D Slicer software. Agreement between the grey matter segmentation performed by the network and the gold standard was assessed using the Dice similarity coefficient (DSC). The relative difference of the [18F]FDG uptake based on the masks obtained from the network and the MRI was measured to assess the influence of the segmentation on quantification.

Results: The median DSC in the test dataset was 0.79 (IQR: 0.75-0.82) and similar among CN, MCI and AD subjects (median DSC difference < 0.03). The mean absolute deviation in grey matter [18F]FDG uptake obtained from both mask types was 0.72%, with the highest deviation being lower than 1% for all scans in the test dataset. There were no clinically significant differences in the quantification of [18F]FDG PET cerebrum grey matter uptake values obtained between the two masks. ***Conclusion:*** We herein demonstrate that cerebrum grey matter segmentation based on [18F]FDG PET uptake is feasible and sufficiently reliable for quantification in patients with AD, despite the markedly grey matter reduced uptake (signal intensity). Further work is needed to confirm this methodology efficacy in other neurodegenerative diseases, overall and in specific brain regions of interest according to specific pathologies. ***References:*** [1] Isensee et al. Nature Methods (2021), DOI: 10.1038/s41592-020-01008-z.

OP-737

A deep learning-based automatic segmentation method on left ventricle in dynamic myocardial perfusion using a CZT-SPECT

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Aim/Introduction: Cadmium-zinc-telluride (CZT) cameras enable dynamic SPECT to evaluate regional myocardial blood flow and coronary flow reserve, and accurate left ventricle (LV) segmentation is crucial for evaluating myocardial perfusion. Nevertheless, accurate labelling of myocardium is challenging due to the high noise-to-signal ratio of dynamic SPECT, making manual annotation results infeasible to train artificial intelligence models. This study aimed to propose an automated segmentation approach in dynamic SPECT images integrating the shape information of static SPECT and image registration. ***Materials and Methods:*** The training set comprised 466 patients who underwent dipyridamole 99mTc-MIBI dynamic CZT-SPECT, and the static and dynamic external validation sets included 54 patients with manual labeling for static images and the averages of the last 180-sec of dynamic images. All images were manually labeled by two experienced nuclear physicians.With 5-fold cross validation, the proposed method was accomplished in two steps. The first step was to train a deep learning model, V-Net, for automated segmentation of LV on static SPECT. The second step was to register the LV segmented by the V-Net to the mean dynamic image of the last 180-sec. Registration was achieved by the SyN non-rigid registration method with the rotation angle constraints to reduce the probability of being trapped in an improper rotation. The non-rigid registration results of the static segmented LV were considered as the segmentation results of the dynamic SPECT images. ***Results:*** The average Dice of V-Net for the static myocardial segmentation was 0.96 in the internal test dataset and 0.95 in the external validation set, suggested that V-Net effectively provides high-quality myocardial segmentation of LV. Moreover, the average dice of the derived myocardial segmentation via registration for the external validation datasets of the dynamic SPECT was 0.85. To evaluate the quality of the registration results, the aligned myocardial regions of the static and dynamic images were assessed using three indices for the external validation dataset. These three indices were Pearson correlation coefficient, mutual information and structural similarity index measure, the results of which were 0.88 ($p<0.001$), 6.73, 0.69. While the reasonably high dice value indicated the accuracy of the segmentation results, three indices suggested that the aligned myocardial regions of LV be highly correlated and mutually similar. ***Conclusion:*** This study demonstrated that automatic 3D segmentation of dynamic image of LV could be effectively attained by non-rigidly registering the myocardium segmented from the static SPECT on to the mean dynamic images.

OP-738

Deep-learning-based automated delineation and classification of metabolic tumor volume in non-small-cell lung cancer in [18F]FDG-PET/CT

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Aim/Introduction: Patients with locally advanced non-small-cell lung cancer (NSCLC) have a high risk of developing distant metastases. It has been shown that applying immunotherapy after radiochemotherapy can significantly improve the prognosis for affected patients. In this context, biomarkers for individualized therapy escalation are urgently needed. One such biomarker could be the total metabolic volume of primary tumor and lymph node (LN) metastases (total tumor burden, TTB). However, delineation of tumor lesions with conventional methods is time consuming and error-prone, especially for the LN metastases. The goal of this study was to investigate feasibility of such delineation with deep learning methods. ***Materials and Methods:*** Automated delineation was performed with a 3D U-Net convolutional neural network (CNN) developed with the nnU-Net software package [1]. The default nnU-Net training parameters were modified to provide better training stability with small lesion targets as well as to better balance sensitivity vs. positive predictive value (PPV) of lesion detection. A dataset consisting of 517 [18F]FDG-PET/CT scans of NSCLC patients was used for the network training and testing following 5-fold cross-validation scheme. In these data, the ground truth labels were defined via manual delineation and labeling of primary tumor and metastases by an experienced physician. ***Results:*** The derived CNN models were capable of accurate delineation, achieving a mean (median) Dice similarity coefficient of 0.831 (0.891). The sensitivity and PPV of lesion detection was 0.974/0.829/0.887 and 0.963/0.741/0.824 for primary tumor/LN metastases/union of both, respectively. Accuracy of lesion classification as primary tumor or LN metastases was 92.1%. Manually and automatically derived TTBs were highly correlated with R2=0.96 and a mean absolute difference of 5.4 ml (after rejecting 1% of the outliers). ***Conclusion:*** In this work, we present CNN models able to perform delineation of and discrimination between primary tumor and lymph node metastases in NSCLC in [18F]FDG-PET/CT with only sporadic manual corrections required. This provides the ability to accelerate large-scale study data evaluation in quantitative PET and has potential for clinical

application. ***References:*** [1] Isensee, F., Jaeger, P.F., Kohl, S.A.A. et al. nnU-Net: a self-configuring method for deep learning-based biomedical image segmentation. Nat Methods 18, 203-211 (2021).

OP-739

Automatic detection of lesions by "artificial intelligence" in [18F]FDG PET/CT in clinical practice : what is the most efficient solution ?

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Aim/Introduction: Artificial intelligence (AI) algorithms have recently been commercialized to assist nuclear medicine physicians in lesion detection in clinical practice. The aim of this study was to evaluate the lesion detection performance on [18F]FDG PET/CT by two commercially available AI algorithms using a convolutional neural network (CNN), when used alone or in addition to a human reading. ***Materials and Methods:*** One hundred and fifty-one [18F]FDG PET/CT scans of patients managed for melanoma or lymphoma in 3 French centers were retrospectively analyzed. Lesion detection was performed according to four methods: manually (M1) ; by using a « PET Assisted Reporting System » (PARS) based on CNN trained on 629 patients with lymphoma and lung cancers (1), with a detection threshold at SUV 2.5 (M2) or PERCIST-like (M3) ; and by using a one-step U-net algorithm trained on 4906 patients with multiple neoplasias (M4) (2). All volumes of interest (VOIs) identified by each of the 4 methods were reviewed by an expert consensus. VOIs judged to correspond to neoplasic lesions related to the pathology studied were labeled "true positives" (TP). The sensitivities of detection methods were compared in pairs using Student's paired-sample t-test, as well as sensitivities of automated methods combined with human reading. ***Results:*** A total of 1,544 lesions were considered as the reference standard. The respective sensitivities one-step method (M4), PARS with a SUV threshold of 2.5 (M2) and PERCIST-like (M3), and the manual method (M1) were 95.7%, 60.2%, 44.3%, and 76.6%, respectively. When combining M4 with human detection (M1), its sensitivity reached 99.9%, significantly higher than that of any other method alone or combined. M4 reported the highest number (1435) of false-positive VOIs, compared with 837 for M2 and 151 for M3. ***Conclusion:*** The use of some clinically available AI algorithms could provide a robust safety net to physicians for lesion detection on [18F]FDG PET/CT, with more than 99% sensitivity. Its routine use is nevertheless currently limited by its high false-positive rate. ***References:*** 1) Nicolò Capobianco, Michel A. Meignan, et al. Deep learning FDG uptake classification enables total metabolic tumor volume estimation in diffuse large B-cell lymphoma. Journal of Nuclear Medicine Jun 2020, jnumed.120.242412;https://doi.org/10.2967/jnumed.120.242412 2) Blanc-Durand, P., Jégou, S., Kanoun, S. et al. Fully automatic segmentation of diffuse large B cell lymphoma lesions on 3D FDG-PET/CT for total metabolic tumour volume prediction using a convolutional neural network. Eur J Nucl Med Mol Imaging 48, 1362-1370 (2021). https://doi.org/10.1007/s00259-020-05080-7.

OP-740

Multi-center Deep learning-based Lesion Segmentation in^{18}F-FDG PET/CT Imaging: Comparative Efficacy, Prognostic Insights, and Clinical Implications

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Aim/Introduction: Medical imaging analysis relies heavily on segmentation, a fundamental task that traditionally demands significant time and expertise for manual execution. Automatic or semi-automatic segmentation methods, particularly those based on deep learning (DL), offer substantial time and labor savings. However, many current medical image segmentation models are limited in their adaptability, especially in the context of PET imaging, which exhibits variability across different centers due to instrumentation and imaging protocol differences, alongside disease-specific biodistribution variations. Moreover, concerns persist regarding the reproducibility and clinical applicability of DL-driven segmentation tools, which often lack robust external dataset validation and clinical evaluation. ***Materials and Methods:*** We developed a DL-based whole-body lesion segmentation using a dataset of 2963 patients scanned with various scanners, undergoing 18F-FDG PET imaging for diseases including lymphoma, lung cancer, and melanoma, acquired from 5 centers. The developed model was tested on a separate dataset and evaluated for lesion detectability and segmentation accuracy against manual segmentations. Furthermore, we assessed the prognostic predictability using clinically relevant features extracted from PET imaging. ***Results:*** The developed model achieved a mean Dice score of 0.745 at the patient level and 0.816 at the voxel level. Bland-Altman analysis demonstrated good agreement between ground truth metabolic tumor volumes (MTV) and predicted MTV, with biases of -55.8 (-930.5, 819.0±1.96 SD) with 95% confidence intervals. Kaplan-Meier curve analysis showed that imaging features extracted from DL-segmentation and manual segmentation exhibited similar prognostic predictability (p=0.0011 for MTV, p=0.00019 for TLG). ***Conclusion:*** The developed DL-based tool has the potential to enhance lesion detectability and segmentation accuracy, offering a streamlined approach for image analysis. It stands to benefit effective patient management and facilitate personalized precision medicine.

1606

Tuesday, October 22, 2024,16:45 - 18:15
Hall Z

Clinical Oncology Track - TROP Session: Oncology & Theranostics Committee: Other Malignancies

OP-741

Safety, pharmacokinetics, and preliminary imaging findings of 68Ga-OncoFAP based on a prospective multicentre Phase I clinical trial in patients with breast, oesophageal, pancreatic and colorectal cancer

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Aim/Introduction: Fibroblast Activation Protein (FAP) has recently emerged as a promising pan-tumoural target for the delivery of diagnostic and therapeutic radio-conjugates. OncoFAP is a small organic ligand with high affinity for human FAP1,2. [68Ga]Ga-OncoFAP is currently being studied in a prospective, multicentre Phase I clinical trial (NCT05784597). The primary objective of this trial is to evaluate the safety; secondary objectives include definition of the kinetics, biodistribution and preliminary imaging findings evaluation. ***Materials and Methods:*** Up to 20 patients with a pathologically confirmed diagnosis of breast, oesophageal, pancreatic, or colorectal cancer are enrolled into two cohorts. Cohort A comprises 3 female and 3 male patients with an early stage tumour; cohort B comprises also patients with advanced/metastatic disease. All patients receive a single administration of 250 (225-275) MBq [68Ga]Ga-OncoFAP followed by PET/CT scans at 0-30, 60, and 120 min, using scanners with an EARL accreditation for 68Ga. Adverse events are assessed according to CTCAE v.5 criteria. Blood and urine samples are collected before and up to 120 min post-administration to analyse pharmacokinetics and excretion. Uptake in lesions and healthy organs is evaluated by SUVmax, SUVmean and tumour:organ ratio. ***Results:*** At the cut-off date of the 18th of April 2024, 17 patients (6 males, 11 females), median age 56 (46-76) years, have been enrolled. Seven (7) patients have a diagnosis of breast cancer, five (5) patients with pancreatic cancer, three (3) patients with oesophageal cancer, and two (2) patients with colorectal cancer. Six patients (3 males and 3 females) have been enrolled in cohort A. No adverse events related to administration of [68Ga]Ga-OncoFAP have been recorded. The maximum concentration in the blood was reached within 10 min of administration, followed by rapid clearance. Biodistribution and quantitative image analysis are currently ongoing. From the preliminary PET/CT scans evaluation resulted that all patients showed rapid and selective tumour uptake. Shortly after administration (0-30 min), SUVmax of the lesions was in the range 4.88-36.36. Healthy organs except for kidney and pancreas had an SUVmean below 5. Kidney uptake was mainly restricted to the urinary tract, and no significant uptake was observed in the kidney parenchyma. Increased uptake in the healthy pancreas was predominantly seen in patients with pancreatic cancer. ***Conclusion:*** [68Ga]Ga-OncoFAP was well tolerated and showed promising pharmacokinetics and uptake properties for PET imaging of a range of solid tumours. ***References:*** 1) Millul et al, PNAS, 2021, 118:16:e21018521182) Backhaus et al, EJNMMI, 2022, 49:1822.

OP-742

Enhanced Diagnostic and Therapeutic Potentials of 68Ga-LNC1013 and 177Lu-LNC1013 in Cancer Imaging and Radionuclide Therapy: A Comparative and Preclinical Study

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Aim/Introduction: 68Ga-LNC1013 is a novel dimeric PET tracer designed for targeting the fibroblast activation protein (FAP), exhibiting prolonged retention in tumors. This study aims to evaluate the diagnostic superiority of 68Ga-LNC1013 PET/CT over ^{18}F-FDG PET/CT in detecting primary and metastatic cancer lesions and to explore the therapeutic potential of 177Lu-LNC1013 in a preclinical setting. ***Materials and Methods:*** In this comparative study, 33 cancer patients with 12 different malignancies underwent simultaneous 68Ga-LNC1013 and ^{18}F-FDG PET/CT imaging. The performance of these tracers was assessed through lesion detection rates and quantitative uptake values (SUVmax and TBR). Additionally, a subgroup underwent 68Ga-FAPI-04 PET/CT. Preclinical studies involving 177Lu-LNC1013 were conducted using CT-26-FAP cell-derived xenografts (CDXs) to assess its potential in radionuclide therapy through SPECT imaging and biodistribution studies. ***Results:*** In our comparative analysis, 68Ga-LNC1013 detected a total of 128 lesions across 33 patients, demonstrating enhanced capabilities over ^{18}F-FDG, which identified 116 lesions. Specifically, 68Ga-LNC1013 detected 25 primary or recurrent lesions compared to 22 by ^{18}F-FDG, and 20 liver metastases versus 17 by ^{18}F-FDG, showcasing its superior detection rates. Quantitative analysis revealed significantly higher SUVmax and TBR for 68Ga-LNC1013 in primary tumors (SUVmax: 12.8 ± 7.5 vs. 7.2 ± 5.6, $P < 0.001$; TBR: 9.7 ± 6.5 vs. 4.8 ± 4.1, $P = 0.001$) and liver metastases (SUVmax: 10.8 ± 3.4 vs. 5.6 ± 2.0, $P = 0.043$; TBR: 4.3 ± 3.4 vs. 2.3 ± 0.9, $P = 0.048$), indicating higher tumor uptake and improved image contrast. Preclinical SPECT imaging showed that 177Lu-LNC1013 achieved peak tumor uptake at 72 hours post-injection, followed by a gradual decrease, with minimal uptake in healthy tissues. This tracer demonstrated superior tumor growth inhibition compared to 177Lu-FAPI-46 and control groups in CDXs, suggesting effective radionuclide therapy potential. ***Conclusion:*** 68Ga-LNC1013 outperforms ^{18}F-FDG in the diagnostic imaging of diverse cancer types, providing higher contrast and detection sensitivity. The theranostic potential of this tracer series is further highlighted by the promising therapeutic outcomes of 177Lu-LNC1013 in preclinical models, setting the stage for advanced FAP-targeted theranostics in oncology.

OP-743

In Vivo needs in Vitro - Subtype specificity of CXCR4 Theranostics in chemotherapy resistant Muscle Invasive Bladder Cancer within the Bladder BRIDGister.

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Aim/Introduction: Patients with MIBC achieving pathological complete response (pCR) upon neoadjuvant chemotherapy (NACT) have improved prognosis. Previously we did show that luminal tumours respond better to NACT, while FGFR1 expression is associated with chemoresistance . Interestingly, the expression of the radioligand target CXCR4 is found in chemoresistant,

stroma-associated tumours rather than luminal or basal tumours. The objective of this study was to prospectively validate the predictive value of molecular subtyping and target quantitation for selecting patients for PET/CT after intraluminal application of 68Ga-CXCR4 (via a transuretrhral catheter) and subsequent intravesical radioligand therapy ("RadioMolecularIncubator Theranostics"). ***Materials and Methods:*** Formalin-fixed paraffin embedded (FFPE) tissues from the first 100 TURB samples from the BladderBRIDGister molecular registry as well FFPE tissue from the first patients undergoing intravesical 68Ga-CXCR4-PET/CT were prospectively collected. RNA from FFPE tissues were extracted by commercial kits, relative gene expression subtyping markers (KRT5, KRT20, PPARG), ADC targets (TROP2, NECTIN4), CPI targets (PD-L1, PD-1, CTLA4) and radioligand targets (CXCR4, FAP) were analysed by standardized RT-qPCR systems (STRATIFYER Molecular Pathology GmbH, Cologne). Hierarchical clustering, Kruskal-Wallis, chi square and contingency tests were done by JMP 9.0.0 (SAS software). ***Results:*** Hierarchical clustering revealed three different clusters by combining target gene quantitation of ADC and theranostic drugs and subtyping markers with strong luminal and basal characteristics as defined by high mRNA expression of KRT20, PPARG and KRT5, respectively with high, intermediate and low expression of luminal target genes. In contrast, CXR4 mRNA expression dominated in non-luminal tumours with only minor expression in luminal tumours. To functionally validate subtype expression of CXCR4 expression, we instilled 68Ga-CXCR4 into the bladder of two advanced bladder cancer patients after failure of neoadjuvant Gem/Cis chemotherapy. 68Ga CXCR4 PET/CT clearly visualized the non-luminal MIBC invading the perivesical soft tissue. In contrast, 68Ga CXCR4 PET/CT was completely negative in the luminobasal MIBC. ***Conclusion:*** We functionally validated the relevance of mRNA-based assessment of bladder cancer subtype expression as well as CXCR4 target gene expression from tumour biopsies in vitro to select patients for effective subsequent theranostic approaches in vivo. Previously, we have shown that determining CXCR4 mRNA from TUR biopsies predicts non response to neoadjuvant chemotherapy. Here we show that non-luminal bladder cancer patients, not responding to neoadjuvant chemotherapy, might benefit best from theranostic 177Lu- or 90Y- CXCR4 radioligand therapies. Molecular subtyping of pretherapy tissue biopsies substantially contributes to precise patient selection for theranostics in bladder cancer when quantifying target gene expression.

OP-744

Comparative Evaluation of [18F]MFBG and [68Ga]Ga-DOTATATE as Imaging Biomarkers in Neuroblastoma

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Aim/Introduction: The molecular radiotherapies, [131I]MIBG and [177Lu]LuDOTATATE, target the norepinephrine transporter (NET) and somatostatin receptor subtype 2 (SSTR-2), respectively, and are pivotal in treating metastatic neuroblastoma. This study aims to compare the anatomical distribution and tumor uptake of [18F]-meta-fluorobenzylguanidine ([18F]MFBG) and [68Ga]Ga-DOTATATE, which visualize NET and SSTR expressions, respectively, to select appropriate therapeutic interventions. ***Materials and Methods:*** In this prospective, single-center study, ten pediatric patients (mean age 5.6 ± 2.7 years) with neuroblastoma histories were assessed. Each patient underwent dual PET/CT imaging using [18F]MFBG and [68Ga]Ga-DOTATATE on the uMI Panorama PET/CT system, following specific tracer injections (0.05 mCi/kg) after intervals of 60-120 minutes for [18F]MFBG and 40-60 minutes for [68Ga]Ga-DOTATATE. Lesion count, Curie scores, and tumor uptake were recorded and compared, with a cap at ten lesions for diffuse or localized regions showing more extensive disease. ***Results:*** Two patients showed negative findings on both [18F]MFBG and [68Ga]Ga-DOTATATE studies. One patient (12.5%) was positive on [18F]MFBG but negative on [68Ga]Ga-DOTATATE, while seven patients showed positive findings on both modalities. The median Curie scores for [18F]MFBG (13.5, IQR: 2, 19) were higher than those for [68Ga]Ga-DOTATATE (median, 6, IQR: 2, 18), though not statistically significant ($p = 0.09$). [18F]MFBG identified 243 lesions, and [68Ga]Ga-DOTATATE detected 226 lesions ($p = 0.307$). Regionally, lesion detection was similar in several areas, while [18F]MFBG detected more lesions in T-spine (34 vs. 30), L-spine (34 vs. 30), upper arms(10 vs. 7), lower arms(2 vs. 0), and soft tissues(25 vs. 21); [68Ga]Ga-DOTATATE showed slightly more lesion detection in the chest (20 vs. 16). Bone/bone marrow metastases demonstrated lower uptake in [18F]MFBG (8.2 ± 7.8) compared to [68Ga]Ga-DOTATATE (9.9 ± 6.7); however, [18F]MFBG exhibited a higher tumor-to-background ratio (TBR) (12.6 ± 8.6 vs. 8.1 ± 5.3). ***Conclusion:*** Both [18F]MFBG and [68Ga]Ga-DOTATATE PET/CT scans demonstrated high lesion detection capabilities, providing complementary information crucial for comprehensive neuroblastoma assessment. The heterogeneous distribution of molecular targets highlighted by these scans suggests that a combined approach using both [131I]MIBG and [177Lu]LuDOTATATE therapies could potentially enhance therapeutic efficacy over using either modality alone.

OP-745

[18F]FDG PET/MRI in muscle-invasive bladder cancer (MIBC): role in staging and neoadjuvant response assessment

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Aim/Introduction: An accurate staging of muscle-invasive bladder cancer (MIBC) is fundamental for prognosis and perioperative therapy planning. The rate of clinical complete response (cCRs) has increased thanks to neoadjuvant therapy (NAT). However, the definition of cCR is still debated. The aim of the present study is to investigate the diagnostic ability of [18F]FDG PET/MRI in MIBC primary tumour (T) and lymph nodes (LN) staging and its role in NAT response evaluation. ***Materials and Methods:*** Prospective study including 36 patients with MIBC candidate to NAT (2021-2023). All subjects underwent [18F]FDG PET/MRI before and after NAT. Treatments included: chemotherapy (N=4), immune-checkpoint inhibitors (N=2), chemo-immunotherapy (N=20), enzyme inhibitors (N=2) and sacituzumab govitecan (N=6). Radical cystectomy with pelvic lymph node dissection was performed in all patients, after completing NAT.Two Nuclear

Medicine physicians and a Radiologist reviewed [18F]FDG PET/MRI scans. [18F]FDG LN uptake and nacVI-RADS score were determined on Pre-NAT PET/MRI images. Balanced accuracy (bACC), sensitivity (SN), specificity (SP), positive and negative predictive values (PPV, NPV) were used to test the diagnostic accuracy of [18F]FDG PET/MRI in MIBC staging against pathological response on post- NAT scans. NAT response was assessed as: 1)complete (ypT0N0), 2) partial (ypT<2N0), and 3)no-response. Fisher's exact test and multinominal logistic regression were used to determine the prognostic significance in predicting NAT response. ***Results:*** In 10/36 patients (27.8%) pathological LN involvement was detected. LN [18F]FDG uptake at baseline was present in 5/36 patients and in 4/36 at post-NAT assessment. For T staging, [18F]FDG PET showed a bACC=54.35%, SN=8.7%, SP=100%, PPV=100% and NPV=38.24%, while for N staging a bACC=70%, SN=40%, SP=100%, PPV=100% and NPV=81.25%. For T staging, MRI showed a bACC=85.79%, SN=86.96%, SP=84.62%, PPV=90.91% and NPV=78.57%, while for N staging a bACC=77.77%, SN=90%, SP=65.4%, PPV=50% and NPV=94.91%. Regarding response, among NAT complete-, partial- or non- responders, a statistically significant difference in the frequencies of both pre- NAT [18F]FDG LN uptake (p=0.048) and nacVI-RADS (p=0.004) was observed, with higher frequencies of LN pathological [18F]FDG uptake and higher nacVI- RADS scores in non-responders. Conversely, only nacVI-RADS score predicted NAT pathologic response, according to multinominal logistic regression, with nacVI-RADS significantly differentiating complete response from partial (OR= 3.59, p=0.021) and no response (OR=4.68, p=0.003). ***Conclusion:*** [18F]FDG PET/MRI demonstrated overall good diagnostic accuracy in detecting MIBC, despite the low sensitivity of [18F]FDG PET in T and N staging. NacVI-RADS score showed a role in predicting NAT response, with potential implications in improving MIBC patients' quality of life.

OP-746

Diagnostic performance of ^{99m}Tc-Sestamibi SPECT/CT for the Characterization of Solid Renal Masses with standard of truth by Histopathology: Secondary Endpoint Analysis of a Prospective Study

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Aim/Introduction: To evaluate the accuracy of 99mTc-Sestamibi SPECT/CT in differentiating aggressive/concerning kidney lesions (i.e. clear cell renal cell carcinoma (ccRCC) and papillary RCC (pRCC)) from indolent/non-concerning lesions (such as oncocytoma, low grade oncocytic RCC, chromophobe RCC (chRCC) and hybrid oncocytic chromophobe tumor (HOCT)). ***Materials and Methods:*** We report explorative data and a secondary objective analysis of a single-institution prospective, explorative, nonrandomized study (NCT03996850, IRB #18-001817) primarily investigating the impact of 99mTc-Sestamibi SPECT/CT on patient management. 73 patients (51 male, 22 female) who underwent 99mTc-Sestamibi SPECT/CT for the evaluation of a solid renal mass ≥1.5 cm diameter in the cT1N0M0 stage previously identified on CT and/or MRI (median of 61 days IQR 57 of imaging interval) were included in this analysis. Lesions on SPECT/CT were visually rated as either positive (non-concerning) or negative by one non-blinded reader. Positive lesions were further classified using a previously published uptake score ranging from 1-5 (with 1= uniformly high tumor uptake, 2= variable tumor uptake with areas of high uptake, 3= peripheral uptake with central photopenia, 4= definite tumoral uptake below surrounding renal parenchyma, and 5= uptake predominantly in the endophytic portion) [1]. In a subgroup of patients, SPECT/CT findings were compared to histopathology results (n=61; surgery performed median of 75 days IQR 79.5 after SPECT/CT). ***Results:*** A total of 73 99mTc-Sestamibi SPECT/CT scans were included with a total of 93 lesions (median diameter 2.4 cm). Visual analysis demonstrated 54 (58.1%) negative and 39 (41.9%) positive lesions. The following uptake scores were assigned to the positive lesions: score 1 (n=17, 43.6%), 2 (n=7, 17.9%), 3 (n=0), 4 (n=4, 10.3%), and 5 (n=11, 28.2%). Histopathological diagnosis was available in 61 cases (29 ccRCC, 5 pRCC, 3 chRCC, 1 HOCT, 14 oncocytomas and 9 low grade oncocytic RCC), i.e. n=34 aggressive/concerning lesions vs. n=27 indolent/non-concerning lesions. For the diagnosis of non-concerning kidney lesions using 99mTc-Sestamibi SPECT/CT, sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV) and accuracy were 78%, 94%, 91%, 84% and 87%, respectively. ***Conclusion:*** 99mTc-Sestamibi SPECT/CT showed potential to non-invasively depict non-concerning solid renal masses when conventional imaging is indeterminate. 99mTc-Sestamibi SPECT/CT might facilitate patient selection for active surveillance. ***References:*** 1) Campbell et al. 99mTc-sestamibi SPECT/CT for the characterization of renal masses: a pictorial guide. Br J Radiol 2018. doi: 10.1259/bjr.20170526.

OP-747

The Role of [18F]FDG PET/CT for predicting histology and prognosis in patients with thymic lesions.

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Aim/Introduction: The need of a non-invasive diagnostic tool able to predict the thymic epithelial tumors (TETs) aggressiveness would be necessary for an optimized stratification of risk which is essential for an effective therapeutic approach. CT and MRI usually fails to discriminate among different WHO histologic subtypes. Conversely, preliminary data suggest that PET metrics, i.e. SUVmax, could be able to distinguish among less and more aggressive TETs. We aimed to investigate whether FDG PET metabolic parameters were associated with histology and to assess their potential prognostic role in patients with resected thymic lesions. ***Materials and Methods:*** One hundred and sixteen patients (49/67 M/F; mean age 59.5 years) who underwent thymectomy and preoperative 18F-FDG PET/CT from 2012 to 2022 were retrospectively considered from two Hospitals (Fondazione Policlinico Universitario A. Gemelli IRCCS, Rome and Fondazione IRCCS Cà Granda Ospedale Maggiore Policlinico, Milan). Associations between histology and metabolic parameters (i.e. SUVmax, SUVmean, SUVpeak, TLG, MTV, rPET,

qPET, tumor-to-mediastinum (T/M), SUVmax/Tcm ratios were examined. Progression-free-survival (PFS) was determined and compared using the Kaplan-Meier and the log-rank test. The median follow-up was 38 months (range 14-72 months). ***Results:*** Twenty-seven thymic hyperplasia, 41 low-risk thymomas (LRT, types A, AB, B1), and 48 high-risk thymomas (HRT, types B2, B3, carcinoma) were included. Metabolic parameters of HRT and LRT patients were significantly different, i.e. SUVmax (mean 4.8 [4.1-7.3] vs 4.5 [3.4-5.3], p<0.001), SUVmean (3 [2.3-4.6] vs 2.7 [2.2-3.3] p<0.001), SUVpeak (4 [3.2-6.4] vs 3.7 [2.8-4.6] p<0.001), rPET (2.1 [1.3-2.6] vs 1.4 [1.2-2.1] p<0.001), qPET (2 [1.4-2.8] vs 1.5 [1.1-2.6] p<0.001) and T/M (3.2 [2.1-4.6] vs 2.6 [1.8-2.3] p<0.001). TLG and MTV were significantly higher in patients with LRT than HRT (95.3 [23.2-210.1] vs 76.1 [32-284.9] p<0.001; 35 [11-74.8] vs 24.8 [9.6-48.3] p<0.001, respectively). Patients with SUVmax<4.3, as well as those with SUVmean and SUVpeak < 2.87 and 4.03, respectively, showed a longer PFS (p = 0.009, p= 0.05, and p=0.05). MTV, TLG, T/M, and SUVmax/Tcm were not associated with PFS. ***Conclusion:*** Preoperative PET metrics could help to differentiate thymic histotypes. SUVs-based parameters appear promising to predict recurrent disease.

OP-748

The role of $^{64}CuCl_2$ PET/CT in detecting and staging muscle-invasive bladder cancer. Comparison with contrast-enhanced CT and ^{18}F-FDG PET/CT.

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Aim/Introduction: 64CuCl2 is a PET tracer of cancer metabolism with exclusive hepatic excretion and could be thus well-suited to stage muscle-invasive bladder cancer (MBC). In this study, we evaluated the feasibility of a 64CuCl2-based staging of patients with MBC; furthermore, we compared the diagnostic capability of this method with the current gold standards, i.e., contrast-enhanced CT (ceCT) and 18F-FDG PET/CT. ***Materials and Methods:*** We prospectively enrolled patients referred to our institution for pathology-confirmed MBC staging/re-staging between September 2021 and January 2023. All patients underwent ceCT, 18F-FDG, and 64CuCl2 PET/CT within a two-week period. Patient-based and lesion-based analyses (PBA and LBA, respectively) were carried out for all the potentially affected districts (overall, bladder wall, lymph nodes, skeleton, liver, lung, and pelvic soft tissue). ***Results:*** Forty-two patients (nine females) were enrolled. Thirty-six (86%) had evidence of disease, with a total of 353 disease sites. On PBA, ceCT and 64CuCl2 PET/CT showed higher sensitivity than ^{18}F-FDG PET/CT in detecting the primary tumour (p<0.001); moreover, 64CuCl2 PET/CT was slightly more sensitive than ^{18}F-FDG PET/CT in disclosing soft tissue lesions (p<0.05). Both PET methods were more specific and accurate than ceCT in classifying nodal lesions (p<0.05). On LBA, 64CuCl2 PET/CT outperformed 18F-FDG PET/CT and ceCT in detecting disease localisations overall (p<0.001), in the lymph nodes (p<0.01), in the skeleton (p<0.001), and in the soft tissue (p<0.05). ***Conclusion:*** 64CuCl2 PET/CT appears to be a sensitive modality to stage/re-stage MBC and might represent a "one-stop shop" diagnostic method in these scenarios.

OP-749

A Retrospective Study of the Diagnostic Performance of $^{[18F]}$FDG PET-CT for Lymph Node Staging in Patients With Upper Tract Urothelial Carcinoma

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Aim/Introduction: Upper tract urothelial carcinoma (UTUC) is a rare cancer and the diagnostic utility of $^{[18F]}$FDG PET-CT for preoperative lymph node staging in UTUC is somewhat unknown. The aim of this study is to assess the diagnostic accuracy of $^{[18F]}$FDG PET-CT for lymph node staging in patients with UTUC. ***Materials and Methods:*** Seventy-six patients (28 female; median age 72 [IQR 65-76] years) with UTUC in the renal pelvis and/or proximal ureter subjected to radical nephroureterectomy (RNU) and template-based lymph node dissection (LND) who had performed a preoperative $^{[18F]}$FDG PET-CT were retrospectively included in this study. Eleven patients received preoperative induction chemotherapy (IC), and for those patients the $^{[18F]}$FDG PET-CT included in the study was performed before initiating IC. LND was performed according to a predefined and side-specific fractionated anatomic template including paraaortal nodes for the left side and paraaortal/aortocaval/paracaval for the right side, divided into 10 anatomic areas1. Comparison of the $^{[18F]}$FDG PET-CT to the histopathology in the fractionated lymph node specimen was made on a patient level as well as for each predefined anatomic area. Sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV), likelihood ratios and accuracy were calculated in all patients and after excluding those receiving IC. ***Results:*** Out of 76 patients, 31 (41%) had lymph node involvement on $^{[18F]}$FDG PET-CT and 18 (24%) had confirmed lymph node involvement on histopathology. Analyses per patient for all patients (n=76) and after excluding patients who had received IC (n=65) showed: sensitivity 83% and 82%, specificity 72% and 79%, PPV 48% and 58%, NPV 93% and 93%, positive likelihood ratio 3.02 and 3.95, negative likelihood ratio 0.23 and 0.22, and accuracy 75% and 77%, respectively. The corresponding results of analyses per predefined anatomical areas (n=216 and n=203 excluding IC) showed: sensitivity 76% and 75%, specificity 90% and 93%, PPV 50% and 60%, NPV 97% and 97%, positive likelihood ratio 7.64 and 11.19, negative likelihood ratio 0.27 and 0.27, and accuracy 88% and 91%, respectively. ***Conclusion:*** Preoperative $^{[18F]}$FDG PET-CT has a high diagnostic accuracy for lymph node involvement in UTUC located in the renal pelvis and/or the proximal ureter. ***References:*** 1 Bobjer J et al. Location of Retroperitoneal Lymph Node Metastases in Upper Tract Urothelial Carcinoma: Results from a Prospective Lymph Node Mapping Study. Eur Urol Open Sci. 2023 Sep 27;57:37-44.

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Tuesday, October 22, 2024,16:45 - 18:15
Hall Y10-Y12

TROP Session: Neuroimaging Committee: Neuro-Oncology

OP-749

OP-750

Multi-site, prospective trial evaluating FET-PET In Glioblastoma (FIG) Study (TROG 18.06): Central review of initial FET-PET biologic target volume delineation for radiation planning.

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Aim/Introduction: The FIG Study (TROG 18.06) is a prospective, multi-centre trial of O-(2-[18F]-fluoroethyl)-L-tyrosine Positron Emission Tomography (FET-PET) in glioblastoma patients. The primary study objectives are to: 1) determine the proportion of radiation treatment plans that are changed with incorporation of FET-PET imaging, and 2) determine in the post-therapy setting if FET-PET (vs MRI) can differentiate tumour recurrence/progression from pseudo-progression. We report on the progress of the trial, and the results of an assessment of the impact of central Nuclear Medicine physician (NMP) review of prospective FET-PET1 delineation of the biological target volume (BTV) for radiotherapy (RT) planning. ***Materials and Methods:*** Up to 210 adult GBM participants across 11 Australian sites will undergo FET-PET post-surgery/pre-chemo-RT [CRT] (FET-PET1), one month post CRT (FET-PET2) and at suspected progression (FET-PET3). Group 1 participants enter at timepoint 1 (FET-PET1 with MRI1), whilst Group 2 enter at timepoint 2. Adjuvant RT target volumes are derived per standard contrast MRI with hybrid post-hoc RT volumes created by incorporating the FET-PET1 NM-derived BTV utilising MiM version 7.0. All trial sites and NMP have passed credentialling which included three benchmarking cases involving BTV delineation. ***Results:*** Trial recruitment to date is 180 patients (n=117 Group 1 and n=63 Group 2) enrolled to date, with a target of 140 Group 1 patients. During trial credentialling, results demonstrated variations in FET-PET1-derived BTV in 25/72 (34.7%) including both 13 minor and 12 major deviations. During the prospective recruitment phase, to date, 26 of 30 participant FET-PET1 with BTV delineation cases across 11 sites have undergone central review. Of these, 5/26 (19%) requiring resubmission. Reasons for resubmission/protocol deviations have included: incorrect imaging sequence selection within the MiM workflow (two cases), both workflow issues and incorrect background ROI selection (one case); Static GTV overcontouring (one case) and both MiM workflow issues and Static GTV overcontouring (one case). All 5 cases passed central review after subsequent resubmission. ***Conclusion:*** The FIG trial will complete recruitment in 2024 with analyses planned at one year post CRT completion. Despite improvements in resubmission rates compared to the credentialling phase, central review of prospective FET-PET1-derived BTV delineation remains vitally important in ensuring BTV accuracy and protocol adherence. The FIG study is the largest prospective multi-site study of its kind addressing FET-PET's impact on adjuvant radiation planning and its role in management of pseudoprogression and prognostication.

OP-751

PET-based response assessment criteria for diffuse gliomas (PET RANO 1.0): application to ^{18}F-FDOPA PET imaging

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Aim/Introduction: The Response Assessment in Neuro-Oncology (RANO) group recently reported the PET-based response assessment criteria for diffuse gliomas (PET RANO 1.0). The objective of this study was to evaluate these criteria for the amino-acid 18F-FDOPA radiotracer. ***Materials and Methods:*** Patients with histological confirmed glioma, having performed at least one baseline 18F-FDOPA PET scan at the diagnosis after the initial surgery (< 3 months post-surgery) or at recurrence (<3 months before the start of an adjuvant treatment) were retrospectively included. Three different tasks were evaluated according to different population: i. the number of lesion measurable, no-measurable, and non-measurable according to the PET RANO 1.0 criteria and the cases for which striatum physiological uptake was challenging to delineate the lesion in the overall population, ii. the direct comparison of PET RANO 1.0 criteria and the visual interpretation of two experts for patients with at least one follow-up PET scan, and iii. the diagnostic performances of PET RANO 1.0 criteria regarding 6 months progression-free (PFS-6) based on clinico-radiological follow-up and 12 months overall (OS-12) survivals for patients whom the follow-up PET scan was performed during or after a maximal time of 3 months after the end of the treatment. ***Results:*** Ninety patients (52.0±15.3 years old, 40 (44%) women) with a baseline 18F-FDOPA PET were included in this study (70 patients after the initial surgery and 20 patients at recurrence). Among these patients, they presented in average 1.18±0.66 lesion per patient with 10 (11%) patients presenting no-measurable, 3 (3%) non-measurable and 77 (86%) measurable diseases. The delineation of tumoral uptake was challenging due to the striatum physiological uptake in 16/81 (16%) patients. Among the 65 patients with at least one follow-up PET scan, the visual interpretation and the PET RANO 1.0 criteria showed a global concordance of 80% (coefficient κ=0.71), maximal for the mean tumor-to-background ratio (TBRmean) parameter (coefficient κ=0.66). Among the 44 patients (20 evaluating radio-chemotherapy with temozolomide ± bevacizumab, 16 with temozolomide or PCV chemotherapies and 8 other treatments) for whom the diagnostic performances could be calculated, PET RANO 1.0 criteria had respective accuracies of 70% and 73% for PFS-6 and OS-12 (vs. 73% and 80% respectively for the visual interpretation) with the TBRmean and MTV parameters showing the best accuracies. ***Conclusion:*** PET RANO 1.0 criteria are feasible with 18F-FDOPA PET imaging with diagnostic performances approaching those of the visual interpretation.

OP-752

The predictive potential of ^{18}F-FET PET in patients with post-surgical residual mass of high grade glioblastoma

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Aim/Introduction: to determine the diagnostic and predictive potential , in terms of overall (OS) and progression free survival (PFS), of ^{18}F-FET PET in patients with primary glioblastoma (GBM) after surgical resection and before radio-chemotherapy. ***Materials and Methods:*** 32 patients [(15 M;17 F; ≤ 50 y n=9 (28.1%); > 50 y n=23 (71.9%)] with GBM WHO3 n = 6 (18.7%) and WHO4 n = 26 (81.3%) associated with IDH mutation in n = 5 (15.6%) or MGMT methylated in n = 13 (40.6%) underwent a PET scan after surgical resection. Semi-quantitative parameters including tumor-to-brain ratios (TBRmax cut-off value > 1.6 for post-surgical residual mass), SUVmax, uptake volumes and metabolic tumour volumes (MTV) have been taken into account. Univariate analyses and Mantel-Cox log-rank test were used to identify independent variables associated with OS and PFS comparing differences in Kaplan-Meier survival curves (KM).Relationship between parameters was also investigated with Pearson correlation. ***Results:*** For OS and PFS (p = 0.005 - 0.0001), results showed high prediction value associated with the WHO grade, IDH mutation and MGMT methylated , age, and PET findings (TBR max, MTV, uptake volume). The Kaplan-Meier curve highlighted a longer OS and PFS for patients with GBM WHO3, age >50 y, IDH mutation (compared to tumor with wild type mutation), TBRmax (range 3.42 - 6.00), MTV (range 306640 - 15876) and volumes (range 7530 - 76660 cc) values respectively higher than the median cut-off values (4.02, 40245, 18035, respectively). A significant negative exponential correlation was found between PET parameters and both OS and PFS (p<0.0001). ***Conclusion:*** This preliminary work suggests that several clinical and molecular parameters, including molecular neuro-imaging findings, may predict PFS and OS in patients with GBM WHO3-4. A multimodal approach including FET-PET may improve the oncological outcome in glioma patients.

OP-753

[18F]FET PET and DCE MRI metrics in Childhood CNS Tumours

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Aim/Introduction: Using magnetic resonance imaging (MRI) in childhood central nervous system (CNS) tumours, post-treatment identification of residual/recurrent tumours may be challenging. We have recently shown that addition of [18F] fluoro-ethyltyrosine ([18F]FET) PET increases accuracy in paediatric neuro-oncology compared to standard MRI*. In children with primary CNS tumours we assessed [18F]FET PET and advanced MRI metrics to discriminate 1) tumour from treatment effects and 2) high-grade from low-grade tumours. ***Materials and Methods:*** A total of 100 children (41 females, median age 9.8 years, range 0.1 - 19.2 years) with suspicion of primary paediatric CNS tumours were included consecutively and prospectively as previously described*. A total of 133 [18F]FET PET and MRI scans with dynamic acquisition (n=124) and with Dynamic Contrast Enhanced (DCE) perfusion MRI (n=100) were performed at time of diagnosis, recurrence, or before or after treatment. Suspicious lesions were delineated on the [18F]FET PET or alternatively on the MRI scans and maximal tumour-to-background ratio (TBRmax) and curve type (I: steady increasing, II: plateau or III: early peak and decreasing) were extracted. Delineations were transferred to the MRI, and blood volume fraction (BV) estimated using DCE as well as mean Apparent Diffusion Coefficient (ADC) were extracted. The reference standard of each lesion was operation, biopsy, or follow-up*. The abilities of each metric alone or in combination to discriminate tumour from treatment changes (TBRmax, VB) and high-grade from low-grade tumours (TBRmax, curve type, ADC, VB) were evaluated using both simple and multiple logistic regression, and the prediction performance was assessed using area under the curve (AUC), Brier Score and 200 steps of cross-validation. ***Results:*** TBRmax and BV discriminated tumour from treatment effects (crude odds ratio (OR):4.86, 95% confidence interval (CI):[1.87-12.61], p=0.0012 and OR:1.80, CI:[1.07-3.02], p=0.026, but combined only TBRmax was significant OR:4.24, CI:[1.54-11.61], p=0.0050 with AUC:75.6%, CI:[56.5-94.7] and Brier Score 15.8, CI:[11.7-19.9]. All four metrics combined (TBRmax, curve type, ADC, VB) showed the highest ability to discriminate high-grade tumours from low-grade tumours (AUC 81.2%, CI:[59.2-100.0] and Brier Score 13.8, CI:[8.3-19.3]), which was significantly better than e.g. TBRmax alone (p=0.029). ***Conclusion:*** The addition of BV measurements does not increase the ability to discriminative tumour from treatment effects compared to the [18F]FET PET metrics TBRmax alone. However, multimodal imaging using dynamic [18F]FET PET metrics combined with advanced MRI significantly increase the discrimination between high-grade and low-grade paediatric CNS tumours. ***References:*** *Marner et al. (2021) NeuroOncol. 23:2107-16.

OP-754

Feasibility and initial experience of chemokine receptor-4 (CXCR4) expression using ^{68}Ga-Pentixafor (Pars-Cixafor™) and O-2-^{18}F-fluoroethyl-l-tyrosine (^{18}F-FET) PET-MR image fusion in low- and high-grade gliomas

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Aim/Introduction: The current study aimed to evaluate the feasibility of non-invasive MRI, O-(2-^{18}F-Fluoroethyl)-L-Tyrosine (^{18}F-FET), and 68Ga-Pentixafor (Cixafor) PET to increase diagnostic accuracy and to improve the discrimination of treatment-emergent changes in low- and high-grade gliomas. ***Materials and Methods:*** Two separate databases including low- and high-grade gliomas considered in our analysis. In the first subgroup, 29 patients with recurrent glioblastoma underwent Cixafor PET/CT before/after tumor mass resection. The second subgroup included 11 patients with histopathologically proven brain tumor suspected of having recurrent changes 3-4 months after surgery who were referred for an ^{18}F-FET PET/CT scan. In addition, PET/MR image fusion for both Cixafor and ^{18}F-FET was performed. Moreover, for both PET probes, visual and semiquantitative calculation of image-derived metrics, including SUVmax and tumor-to-background ratios (TBR), were performed. ***Results:*** Among eleven patients referred to ^{18}F-FET PET/CT/MR imaging, nine cases (82%) had a positive MRI, six cases (55%) had a positive PET/CT and PET/MRI, and tumor recurrence was observed in 6 patients (55%). Sample follow-up indicated that accuracy, sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) were 64%, 85%, 25%, 67%, 50% for MRI alone and 91%, 85%, 100%, 100% and 80% for PET/CT/MRI, respectively. The results of 29 patients who underwent Cixafor PET/CT were also evaluated visually and semiquantitatively. Visual assessment of Cixafor PET images revealed that 27/29 cases were positive with a mean SUVmax of 3.92. 17.24% (5/29) of patients had WHO grade III pathologies (anaplastic oligodendroglioma/anaplastic astrocytoma). Three out of twenty-nine participants had a stereotactic biopsy. The interval time between biopsy and imaging was 14-38 days (mean 21.71 days). The mean SUVmax of WHO grade IV lesions was significantly higher than grade III (3.131 ± 3.01 vs. 1.99 ± 0.45) and the mean SUVmax of blood pool activity was reported as 1.277 at the superior sagittal sinus area. While the mean target-to-background ratio of grade IV patients was 29.45, all grade III gliomas showed lower lesion uptake than background activity considered at the contralateral cortex areas. ***Conclusion:*** This study concluded that Cixafor had a higher TBR than ^{18}F-FET PET, with the ability to bond with 177Lu-Pentixather. Cixafor imaging could improve recurrence detection.

OP-755

[68Ga]Ga-PSMA PET/CT as a survival indicator in patients with suspected brain tumors of glial origin - preliminary results of a prospective study.

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Aim/Introduction: PET/CT targeting prostate-specific membrane antigen (PSMA) is commonly used in patients with prostate cancer; however, this antigen has been found in other solid tumours, including primary brain tumours such as glioblastoma (GBM). The aim of this study was to evaluate the usefulness of PSMA PET/CT for prognosis in comparison with histopathological results. ***Materials and Methods:*** In this prospective study, we screened patients who were referred to the hospital for surgery, with suspected glioma based on previous imaging studies. The qualitative and quantitative results of [68Ga]Ga-PSMA PET/CT were analysed. Until then at least two years follow up was performed. The collected data were analysed via Kaplan-Meier estimators in terms of overall (OS) and progression free survival (PFS) ***Results:*** Forty-four patients met the inclusion criteria. Twenty of them had positive and twenty-four negative [68Ga]Ga-PSMA PET/CT scans. In quantitative analysis the tumour-to-backgroud (TBR) ratio higher than 44.2 was best for diagnosis GBM. We found a statistically significant difference in PFS and OS between positive and negative PSMA PET/CT study (median OS 294 and 556 (days) vs not reached in negative ones), same as in GBM vs non-GBM patients. Patients with positive PET/CT had similar survival rates as HGG patients, same as patients with positive TBR to those diagnosed with GBM. Interestingly, for patients diagnosed with GBM, a statistical difference was noted between OS for positive and negative test results of [68Ga]Ga-PSMA-11 PET/CT (288 days vs not reached) ***Conclusion:*** The presence of [68Ga]Ga-PSMA-11 accumulation in PET/CT study of brain tumours can be as good a prognostic factor as the histopathological result. The results seem interesting and promising, but require further analysis on a larger group of patients - especially regarding the prognosis of patients with finally diagnosed GBM.

OP-756

Explainable Machine Learning for Diagnosis of Aggressive Glial Lesion with Amino Acid PET Imaging: A Multicentric Clinical Validation

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Aim/Introduction: Machine learning (ML) models based on

radiomics analysis of amino-acid positron emission tomography (PET) imaging have demonstrated efficiency in predicting histo-molecular diagnoses of gliomas. However, their clinical validation on physician interpretation remain challenging. This study aimed to investigate whether the explainable radiomics model impacts nuclear physicians' interpretation of the aggressiveness of presumed glial lesions at diagnosis. ***Materials and Methods:*** Patients underwent static/dynamic 6-[18F]fluoro-L-dopa PET scans to characterize suspected glial lesions retrospectively in conventional magnetic resonance imaging (MRI). With a 75%/25% split for training/test sets, an ensemble ML model employing radiomics features extracted from static/dynamic parametric PET images was trained using cross-validation to assess lesion aggressiveness through histo-molecular diagnosis or clinico-radiological follow-up. Three explainable ML methods including Local Interpretable Model-agnostic Explanations (LIME), Anchor, and SHapley Additive exPlanations (SHAP) were conducted to generate patient-specific explanations. Test set samples were evaluated by eighteen physicians from eight different institutions. During the first phase, physicians analyzed studies exclusively through MRI and PET images. In the second phase, the same physicians reevaluated the studies using all available data, including predictions and explanations derived from the radiomics model. This study was registered on ClinicalTrials.gov (NCT04469244). ***Results:*** Eighty-five patients (54 [39-62] years old, 41 women) were selected. The diagnostic accuracy of physicians in the second phase was significantly improved compared to those of the first phase (0.775 (0.750, 0.802) vs. 0.717 (0.694, 0.737), p=0.007). The explainable radiomics model augmented physician agreement with a 22.72% increase in Fleiss' Kappa and significantly enhanced their decision-making confidence (p<0.001). Among all physicians, Anchor and SHAP demonstrated effectiveness in 75% and 72% of cases, respectively, both surpassing LIME (p≤0.001). ***Conclusion:*** Our results highlight the potential of an explainable radiomics model from amino-acid PET scans, as a diagnostic support tool for physicians to determine the aggressiveness of suspected glial lesions at diagnosis.

OP-757

Value of ^{11}C-MET PET/CT imaging model based on machine learning in predicting IDH1 mutation status in glioblastoma

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Aim/Introduction: The mutation status of IDH is often associated with the prognosis and survival time of patients with glioblastoma. Imaging omics models based on 11C-MET PET/CT was constructed to distinguish IDH1 mutation status in glioblastoma patients, and to explore the application potential and accuracy of the machine learning prediction models. ***Materials and Methods:*** Clinical and imaging data were retrospectively collected from 157 patients with glioblastoma who underwent 11C-MET PET/CT. All patients underwent surgical resection of tumors in our unit, and IDH1 molecular pathologic detection was performed. The 157 patients were randomly divided into a training set and a validation set using an 8:2 ratio. Glioblastoma lesions in 157 patients were delineated as areas of interest (ROI) and PET features were extracted using threshold segmentation. LASSO regression and Spearman correlation analysis were used to screen the most predictive imaging features, and logistic regression (LR), support vector machine (SVM) and decision tree (DT) were used to construct an omics model to distinguish wild and mutant IDH1 cases. The diagnostic efficacy of the model was compared by calculating the area under receiver (AUC) operating characteristic curve (ROC), 95% confidence interval (CI), sensitivity, specificity, accuracy, and P-value of the model and by Delong test. ***Results:*** The comparison results of the diagnostic performance of the decision tree model, logistic regression model, and support vector machine model demonstrated that in the training set, the AUC was 0.910 (95% CI, 0.892~0.922), 0.697 (95% CI, 0.682~0.703), and 0.698 (95% CI, 0.684~0.705), respectively; while in the validation set, the AUC values were 0.805 (95% CI, 0.798~0.812), 0.740 (95% CI, 0.734~0745), and 0.764(95%CI,0752~0773),respectively. Delong test results indicated that compared to LR and SVM models(P < 0.05),the DT model exhibited superior classification performance. ***Conclusion:*** Decision tree prediction model based on 11C-MET PET/CT imaging can accurately predict IDH1 mutation status in glioblastoma, showing high diagnostic performance and potential clinical application value. This model provides strong imaging support for the personalized treatment of glioblastoma and helps guide clinical decision-making.

OP-758

Feasibility and tolerability of [^{131}I]I-PA monotherapy in progressive and recurrent high grade gliomas; an ongoing single institution case series.

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Aim/Introduction: In a phase I-study, safety and tolerability of intravenous 4-L-[131I]iodo-phenylalanine ([^{131}I]I-PA, TLX101, Telix Pharmaceuticals) administered concurrently with second line external beam radiation therapy in patients with recurrent glioblastoma has been demonstrated, with encouraging preliminary efficacy data. Here we report a case series of patients with high grade gliomas treated with [131I]I-PA monotherapy. ***Materials and Methods:*** Patients with 1st or 2nd recurrence of high grade glioma who exhausted local and systemic treatments were referred to our outpatient clinic. Exclusion criteria were life expectancy <12 weeks and KPS <70. [18F]FET-PET was performed, with a minimum tumor-to-background ratio of 2,5 being considered adequate for therapy. [131I]I-PA monotherapy was given in an in-patient setting during 3-5 days, depending on emitted radiation levels, in accordance with local radiation safety legislation. Post-therapy SPECT scans were done after three days, clinical follow-up after each cycle, and follow up MRI 3 weeks after the second cycle. ***Results:*** In August 2021, and between September 2023 and April 2024, five patients (1 oligodendroglioma grade 3, 4 glioblastoma (according to WHO 2021 criteria)) were treated. Mean age was 52±7 years, 5 male. All patients received two cycles with 5 GBq [^{131}I]I-PA, mean time between treatments was 25 days±4. One second cycle was an experimental intra-arterial administration, all others were intravenous administrations. Treatments were well tolerated, without any treatment-related adverse effects. No effects on kidney-, liver- or bone marrow functions were seen. Adequate targeting was demonstrated visually on post therapy SPECT/CT in all patients. To date, two patients have passed away (pt 1 (overall survival (OS)11 months), pt 2 (OS 5 months). One patient is receiving best supportive care based on clinical symptoms and MRI (OS to date 6 months), and two patients are awaiting 3rd treatment (OS 4 and 3 months). ***Conclusion:*** In this ongoing case series of [^{31}I]I-PA monotherapy in recurrent high-grade gliomas, treatment was feasible and well tolerated. Adequate targeting was revealed at post-therapy SPECT imaging.

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Tuesday, October 22, 2024,16:45 - 18:15
Hall G2

Theranostics Track - TROP Session: Oncology & Theranostics Committee: Prostate Cancer Therapy II

OP-759

225Actinium and combined 225Actinium/177Lutetium-labelled (TANDEM) PSMA radioligand therapy (PRLT) in patients with metastatic castration resistant prostate cancer (mCRPC): A retrospective study on long-term adverse events and survival

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Aim/Introduction: 225Actinium-PSMA is an option in advanced mCRPC patients resistant to 177Lutetium-PRLT. Adequate protection is needed to avoid salivary glands' impairment. 225Ac-PSMA PRLT (as monotherapy and as 225Ac/177Lu-TANDEM) was analysed concerning safety/impact on salivary glands function as well as concerning overall survival (OS). ***Materials and Methods:*** Between December 2020 and February 2024, 80 patients (age range 43-88 years) received 225Ac-PSMA PRLT. Salivary gland protection was performed by retroauricular scopolamine patches from two days before to two hours after injection and by chewing a polyglutamate parotid gland protector according to Paganelli's protocol [1]. Patients with ≥1 follow-up visit (n=64) were considered for evaluating xerostomia, haematological, renal, and hepatic adverse events (grading according to CTCAE v.5.0). ***Results:*** Over 38 months, 132 225Ac-PSMA cycles were administered (4 225Ac-monotherapies, 128 225Ac/177Lu-TANDEM PRLTs). At the time of analysis, 42 patients had received one cycle, either monotherapy or TANDEM (1.7-10.2 MBq 225Ac); 23 patients had received two cycles (7-21 MBq 225Ac), and 15 patients had received ≥three cycles (11-28.7 MBq 225Ac). PRLT was generally well tolerated; flare pain was the most common acute adverse event (n=11), followed by nausea (n=7) and vomiting (n=3). During follow-up, 54 patients died (OS 5 days - 30 months), 26 patients are still alive (follow-up 2-36 months). After PTRL (vs. baseline), anaemia G1/G2 and G3 was observed in 67 and 15 patients (vs.53 and 7), respectively; one patient developed anaemia G4; leukopenia G1/G2 and G3 in 28 and 4 patients (vs.20 and 2); thrombocytopenia G1/G2 and G3/G4 in 24 and 14 patients (vs.20 and 5); renal impairment G1/G2 occurred in 16 patients (vs.10); liver alterations G1/G2 and G3 in 24 and 8 patients (vs.22 and 6), respectively. Before PRLT, 17 patients reported xerostomia G1/G2, and 22 patients after PRLT. ***Conclusion:*** This retrospective analysis demonstrates that 225Ac-PSMA PRLT is safe in terms of acute and chronic toxicity. Only few patients experienced G3/G4 long-term adverse events: 9 anaemia G3/G4, 2 leukocytopenia G3, and 9 thrombocytopenia G3/G4, which was generally associated to severe bone marrow involvement or previous chemotherapy. Renal insufficiency G3/G4 and hepatotoxicity G4 did not occur; two patients (one with liver metastases) developed hepatotoxicity G3. Only 5 patients complained about de-novo xerostomia G1/G2 after PRLT. Finally, 225Ac-PSMA PRLT shows promising OS in patients progressing after previous treatments, including 177Lu-PSMA PRLT (OS 2.5 years, follow-up time 3 years). ***References:*** [1] Paganelli G, Sarnelli A, Severi S, et al. EJNMMI, 2020;47(13):3008-3017. doi:10.1007/s00259-020-04856-1.

OP-760

[^{225}Ac]Ac-PSMA-617 Targeted Alpha Therapy in Metastatic Castration-Resistant Prostate Cancer: efficacy and treatment outcome

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Aim/Introduction: Targeted Alpha Therapy (TAT) with [225Ac]Ac-PSMA has been introduced as a new treatment option for patients with metastatic castration-resistant prostate cancer (mCRPC) who have shown refractoriness to [177Lu]Lu-PSMA therapy. The efficacy and treatment outcomes after TAT were evaluated in a retrospective study through PSA level assessment and quantitative evaluation of post-treatment PSMA PET images. ***Materials and Methods:*** We evaluated the pre- and post-treatment [68Ga]Ga-PSMA-11 PET/CT images in patients treated with [225Ac]Ac-PSMA-617 after developing refractoriness to [177Lu]Lu-PSMA-617 therapy. Total tumor volume and organs at risk were segmented, and quantitative parameters were extracted. The efficacy and treatment outcome were evaluated using biochemical response, survival analysis, molecular tumor response, and disease control rate (DCR). ***Results:*** Twelve patients, with a total of 59 [68Ga]Ga-PSMA-11 PET/CT images, were included in the retrospective study. Based on biochemical response results, 8 out of 12 (67%) patients experienced a decline in PSA levels, with 7 out of 12 (58%) showing a >50% decrease and 3 out of 12 (25%) experiencing disease progression. According to the molecular tumor response evaluation using PET images, 7/12 patients (58.4%) had a partial response, 3/12 (25%) had stable disease, and 2 out of 12 (16.6%) showed disease progression. The DCR was 85.7%. An interesting finding was the correlation between total tumor volume reduction and decline in PSA levels (>50%), both of which were observed in 58% (7/12) of the patients. Moreover, the biochemical blood assessment of [177Lu]Lu-PSMA-617 and [225Ac]Ac-PSMA-617 therapies showed no significant effects of [225Ac]Ac-PSMA-617 on Alkaline phosphatase, creatinine, eGFR, hemoglobin, LDH, platelets, and WBC levels. ***Conclusion:*** The mCRPC presents a challenge in patient treatment management due to lower treatment output and efficacy. In this study, TAT with [225Ac]Ac-PSMA-617 showed promising treatment outcomes for mCRPC patients who no longer respond to [177Lu]Lu-PSMA-617 therapy. While the decline in PSA levels is commonly used to evaluate treatment efficacy, total tumor volume may help as a useful response parameter for assessing treatment efficacy. Interestingly, the biochemical blood assessment of [225Ac]Ac-PSMA-617 therapies showed no significant effects on Alkaline phosphatase, creatinine, eGFR, hemoglobin, LDH, platelets, and WBC levels

OP-761

Botulinum toxin plus transdermal scopolamine reduce salivary gland uptake of ^{225}Ac/^{177}Lu-PSMA ligands

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Aim/Introduction: PSMA-targeted radioligand therapy (PRLT) holds promise for the treatment of advanced metastatic castration-resistant prostate cancer (mCRPC). However, salivary gland toxicity is a major dose-limiting adverse effect, especially when it comes to PRLT with alpha-emitting radionuclides such as 225Ac. In this study, we explored the use of Botulinum Toxin (BTX) to mitigate salivary gland uptake of PSMA radioligands. ***Materials and Methods:*** IncoA (Xeomin) was injected percutaneously into the right parotid and left submandibular glands under ultrasound control 3-4 weeks before scheduled 225Ac-PRLT. Transdermal scopolamine was applied during a period of 72 hours prior to PRLT. The SUVmean or SPECT counts were measured from pre-BTX and post-BTX images; ratios of non-injected/injected contralateral gland were calculated and compared pre and post-BTX. ***Results:*** Fourteen patients were included, of whom 2 received BTX twice before scheduled PRLT, of which patients received mean cumulative activity of 225Ac 11.89 ± 7.02 MBq. We found that gradually increasing BTX doses, either alone or in combination with scopolamine, effectively reduced salivary gland PSMA uptake, up to 170 units to the parotid and 80 units to the submandibular gland. No adverse side effects were associated with this treatment. No severe adverse events were observed. ***Conclusion:*** This study demonstrated proof-of-concept of using Botulinum Toxin for mitigating sialotoxicity during PRLT with alpha and beta-emitting radionuclides.

OP-762

The prognostic value of whole-body composition analysis in prostate cancer patients undergoing [^{177}Lu] PSMA radioligand therapy: A Proof of concept study using pretherapeutic [^{18F}]PSMA PET-CT

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Aim/Introduction: This retrospective study aims to develop a deep learning-based approach to whole-body CT segmentation out of standard [18F]PSMA-PET-CT to assess body composition in metastatic castration resistant prostate cancer (mCRPC) patients prior to [177Lu]PSMA radioligand therapy (RLT). Our goal is to go beyond standard [18F]PSMA-PET-based pretherapeutic assessment and identify additional body composition metrics out of the CT-component with predictive and prognostic value. ***Materials and Methods:*** We used a deep learning segmentation model to perform fully automated segmentation of subcutaneous fat, visceral fat, skeletal muscle, and L3 vertebrae from whole-body [18F]PSMA-PET-CT scans of n=92 prostate cancer patients before RLT. The proportions of subcutaneous fat to skeletal muscle and visceral fat to skeletal muscle are compared in detail, both on a 2D slice-by-slice basis (centered at L3) and across the entire 3D CT scan. Statistical analyses were conducted to correlate the parameter ratios of the segmented fat-to-skeletal-muscle composition with patient outcomes. For this purpose, the subjects were divided into two groups based on the median value of the tissue composition. ***Results:*** The automated segmentation model was useful for delineating subcutaneous fat, visceral fat, and skeletal muscle across diverse patient anatomies. Analyses revealed significant correlations between lower subcutaneous fat ratios and poorer therapeutic outcomes (subcutaneous fat volume / skeletal muscle volume; high: median OS: 17 months; low: median OS: 12 months; p=0.037) in the 3D model, suggesting these parameters as potential prognostic indicators. In both 2D and 3D formats, the ratio of visceral fat to skeletal muscle, as well as the ratio of subcutaneous fat to skeletal muscle in 2D, showed no significant differences. ***Conclusion:*** In this proof-of-principle study the implementation of a deep learning-based whole-body analysis provides a robust and detailed CT-based assessment of body composition in mCRPC patients undergoing RLT. Potential prognostic parameters have to be corroborated in larger prospective datasets and compared to [18F]PSMA-PET parameters.

OP-763

Comparison of ^{68}Ga-PSMA and ^{177}Lu-PSMA Total Metabolic Tumor Volume (TMTV) variations for monitoring metastatic castration-resistant prostate cancer in ^{177}Lu-PSMA therapy.

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Aim/Introduction: Previous trials have shown that semi-quantitatively derived SUVmean from 68Ga-PSMA PET/CT imaging could predict the response to 177Lu-PSMA treatment. 177Lu-PSMA SPECT/CT imaging can be performed post-therapy, although recording times on conventional gamma-cameras are too long for routine clinical use. 360° CZT-SPECT cameras, however, enable high-speed whole-body SPECT recordings in only 18 minutes. This study aimed to determine whether the absolute quantification of 177Lu-PSMA scintigraphy provided by a 360° CZT-SPECT/CT system provides consistent results for monitoring metastatic castration-resistant prostate cancer. ***Materials and Methods:*** We included patients eligible for 177Lu-PSMA-617 treatment, who completed at least one treatment cycle, and for whom post-therapeutic 177Lu-PSMA-617 360° CZT SPECT/CT and 68Ga-PSMA-11 PET/CT imaging were acquired. PSA levels were measured before each cycle. Total metabolic tumor volume (TMTV) was segmented using an absolute threshold of 3 SUV followed by manual correction. Total lesion activity (TLA=TMTVxSUVmean) values were determined on 177Lu-PSMA-SPECT/CT images acquired 24 hours post-177Lu-PSMA-617 injection and on pre-injection 68Ga-PSMA-PET/CT images. SPECT/CT images from all cycles were collected, and additionally PET/CT images acquired from C1, C4, C6. A mixed-effects linear model was used to model the global relationship of PSA levels with SPECT and PET TLA variations during treatment cycles. Spearman correlation coefficients were computed between the inter-cycle differences (C1-C4 and C1-C6) of SPECT or PET TLA (ΔSPECTTLA or ΔPETTLA) versus those of PSA (ΔPSA). ***Results:*** Seventy-two patients were included (mean age: 71 ± 8 years), receiving an average of 7327 ± 338 MBq of 177Lu-PSMA per cycle. Forty-one patients received 4 cycles and 25 received 6 cycles. SPECT and PET TLA correlated globally with PSA levels at each cycle (R=0.57 and R=0.67 respectively for SPECT and PET). Moreover, the variation of disease burden according to PSA change in 177Lu-PSMA-SPECT/CT was at least as effective as 68Ga-PSMA-PET/CT with correlations of 0.76 and 0.65 respectively for C1-C4 ΔSPECTTLA and ΔPETTLA; and correlations of 0.74 and 0.68 for C1-C6 ΔSPECTTLA and ΔPETTLA . ***Conclusion:*** Quantitative 177Lu SPECT/CT imaging after each cycle of 177Lu-

PSMA-617 treatment enables the determination of TLA, strongly correlated with PSA and its variation during treatment. Results provided by a 360° CZT-camera seem at least as good as PSMA-PET/CT imaging for monitoring metastatic castration-resistant prostate cancer. The early assessment of treatment using these scintigraphic biomarkers, obtained without further radiotracer injection, and having procedure times fast enough for acceptable clinical routine, might contribute to optimizing the management of these patients.

OP-764

Assessment of Early Treatment Response with [^{177}Lu] PSMA Whole-Body-Scintigraphy Compared to Interim PSMA-PET

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Aim/Introduction: PSMA-PET is an essential tool for patient selection prior to radioligand therapy (RLT), interim staging and follow up to monitor therapy. The value of post therapeutic whole-body scans (WBS) after injection off [177Lu]PSMA is underestimated. The aim of this study was to compare early response to treatment as assessed by post-therapeutic WBS with interim staging by PSMA-PET after 2 cycles to predict overall survival (OS). ***Materials and Methods:*** Patients with metastatic castration resistant prostate cancer, who received at least two cycles of RLT, and interim PSMA-PET were retrospectively evaluated. The PROMISE V2 framework was used to categorise PSMA expression and assess response to treatment. Response was defined as either disease control in responders (DCR) or disease progression in those failing to respond. ***Results:*** A total of 188 men treated with RLT between February 2015 and December 2021 were included. The comparison of various imaging modalities showed a robust and statistically significant correlation, as determined by the Cramer V test: e. g. response on WBS during second cycle compared to first interim PET ($c\varphi = 0.888$, $P < 0.001$, $n = 188$). The median follow-up time was 14.7 months (range: 3-63 months; 125 deaths occurred). Median OS was 14.5 months (95% CI: 11.9-15.9). Early response assessment was associated with a significantly better OS: e.g. DCR of second cycle WBS (24 vs 13 months, $P < 0.001$) with a HR of 2.81 ($P < 0.001$) or DCR of interim PET after 2 cycles (24 vs 11 months, $P < 0.001$) with a HR of 3.5 ($P < 0.001$). A decline of at least 50% in PSA levels after two cycles of RLT also indicates a significantly lower likelihood of death (26 vs 17 months, $P < 0.001$) with a HR of 1.92 ($P = 0.001$). ***Conclusion:*** Routinely acquired WBS after RLT with [177Lu]PSMA can be used for interim analysis with comparable results to PSMA-PET and can identify patients at risk of poor outcomes.

OP-765

A novel approach to predict overall survival in mCRPC patients treated with 177Lu PSMA therapy using radiomic features: A step toward unraveling the puzzle

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Aim/Introduction: Radiomics, employing data mining and medical image analysis, is a novel technology generating significance for its potential in cancer diagnosis & response assessment.177 Lu-PSMA -617 is a recently approved therapeutic option for end-stage prostate cancer patients. Early prediction of progression-free survival may facilitate superior treatment strategies and enable early therapeutic adjustments, potentially reducing morbidity and enhancing survival outcomes in patients with advanced prostate carcinoma. Using a hybrid machine learning approach and a reliable tensor radiomic feature, the study aims to predict overall survival outcomes ***Materials and Methods:*** A total of 40 mCRPC patients treated with 177 Lu PSMA therapy where baseline and post-therapy SUV max, SUV mean, SUV peak, PSMA-derived tumor volume and total lesion PSMA were calculated and used for analysis. Tumor ROI on PSMA PET-CT scans were segmented using a region threshold approach, and Radiomic features (RFs) were extracted from them using MATLAB program. Response in PSMA-TV was assumed when a decline > 30% was present. Spearman's Rank correlation examined the relationship between RFs and OS, while univariate analysis assessed their role in predicting OS. Significant RFS ($p=0.005$) from univariate analysis were included in multivariate Cox regression to assess hazard ratio. ***Results:*** A total of 176 RFs including 2D and 3D features from baseline and follow-up scans done after 3 cycles of 177Lu PSMA therapy were extracted for each ROI in 40 patients. 67 3D texture features were chosen from the 176 risk factors for statistical analysis because 3D analysis covers the entire tumor volume, providing more precise capture of spatial heterogeneity. Univariate analysis identified 13 risk factors significantly correlated with OS, 7 of which were selected for COX regression. However, clinical stage emerged as a strong predictor of survival, with one risk factor from the multivariate analysis being highly predictive of overall survival. GLRLM percentage had a hazard ratio of 5.4 ($p=0.003$), signaling a fivefold rise in mortality risk ***Conclusion:*** This is noteworthy study where we have confirmed that the GLRLM percentage as a reliable indicator of overall survival, with a fivefold increase in the risk of death associated with higher values of this predictor. By contrasting features extracted from baseline and follow-up images, delta radiomics can identify early indicators of recurrence, metastasis, or mortality. Challenges inherent in clinical implementation of radiomics techniques include image standardization, registration, and data exchange. Further investigation is warranted to assess the robustness and clinical utility of radiomics features.

OP-766

99mTc-antigranulocyte scintigraphy for estimation of bone marrow reserve prior to PSMA-therapy in mCRPC patients

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Aim/Introduction: The development of PSMA radioligand therapy, which targets the surface protein PSMA present on prostate cancer cells, has transformed the approach to treating metastatic, castration-resistant prostate cancer (mCRPC). One limitation of RLT is the potential for the depletion of the bone marrow stem cell reserve. This is particularly relevant in patients who have experienced extensive osseous tumor load or have

undergone myelotoxic treatment, such as chemotherapy. The objective of this pilot study was to assess the potential of 99mTc-antigranulocyte scintigraphy as a tool for the estimation of bone marrow reserve prior to PSMA-therapy. ***Materials and Methods:*** A total of 10 patients diagnosed with mCRPC with extensive osseous tumour load on ^{18}F-PSMA PET/CT were included in the study. Prior to PSMA-therapy, all patients underwent 99mTc-antigranulocyte scintigraphy. The spatial overlap of osseous tumour burden and bone marrow was then compared between the two modalities.In instances where both images exhibited a low degree of spatial overlap, RLT was conducted. These patients underwent a laboratory analysis at four and eight weeks following the initial therapy cycle. ***Results:*** A spatial correlation between viable bone marrow and PSMA-positive metastases was not observed in nine of the ten patients. Two patients underwent 177Lu-PSMA-therapy, three underwent 225Ac-PSMA-therapy, and two underwent 225Ac-177Lutetium-PSMA-tandem-therapy. Due to acute contraindications, two patients did not receive PSMA-therapy. Overall, the laboratory analysis demonstrated stable results at four and eight weeks following the initial therapy cycle. The hemoglobin levels were 9.3 ± 2.3, 9.3 ± 2.0, and 9.6 ± 1.9 g/dL, respectively, while the white blood cell count was 4.0 ± 1.1 vs. 4.1 ± 1.3 vs. 4.2 ± 0.8 G/l; platelets: 147 ± 84.5 vs. 136.1 ± 59.6 vs. 130.0 ± 50.4 G/l; neutrophils: 2.6 ± 0.9, 2.8 ± 1.2, and 2.8 ± 1.2 g/l, respectively. ***Conclusion:*** PSMA-therapy appears to be a viable therapeutic option in patients presenting with spatial mismatch on PSMA PET/CT and 99mTc-antigranulocyte scintigraphy, despite extensive osseous tumor load. Dosimetry studies are currently in progress with the aim of determining the bone marrow doses to be administered in the included patients.

OP-767

Does Pre-Therapy PSA Influence ^{177}Lu-PSMA-617 Treatment Outcomes?

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Aim/Introduction: Patients with metastatic castration-resistant prostate cancer (mCRPC) who experience biochemical recurrence and who have previously received both androgen receptor pathway inhibition therapy and taxane-based chemotherapy are eligible for treatment with 177Lu-PSMA-617 in the USA. During treatment, the PSA level is used as a marker for radioligand therapy (RLT) therapy response. Treatment outcomes vary and are difficult to predict. Thus, our study aims to investigate factors influencing both treatment failure and success in patients with mCRPC undergoing therapy with 177Lu-PSMA-617. ***Materials and Methods:*** We retrospectively evaluated patients at our institution from December 2021 to December 2023 with mCRPC who completed or failed 177Lu-PSMA-617 therapy. The patients were divided into two groups; the treatment success group included those who received six cycles of 177Lu-PSMA-617 and demonstrated biochemical response, and the treatment failure group included those who discontinued their treatment before cycle six due to enrollment in hospice or biochemical failure. We utilized the REDCap database (hosted at the University of Arizona, Tucson, AZ, USA) for data collection and storage. Pre-therapy PSA level and kinetics were evaluated among the two groups. A p-value of <0.05 was considered statistically significant. ***Results:*** A total of 137 cycles of 177Lu-PSMA-617 therapy were administered to a cohort of 32 patients. The study cohort consisted of 13/32 (40.6%) in the success group and 19/32 (59.4%) in the treatment failure group. The success group demonstrated a lower pre-therapy mean PSA (90.7, ±114.8, p-value 0.006) (mean, SD), longer pre-therapy PSA doubling time (7.2 months, ±12.7, p-value 0.049), and lower pre-therapy PSA velocity (48, ±95.7, p-value 0.014). In contrast, the treatment failure group displayed a higher pre-therapy mean PSA (449.1, ± 547.3), shorter pre-therapy PSA doubling time (1.7, 4.9), and faster PSA velocity (600.7, ±888.7). ***Conclusion:*** Lower pre-therapy PSA, longer pre-therapy PSA doubling time, and lower pre-therapy PSA velocity may be potential indicators of 177Lu-PSMA-617 better treatment outcome in patients with mCRPC, as our treatment failure group demonstrated the opposite trends. Studying a larger patient cohort in the future may be beneficial to assess this patient population further.

1609

Tuesday, October 22, 2024,16:45 - 18:15
Hall F

e-Poster Presentations Session 12: Thyroid Committee: Endocrine Disoders: the Role of Nuclear Medicine

EPS-232

SSTR PET/CT in patients with Ectopic Cushing syndrome - A retrospective single center experience

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Aim/Introduction: Ectopic ACTH hyperproduction can account for upto 10% of all cases of Cushing syndrome and, after excluding pituitary and adrenal causes, the ectopic source has to be looked for. We aimed to study the role of 68Ga-DOTANOC PET/CT in the detection of the culprit tumor in patients suspected to have ectopic ACTH production. ***Materials and Methods:*** Records of consecutive patients with biochemically proven Cushing syndrome and clinically suspected ectopic source who underwent 68Ga-DOTANOC PET/CT at our tertiary care institution between January 2019 and February 2024 were retrospectively reviewed. All patients were injected 3-4mCi 68Ga-DOTANOC intravenously and underwent whole-body PET/CT 30-40 minutes post-injection. Scanned images were interpreted by two nuclear physicians independently. 68Ga DOTANOC PET/CT findings were corroborated with clinical details. Histopathology details were reviewed for the patients who underwent surgery. Findings of biochemical and conventional imaging were also utilized for correlation. ***Results:*** 81 patients (24 men, 57 women; median age: 32 years) with biochemically proven Cushing syndrome were included in the final analysis. Mean ACTH levels at the time of study were 89 pg/mL (normal range: 7-63 pg/mL). 68Ga-DOTANOC PET/CT was positive for a lesion in 37/81 patients (45.6%), 15/37 (41%) were localized to the lungs, 5/37 (13.5 %) to

the pancreas, and 7/37 (18.9 %) to the thyroid, 4/36 cases were localized to the mediastinum (11%); 6/37 (16.2%) lesions were localized to other sites for the culprit lesions. In 35/37 patients where the lesion was localized, ACTH levels normalised after appropriate management. ***Conclusion:*** 68Ga-DOTANOC PET/CT proved to be a valuable modality in the workup of patients with suspected ECS by revealing the primary tumor in almost half of the cases. Identification of the culprit lesion is of vital importance in managing ECS, as surgical management could completely result in remission. Hence, 68Ga-DOTANOC PET/CT can be a useful non-invasive, imaging test for detection of the primary tumor in patients with suspected ECS.

EPS-233

Imaging with SSTR PET/CT in endocrine syndromes: Insights from a tertiary center experience

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Aim/Introduction: Multiple Endocrine Neoplasia (MEN) and Von-Hippel-Lindau (VHL) syndromes have autosomal dominant inheritance with high penetrance and typically involve organs/glands that have endocrine function. The aim of the present study is to evaluate the role of somatostatin receptor targeted imaging with 68Ga-DOTANOC PET/CT in patients with MEN and VHL syndromes. ***Materials and Methods:*** Data of consecutive patients, clinically suspected/diagnosed with MEN/VHL syndromes, who underwent 68Ga-DOTANOC PET/CT at our tertiary care institute from January 2017 to April 2024, was retrospectively reviewed. Histopathological data was assessed for patients undergoing biopsy/surgery, while clinical, biochemical and conventional imaging correlation was done for others. ***Results:*** 105 patients (37-men, 68-women) with MEN/VHL syndrome (35-MEN1, 34-MEN2A, 7-MEN2B, 29-VHL) underwent 170 68Ga-DOTANOC PET/CT scans: 44.7% (47/105) for baseline evaluation and 55.3% (58/105) for restaging/response assessment/surveillance. In patients with newly diagnosed MEN-1 syndrome (n=15, median age 30.4 years), parathyroid adenomas were universal (100%) followed by pancreatic NET (93.3%). 4/15 patients had all three major features of MEN-1 syndrome, i.e., parathyroid adenoma, pituitary adenoma and enteropancreatic NETs. 40% (8/20) of follow-up MEN-1 patients had new lesions on SSTR imaging, primarily pancreatic NETs (6/8). For newly diagnosed MEN-2 syndrome (n=15, median age 26 years), medullary thyroid carcinoma and pheochromocytoma were most common (73.3% each, 11/15), sometimes co-existent (46.7%, 7/15). Post-surgical MEN-2 patients showed local recurrence in 40% (8/20) on DOTANOC PET/CT, often in paratracheal lymph nodes (6/8). Additionally 6 MEN-2 patients with metastatic disease, undergoing systemic therapy with either TKIs or 177Lu-PRRT, underwent follow-up scans for treatment response. 17 suspected/diagnosed VHL patients (median age 31 years) underwent 68Ga-DOTANOC PET/CT for baseline evaluation, with the most common lesions detected being cerebellar hemangioblastoma and pheochromocytoma (unilateral=7, bilateral=3) in 10/17 (58.8%) patients each, followed by RCC in 3/17 (17.6%) patients. Two (11.8%) patients, had all the four major constituents of VHL detected, i.e., cerebellar hemangioblastoma, clear-cell renal cell carcinoma, retinal-angiomas and pheochromocytoma. Of the VHL patients who underwent post-surgical/treatment follow-up scans, 66.6% (8/12) showed residual disease, 25% (3/12) had no evidence of disease, while one patient (8.3%) had a new left adrenal pheochromocytoma. ***Conclusion:*** In the realm of patients afflicted with hereditary syndromes such as MEN/VHL, 68Ga-DOTANOC PET/CT emerges as a formidable one-stop hybrid imaging tool. It serves manifold objectives, encompassing the determination of baseline disease burden, the facilitation of post-surgical restaging, evaluating feasibility for PRRT therapy, treatment response, disease recurrence and surveillance.

EPS-234

Detection of parathyroid lesions and its impact on clinical management in primary hyperparathyroidism patients using PET-MRI with $^{[18F]}$Fluorocholine

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Aim/Introduction: Primary hyperparathyroidism (PHPT) is characterized by excessive production of parathyroid hormone (PTH) because of the hyperfunction of one or more parathyroid glands (PG). Its prevalence ranges from 0.1% to 0.3%. Diagnosis is clinical, and treatment involves surgical removal of affected PGs; hence, imaging tests are essential for detection and localization. Our objective is to evaluate the detectability of parathyroid lesions by PET/MRI and its impact on the clinical management of PHPT patients. To compare its detectability with PET/CT and the impact on clinical decision-making in cases with positive PET/MRI or negative PET/MRI. ***Materials and Methods:*** Prospective study of PHPT patients with suspected parathyroid adenoma and negative conventional imaging, referred for $^{[18F]}$fluorocholine PET study during 2023-2024. Twenty-one consecutive patients (13 females; 63 years [44-82]) were included. We performed two consecutive PET/MRI acquisitions (T1, T2, and STIR) and PET/CT with an intravenous contrast between 20 and 50 minutes after administering the radiopharmaceutical. Two nuclear medicine physicians and one radiologist reviewed all PET/MRI studies visually and semiquantitatively. The variables evaluated the clinical impact of both PET/CT and PET: decision for surgical intervention (SI) vs. follow-up taken in the multidisciplinary clinical committee. ***Results:*** PET/MRI was positive in 17/21 patients, in these cases: SI=13 patients (76.5%): adenoma confirmation=3, rest pending SI; and follow-up =2. Pending decision=2. PET/MRI-negative in 4 patients (19%), all decided for follow-up. There was discordance PET/MRI-positive - PET/CT-negative in 5 patients, in these cases: SI=3 patients (60%) and follow-up =1. Pending decision by the committee=1. ***Conclusion:*** PET/MRI was superior to PET/CT in detecting hyperfunctioning parathyroid adenomas with a greater clinical impact on therapeutic decision-making. These results endorse the utility of PET/MRI in PHPT patients. We need larger studies to demonstrate the efficacy of the technique and its contribution to the surgical approach in these patients.

EPS-235

Comparing PET-MRI and PET-CT with $^{[18F]}$Fluorocholine for Detecting Parathyroid Lesions in Primary Hyperparathyroidism Patients

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Aim/Introduction: Primary hyperparathyroidism (PHPT) occurs when one or more parathyroid glands (PG) hyperfunction, resulting in the excessive production of parathyroid hormone (PTH). Its prevalence ranges from 0.1% to 0.3%. Diagnosis is clinical, and treatment involves surgical removal of affected PGs; hence, imaging tests are essential for detection. Our aim is to evaluate and compare the detectability of parathyroid lesions by PET/MRI and PET/CT with $^{[18F]}$fluorocholine. To assess interobserver agreement in PET/MRI analysis. ***Materials and Methods:*** Prospective study of 21 patients (13 females; 63 years [44-82]) with PHPT and suspected parathyroid adenoma who underwent $^{[18F]}$fluorocholine PET imaging during 2023-2024. Prior imaging tests were negative or inconclusive. We performed two consecutive PET/MRI acquisitions (T1, T2, and STIR) and PET/CT with an intravenous contrast between 20 and 50 minutes after administering the radiopharmaceutical. All PET/MRI studies were evaluated (visually and semiquantitatively) by two nuclear medicine physicians and one radiologist. ***Results:*** We performed PET/MRI in all 21 patients and found it to be positive in 17 patients (81%), with all 17 patients being positive in PET+MRI. PET/CT in 19/21 patients: positive in 13/19 patients (68%), of which 10 were positive in PET+CT; 2 only in PET; and 1 only in CT; detecting 16 lesions (11 patients with single lesion and 2 with multiple). Among the 19 patients with both PET/CT and PET/MRI, we found a detectability agreement in 14 patients (73.7%). SUVmax mean=6 (1.7-18.4). Interobserver agreement in both studies was very good. ***Conclusion:*** PET/MRI showed superiority over PET/CT in detecting hyperfunctioning parathyroid adenomas, especially in cases of multiple lesions. The high interobserver agreement and its high diagnostic accuracy, because of the availability of two techniques of high anatomical and metabolic diagnostic precision in a single scan, as well as low radiation dose, make PET/MRI a very useful technique in parathyroid lesion diagnosis.

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Correlation Of SUV_{max} Obtained From SPECT/CT With Pathology And Laboratory Findings In Imaging Parathyroid Adenoma

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Aim/Introduction: Primary hyperparathyroidism is an endocrine disorder characterized by hypercalcemia and high/inappropriate serum PTH levels. Diagnosis' made biochemically, and curative treatment is surgery. Detecting and accurately localizing parathyroid adenomas are crucial for treatment success. Parathyroid scintigraphy is an easily accessible, cost-effective method for this purpose. We aimed to compare the pinhole, planar, and SPECT/CT methods in the detection and localization of parathyroid adenoma, and to evaluate the relationship between the SUVmax value which obtained from the SPECT/CT and laboratory-cytopathology findings. ***Materials and Methods:*** Sixty patients with primary hyperparathyroidism referred to our clinic between February-December 2023, who underwent 99mTc-MIBI parathyroid scintigraphy using pinhole, planar, and SPECT/CT techniques, with at least one reported positive, and confirmed to have a single adenoma on pathology, were included. The images were re-evaluated by two nuclear medicine specialists and pathology specimens by a cytopathologist. SUVmax was calculated on the ROI drawn to the adenoma location in all patients on SPECT/CT, except for one whose SPECT/CT was negative. The relationship between SUVmax and laboratory findings, the pathological subtype, size and volume calculated with USG of the adenoma was evaluated. Pathologically cell types were grouped as oxyphilic-dominant, chief-cell-dominant, clear-cell-dominant; patterns were; follicular-dominant, trabecular-dominant, nest-dominant. Statistically significant value was accepted as $p < 0.05$. ***Results:*** The demographic and medical informations are shown in Table-1. There was no statistically significant difference between imaging methods for detecting adenoma, but the highest lesion detection was achieved with SPECT/CT. 7 patients were negative on USG; 1 was considered suspicious on pinhole and planar imaging, and 6 were evaluated as positive by all three methods. A correlation was observed between sizes and SUVmax values; SUVmax was significantly higher in adenomas >1 cm ($p<0.001$) (Table-2). There was a positive correlation between SUVmax and PTH and Ca levels ($p<0.001$). A positive correlation was also observed between the adenoma volume and SUVmax, PTH, and Ca levels ($p<0.001$). The distribution of adenoma subtypes and SUVmax values were as follows: chief-cell-dominant 83.3% (n=53), 6.6±9.3; oxyphil-cell-dominant 6.7% (n=4), 9.0±5.5; clear-cell-dominant 5% (n=3), 3.0±1.2. Though the subgroup lacked enough patients for statistical analysis, SUVmax was higher in the oxyphilic-dominant group. Larger volumes were observed in trabecular-dominant group ($p<0.05$). ***Conclusion:*** SPECT/CT is the most effective method for detecting parathyroid adenoma, and its combination with pinhole and planar imaging increases reliability. The SUVmax obtained from SPECT/CT is correlated with PTH and volume. Calculating the SUVmax can improve diagnostic accuracy.

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Correlation between ^{18}F-Coline PET-CT and surgical localization of parathyroid adenomas in patients diagnosed with primary hyperparathyroidism: insights from our utilization of advanced digital imaging technology.

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Aim/Introduction: Minimally invasive parathyroidectomy in primary hyperparathyroidism (pHPT) depends on the precise preoperative localisation of adenomas. Digital equipment is more sensitive and capable of detecting smaller lesions than analogue equipment. We aimed to determine the concordance between ^{18}F-Fluorocholine in a digital PET-CT scanner and intraoperative findings in the localisation of parathyroid adenoma (PA) in patients with pHPT. ***Materials and Methods:*** Retrospective study of 191 patients with pHPT and negative/discordant conventional imaging tests, who underwent ^{18}F-Fluorocholine on digital PET-CT

between 2021-2024. Patients undergoing surgery up to the date of analysis were included, constituting a final sample of 62 patients. We defined four quadrants of PA location: upper right, lower right, upper left and lower left. A concordance analysis was performed using the Kappa index. ***Results:*** pHPT was caused by single adenoma in 54 (87.1%) patients. Mean age was 62.1±11.1 years, being more frequent in women (87.1%) and in the right lower quadrant (43.06%). The interval between PET-CT and surgery was 202±114 days. The mean lesion size was 8.46±5.43mm with mean SUVmax 8.98±4.42. Miami criteria were met, with a significant fall in intraoperative PTH (mean reduction 70.1%; 95% CI 64.8-75.4; p<0.001). Post-surgery calcaemia was also significantly reduced (-1.84mg/dl; 95% CI -2.24/-1.44; p<0.001). The overall agreement observed between surgical localisation and PET-CT localisation was 93.1%, with a Kappa index of 0.90 (95% CI 0.82-0.98; p<0.001). Agreement was higher in patients with single adenomas (Kappa index: 0.97; 95% CI: 0.92-1.00; p<0.001). ***Conclusion:*** The concordance between ^{18}F-Choline PET-CT findings and surgery in the localisation of PA is excellent in the new digital equipment, allowing for a minimally invasive surgical approach.

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Digital PET/CT in patients with hiperparathyroidism and negative/inconclusive 99mTc-MIBI scintigraphy: first steps towards automatic structured reports.

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Aim/Introduction: To create a local system that allows structuring, storing and translating of ^{18}F- fluorocholine Digital PET/CT findings of patients with hyperparathyroidism and negative/inconclusive 99mTc-MIBI scintigraphy-SPECT/CT into an automatic structured report. ***Materials and Methods:*** 27 consecutive patients with hyperparathyroidism and negative/inconclusive 99mTc-MIBI scintigraphy-SPECT/CT (22 negatives/5 inconclusives) were included. Age, parathyroid hormone (PTH), Calcium (Ca) and renal function were registered. All patients underwent a digital ^{18}F- fluorocholine PET/CT (Discovery MI Gen 2).A positive PET/CT result was defined as a lesion with focal uptake significantly higher than that of the regular thyroid tissue, either in orthotopic or ectopic parathyroid position. A semiautomatic VOI with PET/CT parameters was recorded for each finding (location, CT size, SUVmax and metabolic tumour value (MTV)). Using a Phyton-based script, data was structured and stored into a local file, from where calculations were extracted. In addition, this file included a customizable predesigned report template for different options (one lesion/multiple lesions, ectopic/orthotopic location) and quantitative data (CT size, SUVmax and MTV). ***Results:*** Data extracted from local file (PET/CT parameters): Errors in original data were easily detected (units or administration data) and corrected. Positive studies: 30 parathyroid lesions were detected in 23/27 patients (20 female, Mean age 66 (51-86). PET/CT detection rate was 85%. 19 patients had a single lesion, 4 patients had multiple lesions (2 had renal failure). Mean CT size 8.41 mm (3.8-27.5), MTV 1.25 (0.16-8.5) mm3, SUV max 4.52 (1.5-19). PTH 192 (111-545) pg/ml, Ca 10.7 (9.7-12.15) mg/dl.Negative Studies: 4 patients. 2 had spontaneous normalization of PTH over time, one patient had a fast clearance (faint uptake MIBI SPECT/CT, 135 pg/ml, Ca 9.7 mg/dl) and one patient had negative SPECT/CT and PET/CT scans (PTH 130 pg/ml, Ca 9.7 mg/dl).Reports: All positive studies were automatically translated into a structured report: 19 patients had single lesion (2 ectopic), 4 patients had multiple lesions (2 ectopic). ***Conclusion:*** In case of positive ^{18}F-fluorocholine PET/CT (85%), this self-designed Phyton-based script allowed an easy extraction, storage and translation of the registered PET/CT data into automatic structured reports.

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Evaluating the efficacy of different VOI sizes in quantitative SPECT-CT analysis for Graves, Orbitopathy

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Aim/Introduction: Graves' Orbitopathy (GO) can significantly impair the quality of life of patients even with mild disease, and in rare cases it can even lead to vision loss. Knowledge of the presence and severity of inflammatory activity in GO is essential for effective treatment and the monitoring of therapeutic response. The [99mTc]DTPA-SPECT scan, which has been used for this purpose for about 20 years, provides cost-effective, accurate information on the above-mentioned issues, and allows quantification of activity uptake (AU).However, manual ROI drawing is time-consuming, and its reproducibility is limited. Therefore, we retrospectively re-evaluated images from 99 SPECT-CT examinations, to determine whether spherical VOIs of 2 or 3 cm diameter provide better reproducibility and correlate well with the previously manually fitted ROI parameters, simplifying the assessment while maintaining reliability. ***Materials and Methods:*** From the DTPA SPECT/CT studies performed in our institute between 04/04/2021 and 05/05/2022, 99 examinations were randomly selected. SPECT/CT images of the skull were acquired 20 min after iv. administration of 400 MBq [99mTc]DTPA. SPECT parameters: 128 views, 15 seconds-per-view, 2.36 pixel size. CT parameters: 120kV, 40mAs, 1.5 pitch, 90/min speed, 1.25mm slice thickness.Image reconstruction was perfomed with 3D OSEM-RR, using 48 iterations, and 4 subsets. Similarly to our previous studies, the unit of measurement was x10-6 injected dose/mL. The placement of spherical VOIs into the retroorbital regions was performed independently by 3 nuclear medicine specialists. Inter-rater reproducibility (reliability) was measured using the intraclass correlation coefficient (ICC).The association between old and new uptake values was characterized by Pearson's correlation coefficient, and ordinary least products regression, OLPR (Ludbrook 2012) was applied to estimate the coefficients of linear relationship. ***Results:*** Spheres with a diameter of 2 cm showed better reproducibility than those with a diameter of 3 cm (ICC: 0.930 vs. 0.880). AU values in spheres with 2 cm diameter were higher than in larger VOIs. The difference was systematically bigger at elevated values. In terms of correlation with the previous method, we found that the AU in the larger spheres was closer to the old values. ***Conclusion:*** Although the AU values in the 3 cm VOIs were generally closer to those of the previously used method, since the placement of the smaller spheres is easier and

more reproducible, the use of 2 cm diameter is recommended for the routine measurement of inflammatory activity in GO.

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SPECT/CT of thyroid nodules using a full ring CZT scanner in comparison to planar thyroid scintigraphy

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Aim/Introduction: Superimposition of hyper- or hypofunctioning thyroid nodules with extranodular thyroid tissue or adjacent thyroid nodules may cause problems in planar scintigraphy. SPECT/CT has been suggested as an alternative. The purpose of this study is to evaluate the use of novel solid state SPECT/CT general purpose gamma camera for discriminating hot and cold thyroid nodules from surrounding thyroid tissue in comparison with a planar dedicated thyroid camera. ***Materials and Methods:*** From November 2022 to March 2024 we investigated 129 patients (36 male, 93 female) and a number of 286 thyroid nodules with a mean diameter of 14.4 mm (SD 7.3 mm), ranging from 5 to 59 mm and a mean volume of 1.3 ml (SD 2.5 ml), ranging from 0.1 to 21.9 ml. All patients had been transferred to our institution for routine thyroid investigation and have given informed consent to use their data for research. After intravenous injection of 40 to 50 MBq Tc99m pertechnetate comparative images were taken with a new CZT SPECT/CT and a dedicated thyroid camera. The results were put into three categories of matches with increased (hot nodule), reduced (cold nodule) or indifferent uptake of Tc99m pertechnetate on one hand and four categories of mismatches on the other hand. The mismatches either showed an increased or a reduced uptake in SPECT/CT in comparison to the planar images or a change from slightly increased or reduced uptake into an indifferent image. ***Results:*** 149 of the 285 thyroid nodules investigated showed matching results (30 matching hot, 48 matching cold and 71 matching indifferent nodules). 139 nodules showed a mismatch between SPECT/CT and planar scintigraphy primarily having given equivocal results after planar imaging. 51 of these showed an increase of tracer uptake in SPECT/CT whereas 86 nodules were marked as cold nodules in SPECT/CT. The CZT SPECT/CT system with an extraordinary spatial resolution proved to be superior in detecting nodules small in diameter and volume. ***Conclusion:*** SPECT/CT seems to be more accurate in detecting hot and cold thyroid nodules than planar scintigraphy, especially when investigating small nodules. ***References:*** Schmidt D, Simmerl M, Kuwert T: Is there Incremental Value of SPECT/CT over Planar Imaging in the Assessment of Nodular Goiter by TC99m pertechnetate Scintigraphy? in JNM 2016, 57 (supplement 2) 1699.

EPS-241

^{18}F-FDG PET/CT thyroid uptake and thyroid dysfunction in patients undergoing immunotherapy: a correlation study

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Aim/Introduction: It is well-known that patients treated with immunotherapy for different types of cancer may develop therapy-related thyroid dysfunctions.Aim of the study was to evaluate the correlation between 18F-FDG thyroid uptake on PET/CT performed for treatment response assessment and thyroid function disorders in patients receiving immunotherapy. ***Materials and Methods:*** 18F-FDG PET/CT scans performed for response assessment in patients undergoing immunotherapy in the period 2018-2023 were retrospectively included. Each scan was evaluated by two independent readers in terms of response to treatment and qualitative analysis of thyroid uptake.Patients' data on thyroid function (TSH, fT3 and fT4 serum hormonal levels) were collected, if available, at baseline and by periodical measures during immunotherapy treatment. ***Results:*** 109 18F-FDG PET/CT scans from 88 consecutive patients with complete thyroid function data were evaluated (lung cancer n=46; malignant melanoma n=16; urothelial and bladder carcinoma=13; endometrial carcinoma n=4; breast cancer n=3; lymphoma n=3; laryngeal carcinoma n=2; colorectal cancer n=1).During treatment, 24/88 patients (27%) demonstrated an immunotherapy-related thyroid dysfunction, of whom 20/24 with hypothyroidism (83%) and 4/24 with hyperthyroidism (16%).In this subgroup of patients, a diffuse 18F-FDG thyroid uptake was observed in 10/24 cases (41%) and no significant 18F-FDG uptake in 14/24 patients.In 4/10 patients with diffuse 18F-FDG thyroid uptake and hypotiroidism functional pattern, we observed an initial correlation between the two variables, followed by a synchronous normalization of both 18F-FDG thyroid uptake and hormonal levels at successive controls.In terms of response assessment, these 4 patients showed complete metabolic response (2/4 patients) and partial metabolic response (2/4 patients). ***Conclusion:*** Besides its well-established role in treatment response assessment during immunotherapy, 18F-FDG PET/CT can also be useful to evaluate immunotherapy-related endocrine dysfunctions.In our series, a relevant percentage of patients receiving immunotherapy (27%) was affected by treatment-related thyroid dysfunction.In this subgroup of patients, concomitant diffuse 18F-FDG thyroid uptake was observed in 41% of patients.In a minor sample, we observed an initial correlation between diffuse 18F-FDG thyroid uptake and thyroid dysfunction, followed by a synchronous normalization of both parameters; this scenario was also associated to a complete/partial response to treatment. This trend is in line with larger data from literature suggesting that 18F-FDG thyroid uptake may represent an additional prognostic factor for treatment response in patients undergoing immunotherapy.Nevertheless, further studies with larger cohorts are needed to evaluate the predictive and prognostic value of 18F-FDG thyroid uptake in patients receiving immunotherapy.

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F^{18}-FCH uptake in thyroid parenchymal diseases

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Aim/Introduction: Thyroid nodules may cause misinterpretation on F^{18}-Flurocholine (FCH) PET/CT performed for hyperparathyroidism.The effect of thyroid parenchymal disease on thyroidal uptake of F^{18}-FCH is still debatable. We aimed to investigate if underlying thyroid disease affects F^{18}-FCH uptake and if it is correlated with the status of disease. ***Materials and Methods:*** A total of 188patients who were referred to F^{18}-FCH PET/CT study between January2018-March2020 were retrospectively evaluated. The results of serum TSH,AntiTPO,AntiTg, thyroid ultrasonography were recorded. On F^{18}-FCH PET/CT images, visual grading on MIP images was performed(Grade 0: no visualisation of thyroid gland, grade 1:<skeletal muscle uptake, grade 2:≥skeletal muscle uptake and <salivary gland uptake, grade 3:≥salivary gland uptake). Difference between the uptake intensity of the two lobes is also noted. Uptake pattern is categorised as homogenous, heterogenous or diffusely increased. SUVmax,SUVmean and SUVpeak of thyroid are

calculated. Ultrasonographic findings are categorised as either normal or abnormal(thyroiditis, nodular/multinodular thyroid gland or both). Statistical analysis included Spearmans' correlation analysis of laboratory tests and SUV parameters and Mann-Whitney U Test to compare medians between groups. ***Results:*** Among 188 patients, 64 patients were excluded due to missing data and 3 patients due to previous thyroid surgery. A total of 121 patients (94M,27F,mean age:53,95,min:18,max:83) were included. According to ultrasonography findings, patients with a normal thyroid gland had lower levels of SUVmax,SUVmean and SUVpeak(p=0.013, p=0.012 and p=0.004). Patients with findings of chronic thyroiditis either with or without coexisting nodular disease, had higher levels of SUVmax, SUVmean and SUVpeak (p=0.008, p=0.012 and p=0.004).Median values of serum AntiTg and AntiTPO levels were significantly higher in Grade 2-3 patients compared to Grade 0-1(p=0.011 and p=0.014). Medians of serum TSH didn't differ. AntiTg levels were correlated with SUVmax, SUVmean and SUVpeak(p=0.015,p=0.039 and p=0,014). AntiTPO and TSH levels were not correlated with SUV. However, medians of SUVmax values were higher in hyperthyroidism compared to euthyroid patients (p=0.045). Median values of thyroid antibody levels didn't differ according to uptake pattern and the difference of intensity of uptake between two lobes of thyroid ***Conclusion:*** F^{18}-FCH uptake increases in case of thyroiditis and intensity of uptake is correlated with serum thyroid antibody titres. Serum TSH is not linearly correlated with F^{18}-FCH uptake,although F^{18}-FCH uptake intensity is found higher in hyperthyroidism.

EPS-243

Analysis of mental health disorders in patients treated with ^{131}I in metabolic therapy units: a multicenter study

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Aim/Introduction: Assessment of mental health disorders (anxiety and depression) during treatment in metabolic therapy units. ***Materials and Methods:*** Multicenter study of 181 patients with differentiated thyroid cancer treated with 131I in spanish metabolic therapy units between 2020 and 2023. We have analyzed the presence of anxiety and depression symptoms. We assessed anxiety symptoms according to the validated Hamilton hetero-administered scale collected at admission and at medical discharge. This scale consists of 14 items, each defined by a series of symptoms, and measures both psychic anxiety (mental agitation and psychological distress) and somatic anxiety (physical complaints related to anxiety). We obtained phychic anxiety, somatic anxiety and global score. We assessed the presence of depression symptoms using the validated Beck's Depression Inventory at admission and at medical discharge. For this, the patients were categorized into five categories of depression (normal ups and downs, mild mood disturbance, borderline clinical depression, moderate depression, severe depression and extreme depression). ***Results:*** 181 patients with a mean age of 52.2+-16.23 years. No patient showed symptoms of severe anxiety on the Hamilton scale (>30 points). The patients showed anxiety values of 10.59 prior to admission and 8.45 upon discharge, (p=0.0001). The mean values of previous psychic anxiety were 6.12 and 4.80 at discharge (p=0.0001) and previous somatic anxiety values were 4.47 to 3.65 at discharge (p=0.0001). Regarding symptoms of depression, 27/181 showed mild mood disturbance, 16/181 borderline clinical depression and 10/181 moderate to extreme depression on the Beck depression inventory. Within the subgroup analysis, 10/16 patients (62.5%) with borderline clinical depression showed improvement at discharge: 7 of them showed a normal score and 3 patients a mild mood disturbance. ***Conclusion:*** Staying in the metabolic therapy units does not worsen the emotional state of patients treated with 131I (anxiety and depression). Despite the characteristics of the stay (isolation, treatment with radioactivity, etc.), the fact of undergoing treatment has a positive impact on the patients' psychic and somatic anxiety. In spite of the improvement of depression symptoms, there are no significant changes before and after therapy.

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Increased BMI, diabetes, and decreased GFR are associated with prolonged effective half-life of ^{131}I in thyroid cancer patients

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Aim/Introduction: We analysed external dose-rate signals of differentiated thyroid cancer (DTC) patients measured with remote dose-rate meters to study the effect of patient characteristics on the effective half-life (Teff) of 131I. The aim is to gain novel understanding of the clearance of 131I in DTC patients by investigating whether there is a relationship between patient's clinical characteristics and Teff. ***Materials and Methods:*** Altogether 110 low- and higher-risk DTC patients (74 females and 36 males) aged between 14 and 85 years who underwent postoperative radioiodine (RAI) therapy between September 2018 and February 2023 in Turku University Hospital were studied retrospectively. According to the clinical practice, all patients underwent total thyroidectomy and met the criteria for RAI. The external dose-rates were monitored continuously during radiation isolation period with a remote dose-rate meter fixed on the ceiling of the isolation room. Some patients received several RAI therapies during the study period and a total of 135 external dose-rate signals were analysed. Patient's movements in the isolation room affect measured dose-rate signals, and hence some of the measurement points were location corrected afterwards with factors obtained from the calibration measurements using a RAI capsule. Each patient's dose-rate signal was resampled and modelled with a monoexponential function. Teff was calculated from the fitted function. All 26 patient characteristics were considered in the statistical analysis. Generalized linear mixed model (GLMM) was used to analyse the association between Log Teff and patient characteristics. Model included age, body mass index (BMI), glomerular filtration rate (GFR), other comorbidities, thyroglobulin (TG), administered activity, and treatment cycle. Variables were selected based on previous studies and most significant for the model. ***Results:*** The mean Teff was 13.47 ± 5.43 h for all patients. Longer Teffs were associated with increased BMI (p=0.004), diabetes (p=0.007), and decreased GFR (p<0.001). We

also discovered that neither age nor subsequent RAI therapies significantly affect on the whole-body Teff (p=0.522 and p=0.414, respectively). ***Conclusion:*** Increased BMI, diabetes and decreased GFR prolong the whole-body Teff of 131I after RAI therapy. To our knowledge, this was the first study to show statistical significance between BMI, diabetes and Teff of DTC patients. These findings could be utilized in the optimization of personalized RAI therapies and enhancing radiation safety precautions in clinical practice.

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Effects of radioactive iodine therapy on LH,FSH, AMH and menstrual cycle in women with thyroid carcinoma

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Aim/Introduction: Differentiated thyroid carcinoma (DTC) is the most common endocrine malignancy. Total thyroidectomy with subsequent radioactive iodine therapy (RIT) followed by levothyroxine consumption is a routine approach to deal with DTC. Widespread use of RIT in patients with DTC has raised concerns about its potential adverse effects on female reproductive organs. We aimed to check the effects of postoperative RIT on menstrual symptoms and sex hormones in patients with DTC. ***Materials and Methods:*** Women in reproductive age with DTC admitted in Nuclear Medicine department from 2020 to 2021 were studied. The demographic and menstrual information was recorded at first presentation and follow-up visits. Blood samples were taken for measurement of follicle stimulating hormone (FSH), luteinizing hormone (LH), anti-Müllerian hormone (AMH), and estradiol at baseline, 6 and 12 months after RIT. ***Results:*** 77 women with DTC and mean age of 35 years were studied. Roughly half (50.4%) received high-dose RIT (i.e. ≥100 mCi administered radioiodine). No patient had distant metastasis. Dysmenorrhea was reported in 23 (29.9%) of the patients and flushing was seen in 6 (7.8%). The number of pads used during menstrual periods, the length of menstrual periods and its frequency decreased significantly 2 months after RIT and returned to baseline values one year after RIT. The LH, FSH, and estradiol levels has increased continuously 6 and 12 months after RIT. In contrast, the mean serum level of AMH was not changed compared to that of the pre-treatment level. The changes in sex hormones and menstrual cycles were not different between the low and high-dose RIT groups ($p > 0.1$). ***Conclusion:*** The serum levels of LH, FSH, and estradiol hormones increased after RIT for up to 12 months after RIT while the AMH levels were stable. The menstruations were adversely affected 2 months after radioactive iodine therapy regardless of the dose of radio-iodine and improved by 6 months.

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Long-term outcomes of radioiodine therapy in differentiated thyroid cancer patients presenting with incomplete or indeterminate results

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Aim/Introduction: Differentiated thyroid cancer (DTC) presents significant challenges in treatment and monitoring due to its varied responses to radioiodine therapy (RAIT). This is particularly evident in cases falling into the category of incomplete or indeterminate dynamic risk assessment. Understanding the extended outcomes of RAIT beyond conventional follow-up periods is crucial for refining treatment strategies and improving patient care. ***Materials and Methods:*** This retrospective study aimed to comprehensively investigate the long-term outcomes of RAIT in DTC patients with incomplete or indeterminate responses one year post-treatment. The primary objective was to evaluate therapeutic efficacy, factors influencing prognosis, and the incidence of late side effects and mortality associated with RAIT. A cohort of 43 DTC patients with incomplete or indeterminate responses post-RAIT underwent rigorous evaluation following ATA guidelines. In total, 24 clinical-oncopathological parameters and 18 laboratory and imaging parameters were assessed to evaluate the therapeutic response. Statistical methods such as the McNemar test, chi-square test of group diversity, and multifactorial regression analysis were used to validate treatment outcomes and identify predictive factors. ***Results:*** The study revealed significant therapeutic success beyond one year (McNemar test, p=0.0001), with a notable increase in excellent responses upon final evaluation. Thyreoglobulin analysis revealed a noticeable trend: patients initially classified in the indeterminate group often transitioned into the incomplete response category by the final follow-up (McNemar test, p=0.011). Factorial analysis identified age, aggressive pathology, lymph node status, and perineural spread as significant predictors of therapeutic outcomes (Multiple Linear Regression, R2=0.63; F=3.41; p=0.003). While early side effects correlated with aggressive pathology and higher doses, late side effects and mortality displayed no association with RAIT factors, suggesting multifactorial determinants. ***Conclusion:*** This research provides valuable insights into the extended results of RAIT for DTC patients, particularly those with incomplete or indeterminate responses. Given the possibility of patients transitioning between different risk groups during therapy, it is advisable to maintain close follow-up even after one year, particularly for those with incomplete or indeterminate responses. These findings emphasise the significance of continuous monitoring and tailored interventions to maximise therapeutic effectiveness and patient care in DTC management. Further research is warranted to unravel the intricate interplay of factors affecting long-term outcomes and to refine treatment strategies accordingly.

EPS-247

The impact of risk factors ascertained at the surgery of the primary tumor on metastasis appearance and outcome of patients with papillary thyroid microcarcinoma (PTMC).

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Aim/Introduction: Most PTMCs with larger diameter of ≤10 mm have favorable long-term prognosis, but can also exhibit aggressive behavior when neck lymph node (LN) metastases are associated. However, the role of minimal extrathyroid tumor extension (mETE) is still discussed and it has been removed from AJCC 8th Edition because many authors reported no impact on metastasis appearance and disease-free survival (DFS). In PTMC patients, we investigated some risk factors influence on recurrences, metastases, and DFS during follow-up. ***Materials and Methods:*** We retrospectively enrolled 449 consecutive PTMC patients, 85 M and 364 F, 254 aged <55 and 195 ≥55 years who underwent total thyroidectomy and radioiodine ablation.

Risk factors were present in 164/449 patients, such as neck LN metastases, mETE and multifocality/multicentricity (M/M). In every case, eventual metastases were detected during follow-up using 131I-whole body scan (WBS) and SPECT/CT, ultrasound, needle biopsy, and serum thyroglobulin assay. The lesions were confirmed by histology; when surgery was not feasible, metastases were confirmed during about a ten-year follow-up by aforementioned exams. ***Results:*** During follow-up, metastases were ascertained in 47/449 patients (10.5%), 6 M and 41 F, 29 aged <55 and 18 ≥55 years. Globally, 85 metastases were ascertained, 73 in the neck and 12 at distance (3 lung, 5 mediastinum, 4 bone). Risk factors were discovered during surgery in 27/47 (57.4%) of patients who developed metastases; mETE was globally present in 14 patients, neck LN metastases in 12 and M/M in 14. Among the 402/449 patients who did not develop metastases, risk factors were ascertained in 137/402 cases (mETE in 25 patients, LN in 13 and M/M in 117). Comparing the different variables, at Cox regression multivariate analysis, neck LN metastases (9.38 [95%CI 3.75-23.45] p<0.001) and mETE (5.97 [95% CI 2.69-13.24] p<0.001), but not M/M, gender and age, were significantly associated with an increased risk of metastasis during follow-up. DFS was significantly (p<0.001) lower in the patients with both these risk factors than patients without risk factors. ***Conclusion:*** In the present study, neck LN metastases and mETE proved significant risk factors for metastasis appearance and DFS reduction in PTMC patients during follow-up. The data confirmed that neck LN metastases are indicators of PTMC aggressiveness, as reported in numerous studies; however, the same results have been obtained by mETE suggesting a reflection on its previous removal from AJCC 8th Edition. Active surveillance in the follow-up of PTMC patients with mETE should be recommended.

EPS-248

Possible restrictions of levothyroxine absorption in thyroid cancer patients

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Aim/Introduction: In patients with thyroid carcinoma, optimal thyroid hormone control remains an essential component of tumor therapy. Suppressing TSH levels, are often an essential component of tumor therapy. However, there are several factors, such as the use of pantoprazole or gastrointestinal diseases, showing a negative impact on absorption of levothyroxine and resulting in higher levothyroxine doses to achieve the desired levels. ***Materials and Methods:*** We established a questionnaire with 16 variables on possible influencing factors (including pantoprazole intake, gastrointestinal diseases) in daily routine and initially analyzed the responses of 40 thyroid cancer patients. ***Results:*** Of the 40 patients aged between 22-87 years (median 53 years; 23 female, 17 male) who were on levothyroxine for 0.5-39 years (median 4.5 years), 20 patients reported suffering from concomitant diseases, 26 confirmed regular additional medication intake, of whom 10 were taking pantoprazole and 2 taking iron supplements in parallel. 14 patients indicated a time interval of additional medication intake between 0-12 hours (median 1.25 h). 20 respondents reported suffering from occasional and/or regular gastrointestinal complaints, 3 patients had undergone gastrointestinal tract surgery. ***Conclusion:*** The preliminary evaluation of our study on the presence of factors influencing the absorption of levothyroxine in thyroid cancer patients shows that the majority of patients have potentially influencing variables that are often hardly taken into account in routine clinical practice and can lead to a less than optimal setting. The treating physicians should be aware of such influencing factors. ***References:*** Virili C, Antonelli A, Santaguida MG, Benvenga S, Centanni M. Gastrointestinal malabsorption of thyroxine. Endocr Rev. 2019 Feb 1;40(1):118-136. doi: 10.1210/er.2018-00168. PMID: 30476027.

EPS-249

Sequence of cancers - Thyroid carcinoma

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Aim/Introduction: With longer patient survival, secondary, tertiary, etc. neoplasms are increasingly relevant to patient care and quality of life. However, are there any specific neoplasms following or primordial cancers leading to thyroid cancer that we should or could be aware of when treating patients? ***Materials and Methods:*** We searched the SEER Research Plus Data, 8 Registries, Nov 2023 Sub (1975-2021), released April 2024, based on the November 2023 submission. We limited our search to patients with a thyroid carcinoma at any time in their history regardless of sequence and considered any tumor during their lifetime. ***Results:*** A total of 10.648 patients were included. The most common primary was thyroid cancer (9.140) followed by breast cancer (324), melanoma (135) and prostate cancer. The most common secondary cancers irrespective of treatments were breast cancer (2.154), thyroid cancer (1,726), lung and bronchus cancer (900) and prostate cancer (872). The most common tertiary cancers were breast cancer (618), lung and bronchus cancer (350) and melanoma (268). The most common quaternary cancer was breast cancer (127), lung and bronchus cancer (103) followed by melanoma (96). Histologic variance was somewhat limited with papillary thyroid carcinomas (ICD-O-3 8260/3) accounting for 3.208 cases and (8050/3) with 2.116 cases, followed by papillary cancer of follicular variant (8340/3) with 2.112 cases, follicular adenocarcinoma with 688 cases (8330/3). Almost all following neoplasia's were limited to adenocarcinoma 8140/3, infiltrating duct carcinoma 8500/3, papillary carcinoma 8260/3 and papillary carcinoma of follicular variant 8340/3. All other histologies had case counts well below 100 cases except for the third sequential neoplasm where squamous cell carcinomas reached 123 cases. Comparing RIT to non-RIT patients for primary papillary thyroid carcinoma only (8260/3, 8340/3 and 8050/3) there were 2.687 (primary), 459, 74 and 6 sequential thyroid carcinomas compared to 4.085 (primary), 762, 122 and 29 in the non-RIT group with no significant differences between the groups. ***Conclusion:*** Thyroid carcinomas show limited histologic variance with regard to consecutive cancers. The most common sequential cancer is breast cancer followed by recurring thyroid cancer, lung and bronchus cancer as well as prostate cancer and melanoma. There was no significant difference between patients that received radioiodine for primary thyroid carcinoma and those that did not regarding thyroid carcinoma as a sequential cancer.

EPS-250

Stimulated thyroglobulin level in differentiated thyroid carcinoma: improvised role in guiding follow-up

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Aim/Introduction: Serum Thyroglobulin (Tg) is a well-established marker used in management of patients with differentiated thyroid cancers (DTC). High-sensitivity Tg tests are crucial in early detection of recurrence. Various guidelines including European

Society for Medical Oncology and the American Thyroid Association (ATA) recommends use of Tg for guiding management of the thyroid cancer patients. On follow up, stimulated Tg (STg) levels <1 ng/ml is defined as excellent response post RAI treatment. ATA suggests no need of follow up whole body radioiodine scan (WBIS) in patients with low risk of recurrence and STg <1ng/ml. We studied role of follow-up undetectable STg in DTC patients in all ATA risk categories. ***Materials and Methods:*** We retrospectively analyzed data of 378 DTC patients, who were referred to Nuclear Medicine department post thyroidectomy for further management. 31 patients with raised anti-Tg levels were excluded from study. Patients were divided into two groups, Group 1 with STg < 1 and Group 2 with STg value >1. The initial risk of recurrence in patient was assessed using ATA criteria and were stratified into low, intermediate and high-risk categories. The findings of WBIS on 6 month follow up post Radioiodine ablation/therapy was also analyzed in all six groups. The results were calculated in percentage. ***Results:*** A total of 347 patients (97 male and 250 female, mean age 38.03 years) were included in the study, of these 123 had low risk, 147 had intermediate risk while 77 patients had high risk. In all three-risk category with STg < 1 ng/ml and negative Anti-Tg, WBIS shows no abnormal uptake. In low-risk category, even though none of the patients showed any abnormal on WBIS, STg value was >1 ng/ml in 97 patients (Table 1). ***Conclusion:*** To summarize, the WBIS can be avoided at follow up in patients with STg less than 1 ng/ml and negative anti-Tg level in all risk category defined by ATA. This can safely avoid morbidity associated with achieving hypothyroid state for WBIS. ***References:***
1. Haugen BR, Alexander EK, Bible KC, Doherty GM, Mandel SJ, Nikiforov YE, Pacini F, Randolph GW, Sawka AM, Schlumberger M, Schuff KG, Sherman SI, Sosa JA, Steward DL, Tuttle RM, Wartofsky L. 2015 American Thyroid Association Management Guidelines for Adult Patients with Thyroid Nodules and Differentiated Thyroid Cancer: The American Thyroid Association Guidelines Task Force on Thyroid Nodules and Differentiated Thyroid Cancer. Thyroid. 2016 Jan;26(1):1-133.

EPS-251

Postoperative basal serum thyroglobuline (Tg) prior to radioiodine therapy as a predictive factor of recurrence in patients with differentiated thyroid cancer (DTC)

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Aim/Introduction: To assess the role of post-surgery serum thyroglobulin and prior to iodine-131 therapy as a prognostic factor for locoregional or distant recurrence. ***Materials and Methods:*** We conducted a retrospective study of 242 patients (81% women, 19% men, mean age: 50.5 ± 14.2 years) with differentiated thyroid cancer (90.9% papillary, 9.09% follicular), non-metastatic debut and treated with total thyroidectomy. 142 patients (58.7%) underwent lymphadenectomy (73.3% prophylactic, 26.7% therapeutic), 40.7% of which resulted in pathological lymphadenopathies. Serum TG was determined 6-8 weeks after surgery, using the Immunulite 2000 Siemens method, with a functional sensitivity of 0.5 ng/ml. All patients subsequently received iodine-131 therapy, followed by a post-treatment whole-body scan and cervicothoracic SPECT/CT acquired 7 days after radioiodine administration. Uptake was observed only in the thyroid bed in 88.8% of the studies and extrathyroid uptake in 8.26%. The median follow-up was 11 years (P25: 8.8, P75: 13.5). Data on both locoregional and distant recurrence were collected from the clinical history during follow-ups. Statistical software R Core Team version 4.0.1 was used for statistical analysis. Patients with positive antithyroglobulin antibodies were excluded. ***Results:*** 32 of the 242 patients (13%) presented recurrence (71.9% lymph node, 28.1% Bone/ Lung), with median time to recurrence of 1.41 years (P25: 0.65; P75: 3.97). Patients with relapse in follow-up presented a median serum TG value after surgery of 2.05 ng/ml, compared to 0.5 ng/ml of the non-recurrence patients. TG was categorized taking the value 2.6 ng/ml as a cut-off point, which corresponds to the P95 of the group of patients with no recurrence during follow-up. 14 (43.8%) of the patients who relapsed had post-surgery thyroglobulin values >2.6 ng/ml, compared to 4.3% (9/210) in the non-recurrence group. Performing a univariate analysis with this cut-off point, we have observed statistically significant differences between the patients who did relapse and those who did not ($p<0.001$). We observed that serum TG values >2.6 ng/ml implies a 17-fold higher risk of presenting recurrence (OR: 17.3, CI95% [6.6-45.6], AUC: 0.697 [0.582-0.812]). When applied a multivariate logistic regression model, post-surgery serum thyroglobulin was shown as an independent variable. ***Conclusion:*** Basal serum thyroglobulin after surgery and prior to radioiodine therapy is an independent predictive factor of recurrence in patients with DTC. A serum thyroglobulin value >2.6 ng/ml implies a 17 times higher risk of suffering a recurrence, either lymph node or distant metastasis. 43.7% of patients who relapsed had thyroglobulin values >2.6 ng/ml.

EPS-252

Real-world applicability of recent Thyroid Cancer Guidelines on ablation

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Aim/Introduction: Thyroid cancer (TC) is the most common endocrine malignancy. Intermediate and low risk patients constitute the majority of cases to be treated, to whom different approaches of Iodine-131 therapy (ablation) have been implemented. The uncertainty and inconclusiveness regarding the ideal management of low-risk TC patients, especially concerning ablation use, emphasises the pressing need for "real life" applicable guidelines (GLs), which will be able to ensure the best clinical practice. Recently, various Guidelines (GLs) have been published on whom should be ablated, when and under which circumstances. Our study compares 6 of these GLs with a given patient cohort. Additionally, we will evaluate each GL's quality via an independent tool (AGREE II). ***Materials and Methods:*** Our cohort included 336 patients who were ablated between 2010 and 2013 in two different hospitals onto whom the following 6 GLs were retrospectively implemented: 2009 and 2016 ATA, ETA, NICE, German and EANM/SNMMI. Each GL's quality has been evaluated by four experienced Nuclear Medicine doctors with the help of the AGREE II tool. ***Results:*** We show that a great variability exists among the GLs. ATA 2016 is a clear improvement of the ATA 2009, but present a large grey area of "probable ablation candidate" patients. ETA and NICE agree that only a small portion of our ablated patients would benefit from it and the AGREE II

tool shows a lack of applicability, but very good scores elsewhere. On the contrary, German and EANM/SNMMI GLs agree that most of our clinical decisions to ablate were correct and their AGREE II scores are the highest in all six domains. ***Conclusion:*** More accurate, clear and evidence-based GLs are needed, encouraging individualised and patient-centered management, for assuring a better prognosis and quality of life in TC patients.

1610

Tuesday, October 22, 2024, 16:45 - 18:15
Hall G1

CTE 8 - Technologists + Inflammation & Infection Committee - Imaging Infection in Specific Populations

OP-768
Intensive Care hybrid imaging – how to handle the case of emergency?
P. van Snick; *University Medical Center Groningen, Nuclear medicine and molecular imaging Dep, Groningen, NETHERLANDS.*

OP-769
Heart in flames – radionuclide diagnosis of cardiac infectious diseases
S. Seifert;
University Hospital Würzburg, Clinic for Nuclear Medicine, Würzburg, GERMANY.

OP-770
The ^{18}F-FDG PET-CT in cardiac inflammation & infection - the original case studies
M. Köhner;
Uniklinikum Erlangen, Nuclear Medicine Dep, Erlangen, GERMANY.

OP-771
Diabetes-related inflammatory and infectious diseases: Nuclear Medicine applications
M. De Feo;
Policlinico Umberto I-Sapienza University of Rome, Department of Radiological Sciences, Oncology and Anatomical Pathology, Rome, ITALY.

1611

Tuesday, October 22, 2024, 16:45 - 18:15
Hall Y1-Y3

EU Policy Symposium 2 - Empowering Tomorrow – the Nuclear Medicine Community Strategic Role within EU Projects & Tenders on Workforce

OP-772
The importance of EU projects for professional societies
R. Price;
European Cancer Organisation , Brussels, BELGIUM.

OP-773
RLT Academy: an ERASMUS + project to develop a first of its kind RLT training opportunity
C. Deroose;
UZ Leuven, Nuclear Medicine, Leuven, BELGIUM.

OP-774
EUREST: workforce availability, education, and training needs
F. Jamar;
UCLouvain , Leuven, BELGIUM.

OP-775a
INTERACT-EUROPE & INTERACT100: developing an Inter-specialty cancer training curriculum
P. Erba;
University of Milan Bicocca , Milan, ITALY.

OP-775b
How to improve the implementation of EU projects?
K. von Bremen;
Nuclear Medicine Europe, Bern, SWITZERLAND.

OP-775c
How to improve the implementation of EU projects?
M Hierath;
European Institute for Biomedical Imaging Research , Vienna, AUSTRIA.

OP-775d
How to improve the implementation of EU projects?
M. Goulart;
European Commission Joint Research Centre , Brussels, BELGIUM.

1701

Wednesday, October 23, 2024, 08:00 - 09:30
Hall 1

CME 13 - Neuroimaging Committee - What is the Road Map to install a new neurological PET Tool?

OP-776
Use: Regulations in the application of neurological PET radiotracers in the EU
O. Kiß;
Institute of Radiopharmaceutical Cancer Research, Helmholtz-Zentrum Dresden-Rossendorf (HZDR), Dresden, GERMANY.

OP-777
Approval: Marketing authorization of novel brain imaging biomarkers in the EU
S. Kapanadze;
Unit for Gastroenterology, Metabolic Disorders, Radiology Federal Institute for Drugs and Medical Devices, Bonn, GERMANY.

OP-778
Reimbursement: How to get money for neurological PET in the EU
M. Brendel;
LMU Hospital, Department of Nuclear Medicine, Munich, GERMANY.

1702

Wednesday, October 23, 2024, 08:00 - 09:30
Hall 4

Special Track 13 - Dosimetry Committee - Debate: Voxel Dosimetry - Love it or Hate it

OP-780
Point of View: Love it!
J. Brosch-Lenz;
Department of Integrative Oncology, BC Cancer Research Institute, Munich, GERMANY.

OP-781
Point of View: Hate it!
J. Tran-Gia;
University Hospital Würzburg, Würzburg, GERMANY.

1703

Wednesday, October 23, 2024, 08:00 - 09:30
Hall X9-X12

LIPS Session 13 - Oncology & Theranostics Committee - PET/MRI What should we know?

OP-782
Basic principles and clinical applications
N. Ahmadi Bidakhvidi;
University Hospital Leuven, Nuclear Medicine, Leuven, BELGIUM.

OP-783
Abdominal PET/MR in oncology
C. Berliner;
University Hospital Essen, Nuclear medicine, Essen, GERMANY.

OP-784
PET/MR in neuro-oncology
F. Fraioli;
University College London, Institute of Nuclear Medicine, London, UNITED KINGDOM.

1704

Wednesday, October 23, 2024, 08:00 - 09:30
Hall X1-X4

M2M Track - TROP Session: Radiopharmaceutical Sciences + Translational Molecular Imaging & Therapy Committee: For Peptides Only

OP-785
Selective PET imaging using the Al^{18}F-labeled CXCR4 antagonist LY2510924: "Al^{18}F-NOTA-SC, the new kid on the block".
M. Spahn, *T. Van Loy, S. Celen, M. Koole, C. Deroose, D. Schols, W. Vanduffel, G. Bormans, F. Cleeren;*
KU Leuven, Leuven, BELGIUM.

Aim/Introduction: CXCR4 is overexpressed in various cancers such as multiple myeloma (MM). Here we evaluate [18F]AlF-NOTA-SC, an Al18F-labeled radiotracer derived from LY2510924 [1], for CXCR4 targeted imaging as an 18F-alternative for [68Ga]Ga-PentixaFor. The theranostic potential was assessed by co-injection with [177Lu]Lu-DOTA-BL02 [2]. ***Materials and Methods:*** The CXCR4 affinity (IC50) was assessed by incubating CXCR4 overexpressing Jurkat cells with the non-radioactive compounds and CXCL12AF647. The NOTA-SC peptide was labeled with [18F]AlF and radioactive cell-binding assays were conducted on high (U87.CD4.CXCR4), moderate (MM.1S) or non (U87.CD4) CXCR4-expressing cells. The biodistribution was assessed in naïve mice, tumor mice bearing both non-CXCR4 expressing (U87.CD4) and CXCR4 expressing (U87.CD4.CXCR4) subcutaneous tumors, and in a subcutaneous and systemic MM.1S mouse tumor model. Both dynamic µPET/CT (60 min) and ex vivo biodistribution (75 min p.i.) were performed with [18F]FDG µPET/CT scans as comparison. Further, a [18F]AlF-NOTA-SC PET/MRI study was performed in a non-human primate. The theranostic potential of [18F]AlF-NOTA-SC was assessed in a MM.1S subcutaneous tumor model by co-injecting it with [177Lu]Lu-DOTA-BL02 followed by ex vivo dual-label measurements. ***Results:*** IC50 values of 14.3±2.6nM and 8.6±1.1nM were obtained for [natF]AlF-NOTA-SC and [natGa]PentixaFor, respectively. [18F]AlF-NOTA-SC was labeled with a radiochemical yield of 28.4±6.7%, radiochemical purity of 98.6±0.7% and molar radioactivity of 16.4±3.4 GBq/µmol. The total-bound fraction on U87.CD4.CXCR4 cells resulted in 7.1±0.5% of administered activity (AMD3100 blocking by 58%) and 2.46±0.13% on MM.1S cells (AMD3100 blocking by 31%). The uptake in U87 cells without CXCR4 expression was below 1.5%, indicating CXCR4 specific uptake. [18F]AlF-NOTA-SC showed an excellent biodistribution with fast renal clearance. Furthermore, high uptake was observed in U87.CD4.CXCR4 (SUV 3.04±0.65) and in MM.1S tumors (SUV 1.95±0.06). [18F]AlF-NOTA-SC outperformed [18F]FDG and negligible uptake was measured in U87.CD4 tumors (SUV 0.04±0.00) or in the AMD3100 blocked condition (MM.1S, SUV 0.06). In the systemic MM.1S model [18F]AlF-NOTA-SC accumulated in multifocal lesions, e.g. femurs, spine and skull, similar to the pathogenesis in MM patients. Further, [18F]AlF-NOTA-SC showed an excellent biodistribution profile in the non-humane primate with fast renal clearance, a moderate uptake in the bone marrow and spleen and high uptake in kidneys and adrenal glands (physiological uptake) [3]. The co-injection with [177Lu]Lu-DOTA-BL02 showed comparable tumor uptake at 75 min p.i.(SUV[18F]AlF-NOTA-SC 3.06±0.48 vs. SUV[177Lu]Lu-DOTA-BL02 3.19±0.36). ***Conclusion:*** [18F]AlF-NOTA-SC showed CXCR4 specific tumor uptake and excellent pharmacokinetic profile. By outperforming [18F]FDG, [18F]AlF-NOTA-SC is a promising candidate for clinical translation. ***References:*** [1]Peng,2015;14(2):480-490. doi:10.1158/1535-7163.MCT-14-0850 [2]Kwon,2022;28(8):1628-1639. doi:10.1158/1078-0432.CCR-21-3284 [3]Gao,2023;62(3):267-271. doi:10.3760/cma.j.cn112138-20220609-00440.

OP-786
Disialoganglioside GD2 targeted PET-NIR imaging of high-risk children neuroblastoma with newly synthesized peptide
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Aim/Introduction: High-risk neuroblastoma is one main childhood cancer with great heterogeneity. It carries a neuroblastoma-specific antigen in the form of a glycolipid antigen known as

Disialoganglioside GD2 which serves as one promising target for immunotherapy. Comparing with GD2 targeted antibody, Peptide is easier to be structure modified, produced, easily to be labelled with imaging radionuclide 68Ga, 18F and be conjugated to near-infrared (NIR) fluorescent dye. Here, we synthesized one GD2 targeted peptide (GD2TP) and prepared a PET-NIR multimode imaging agent to evaluate high risk neuroblastoma metastasis and improve fluorescence-guided surgery. ***Materials and Methods:*** GD2BP were designed based on the structure of GD2 targeted antibody and prepared via solid phase peptide synthesis, mixed with TATA for cyclization and radiolabeled with 68Gallium or Cy5.5. In vitro cell binding affinity and specificity experiments of 68Ga/Cy5.5-GD2BP were performed in neuroblastoma tumor cells with varying levels of GD2 expression. Ex vivo biodistribution and Animal PET, NIR imaging of 68Ga/Cy5.5-GD2BP were performed in mice bearing SK-N-SH Neuroblastoma xenografts. Surgery navigation was performed based on the pre-operation PET-CT imaging and real-time NIR imaging. Tumor uptake of 68Ga/Cy5.5-GD2BP (percentage of injected dose, %ID/g) was compared with GD2 expression based on IHC results from tumor xenografts. ***Results:*** 68Ga-GD2BP was synthesized with high radiochemical purity. It was stable in PBS for 3 hours with radiochemical purity ranging from 96% to 98%. Cell binding specificity of 68Ga/Cy5.5-GD2BP was confirmed by GD2 blockage. Positive correlation was found between tumor cell uptake of 68Ga/Cy5.5-GD2BP and GD2 expression with R2 being 0.86. 68Ga-GD2BP was excreted rapidly via kidney and its retention in blood circulation was short. Tumor uptake of 68Ga-GD2BP (%ID/g) at 1h, 2h, 3h was (2.9±0.25), (3.8±0.7) (2.6±0.1) and (0.65±0.1 on 2h) at the block group. Tumor/normal tissues uptake ratio of Cy5.5-GD2BP at 2h post tail vein injection was (15±3.2) and NIR imaging proved that Cy5.5-GD2BP could successfully delineate the boundary between the tumor and normal tissues with high temporal and spatial resolution. ***Conclusion:*** 68Ga/Cy5.5-GD2BP, as one newly prepared GD2 targeted multimode imaging peptide, maybe promising for neuroblastoma GD2 expression evaluation, precision preoperative diagnosis and surgery navigation.

OP-787

Assessing αvβ6 Integrin Expression in Pancreatic, Head and Neck Carcinoma Using ^{68}Ga-Trivehexin PET/CT and its correlation with Immunohistochemistry.

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Aim/Introduction: αvβ6-integrin is exclusively expressed in epithelial cells and is upregulated in many carcinomas, such as head and neck squamous cell carcinoma (H&N-SCC) and Pancreatic Ductal Adenocarcinoma (PDAC). Expression of αvβ6 integrin is almost always tumour specific with surrounding normal stromal tissue not expressing αvβ6. Trivehexin is a recently synthesized improved trimerized αvβ6-integrin selective nanopeptide which can be used as a diagnostic agent after being labelled with a positron emitter like 68Gallium. This is a pilot study to assess the potential role of 68Ga-Trivehexin PET/CT in patients of H&N-SCC and PDAC and their correlation with level of αvβ6-integrin expression by the tumour tissue on IHC. ***Materials and Methods:*** 32 patients with suspected H&N-SCC (n=20), or PDAC (n=12) underwent whole-body 68Ga-Trivehexin PET/CT and 18F-FDG PET/CT scans on two separate days. All 32 patients underwent biopsy from the tumor site for histopathological diagnosis and IHC for αvβ6-integrin expression. The degree of αvβ6-integrin expression on IHC was scored using the immunoreactive score (IRS) and modified 4-point IRS classification. ***Results:*** The 68Ga-Trivehexin PET images demonstrated increased tracer uptake in primary as well as in metastatic lesions (mean SUVmax 5.9 ± 3.3) with good lesion delineation seen in 8/9 cases of PDACs. On the other hand, 18F-FDG PET/CT showed increased tracer uptake (mean SUVmax 6.2 ± 2.6) in the lesions in 7/9 cases of PDACs. Among various cases of H&N-SCC, increased uptake of 68Ga-Trivehexin (mean SUVmax 6.6 ± 4.5) and 18F-FDG (mean SUVmax 12.7 ± 6.7) were seen in 17/18 patients (one case of tracheal carcinoma showed no significant uptake of either tracer). The two cases of inflammatory changes with suspected disease recurrence, showed increased tracer uptake in 18F-FDG PET/CT (7.98 ± 3.1) and no significant uptake in 68Ga-Trivehexin PET/CT (2.2 ± 0.34). 68Ga-Trivehexin PET/CT showed positive uptake in 36/38 lesions positive for αvβ6 integrin expression on IHC with mean higher SUVmax seen in lesions with higher IRS score. 68Ga-Trivehexin SUV Max tumor showed a positive association with αvβ6 expression (correlation coefficient 0.6830) with significant p-value (p <0.0001). A higher sensitivity, specificity and accuracy of 68Ga-Trivehexin PET over 18F-FDG PET was seen for detection of primary and metastatic lesions. ***Conclusion:*** 68Ga-Trivehexin is a promising non-invasive molecular imaging agent for tumors expressing αvβ6 integrin, especially in cases where 18F-FDG PET/CT scan may be suboptimal due to its low uptake owing to low GLUT receptors, or due to its nonspecific uptake around tumor sites.

OP-788

The chirality in position 1 and 2 of DOTA-NOC determines affinity and subtype selectivity

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Aim/Introduction: Radiolabeled somatostatin receptor subtype 2 (SST2) agonists (i.e. DOTA-TATE and DOTA-TOC) are clinically established. Recent trials indicated certain advantages of SST2 antagonists over agonists. A structural difference between SST2 antagonists and agonists is the inverted chirality in position 1 and 2 ((L-Phe1, D-Cys2) vs (D-Phe1, L-Cys2), respectively). However, such information is not available for analogs with multi-receptor selectivity. Herein we investigated how these configurations affects affinity, subtype selectivity and functional properties of DOTA-NOC (DOTA-D-Phe1-c(Cys2-1Nal3-D-Trp4-Lys5-Thr6-Cys7)-Thr(ol)8), a known SST2 and SST5 agonist. ***Materials and Methods:*** DOTA-NOC (D1,L2), and its diastereomers MRL18 (L1,D2: [Phe1,D-Cys2]-NOC), MRL18D (D1,D2: [D-Phe1,D-Cys2]-NOC) and MRL18L (L1,L2: [Phe1,Cys2]-NOC) were synthesized, conjugated to DOTA and labeled with Lu-177. Their affinity (IC50) was evaluated on HEK-SST2 and on CHO-SST5 membranes, using 125I-Tyr-SS-14. Their SST2 functionality was assessed using 7TM phosphorylation assay. Their cellular uptake and distribution were determined on HEK-SST2 cells. SPECT/CT images were acquired in HEK-SST2 and HEK-SST5 xenografts at 1h post-injection. ***Results:*** Compared to DOTA-NOC (IC50 = 0.36 and 13.8 nM for SST2 and SST5, respectively): a) Inversion of chirality to L1,D2 (DOTA-MRL18) resulted in reduced affinity for SST2 and loss of affinity for SST5 (IC50 = 4.9 and >1000 nM, respectively). b) Introduction of both D-amino acids (DOTA-MRL18D) resulted in massively reduced affinity for both subtypes (IC50 = 39 and 334 nM, respectively). c) Introduction of both L-amino acids (DOTA-MRL18L) led to

high SST2 and moderate SST5 affinity (IC50 = 0.66 and 49 nM, respectively). In line with the affinity data, high internalization was only observed for [177Lu]Lu-DOTA-NOC and [177Lu]Lu-DOTA-MRL18L (65 and 80% of added activity, at 4h/37°C, respectively), indicating agonism. [177Lu]Lu-DOTA-MRL18D had no uptake and [177Lu]Lu-DOTA-MRL18 had low total uptake (~15% at 4h/37°C), distributed equally between the cell surface and internalized fractions, indicating an impact on its agonism/antagonism functionality. However, in the 7TM phosphorylation assay DOTA-MRL18 and DOTA-MRL18L showed SST2 agonism similar to DOTA-NOC. SST2- and SST5-targeting in vivo, followed by SPECT/CT imaging, was in line with the affinity data. ***Conclusion:*** The inversion of chirality at position 1 and 2 does not switch the multi-receptor agonist DOTA-NOC to an antagonist. The results suggest that position 2 requires L2 configuration for sustaining SST5 affinity, while D1 and L1 configuration are both tolerated in position 1. Acknowledgement: We acknowledge ITM (Munich) for the financial support.

OP-789

Preclinical evaluation of FL-031, a novel vector for next generation SSTR2 targeting radioligand therapy for the treatment of SSTR2-positive cancers

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Aim/Introduction: Somatostatin receptor 2 (SSTR2) is frequently overexpressed in neuroendocrine tumors (NETs) and other solid tumors including small cell lung cancer (SCLC), making it a promising target for diagnostic imaging and radioligand therapy. Lutetium-177 labeled somatostatin analog 177Lu-DOTATATE has been approved for the treatment of gastroenteropancreatic (GEP)-NETs, while its efficacy in SCLC is currently being explored in clinical trials. This study evaluated the preclinical characteristics of a novel SSTR2-targeting radioligand 177Lu-FL-031, which was engineered leveraging our proprietary platform. 177Lu-FL-031 demonstrated favorable biodistribution profiles and promising anti-tumor activities compared with 177Lu-DOTATATE in multiple xenograft mouse models, including in SCLC xenograft models with moderate or low SSTR2 expression. ***Materials and Methods:*** Binding affinity, selectivity and cross-species activity of FL-031 was evaluated in 293T cells with exogenous SSTR2 expression. The biodistribution profile of 177Lu-labeled FL-031 was characterized by SPECT/CT and ex vivo biodistribution assays in mice bearing SSTR2-expressing tumor xenograft models. The anti-tumor activity of 177Lu-FL-031 was compared with 177Lu-DOTATATE in mice bearing different xenografts with a single administration of 18.5 or 37 MBq/mouse. ***Results:*** FL-031 showed a 10-fold higher affinity to SSTR2 overexpressing 293T cells compared with DOTATATE (IC50 0.8 nM vs. 9.3 nM). FL-031 was >500-fold selective for SSTR2 over all other SSTR family members and demonstrated cross species reactivity with comparable affinity to SSTR2 of human, mouse, rat, dog and pig. High and specific tumor uptake was observed for 177Lu-FL-031 in AR42J and NCI-H524 xenograft models, with rapid clearance from all normal organs. Importantly, 177Lu-FL-031 demonstrated significantly increased tumor uptake and improved tumor-to-kidney ratio compared with 177Lu-DOTATATE. Moreover, 177Lu-FL-031 exhibited improved in vivo anti-tumor activities in AR42J, NCI-H524 and NCI-H69 xenograft models compared with 177Lu-DOTATATE. No notable body weight loss was observed in these studies and complete regression was achieved in the SCLC NCI-H524 model. Furthermore, in a post-177Lu-DOTATATE model, 177Lu-FL-031 induced regression and exhibited significantly improved anti-tumor activity compared with retreatment by 177Lu-DOTATATE, suggesting that 177Lu-FL-031 may overcome the resistance to 177Lu-DOTATATE. ***Conclusion:*** FL-031 exhibited tight binding affinity and high selectivity towards SSTR2. 177Lu-FL-031 demonstrated improved biodistribution profile and anti-tumor activity compared with 177Lu-DOTATATE in multiple models. Collectively, FL-031 is a promising vector for radioligand therapy targeting SSTR2-positive cancers. As the next step of developing our next-generation SSTR2 targeting radionuclide drug conjugate (RDC), we plan to initiate studies to investigate FL-031 conjugated to the radionuclide Actinium-225.

OP-790

Caspase-3 selective peptide-based probes for imaging of tumour cell death.

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Aim/Introduction: The fact that many cancer treatments exert their effect by inducing tumour apoptosis allows the assessment of early response to therapy, which may improve patient outcomes. Multiple PET imaging radiotracers have been developed to image apoptosis. Among these, tracers targeting active caspase-3, the main executor of apoptosis, have shown low absolute tumour uptake and lack of selectivity. Therefore, the goal of this study was to design selective PET tracers for imaging caspase-3 activation, and to assess their value for the evaluation of response to cancer therapy. ***Materials and Methods:*** Caspase-3-selective activity-based probes (ABPs) were developed based on two selective inhibitors Ac-DW3-KE (Ac-3Pal-Asp-βhLeu-Phe-Asp-KE) and Ac-ATS010-KE (Ac-3Pal-Asp-Phe(F5)-Phe-Asp-KE) [1]. The binding kinetics (kinact/Ki) and selectivity of the probes to different caspases were determined experimentally by measuring the cleavage of fluorogenic substrates. Radiosynthesis was performed by click reaction with 18F-labelled prosthetic groups, and the lipophilicity and stability of the tracers were assessed. The most promising tracers were evaluated in an in vitro model of apoptosis. Subsequently, in vivo experiments allowed to assess the radiotracer biodistribution in healthy mice and tumour targeting in an in vivo colorectal cancer model treated with apoptosis-inducing targeted therapy. ***Results:*** All probes showed high caspase-3 selectivity, with the DW3-KE-based ABPs displaying slower kinetics than ATS010-KE-based ABPs. Therefore, subsequent ABPs were based on the Ac-ATS010-KE sequence, generating a library by introducing different N-terminal linkers. The linkers had a minor effect on selectivity and binding kinetics (Table 1). The radiotracers were synthesized with moderate radiochemical yield (6.4±3.1% to 12.37±10.85%) and purity (89.93±13.3% to 99.76±0.05%) and, the logD ranged from -0.42±0.18 to -2.58±0.01. The ABPs remained stable in mouse plasma in vitro (77-88% after 2h), however, in vivo less than 25% remained intact 1h post-injection (p.i.). All radiotracers showed mixed renal-hepatobiliary excretion. The least hydrophilic tracer [18F]MICA-316 showed an increased uptake in apoptotic HeLa cells in vitro (28.5±5.2%ID/g) compared to the caspase-3-deficient control group (7.53±1.53%ID/g, P=0.0097). In vivo, [18F]MICA-316 imaging showed limited tumour uptake and could not discriminate between treated (0.55±0.32 %ID/cc) and untreated (0.52±0.12%ID/cc) tumours 60 minutes p.i., despite being able

to bind caspase-3 in tumour homogenates. ***Conclusion:*** In conclusion, novel caspase-3-selective ABPs were developed, retaining the kinetic properties of the original inhibitors. [18F]MICA-316, was able to detect apoptosis in vitro, however, low tumour accumulation was observed in vivo. Future caspase-3-selective radiotracers will have higher stability and tumour accumulation. ***References:*** 1 Solania et al. ACS Chemical biology 2019.

OP-791

Synthesis and preclinical evaluation of 89Zr labeled Angiotensin peptide as a breast cancer imaging agent using PET.

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Aim/Introduction: Angiotensin (Ang) II, the main effector peptide of the renin-angiotensin system, has been implicated in diverse aspects of cancer progression, such as cell proliferation, cell migration, invasion, tumor angiogenesis, and metastasis. Ang-(1-7) is a biologically active heptapeptide generated mainly from AngII by the enzymatic activity of angiotensin-converting enzyme 2. AngII is known to play a critical role in breast cancer development by stimulating breast cancer cell proliferation and modulating tumor cell migration and invasion. AngII mediates its action through two G-protein coupled receptors, AT1 and AT2. Overexpression of AT1 receptor in breast cancer seems to promote tumor growth and angiogenesis, thus targeting AT1 receptor using AngII peptide would facilitate the detection of breast carcinoma. The goal of this study was to assess whether the peptide of the renin-angiotensin system, AngII holds the potential to target AT1 receptor overexpressing breast cancer. ***Materials and Methods:*** Zr-89 was produced using a solid target (89Y metal foil), beam energy of 13 MeV, and beam current of 15 µA. DOTA-coupled AngII peptide was synthesized by solid-phase peptide synthesis according to the Fmoc/HATU chemistry. Radiolabeling with 89Zr was achieved in the presence of ammonium acetate buffer and heating the mixture for 45 min. 89Zr-labeled AngII peptide was evaluated for its binding capacity with SUM159, a mesenchymal triple-negative breast cancer cell line. The normal pharmacokinetics was performed in balb/c mice and the tumor targeting study was done in nude mice with SUM159 tumors xenografts. ***Results:*** DOTA-AngII peptide showed high labeling efficiency (≥80%) with Zr-89. The stability of radiopeptide in plasma was high. 89Zr-AngII peptide showed nanomolar (45 nM) AT1 receptor-specific affinity. In vivo, biodistribution in mice showed rapid clearance of radiopeptide from the blood and excretion mainly by the renal route due to its hydrophilic nature. A low uptake of radioactivity was seen in the major organs including lungs, liver, stomach, spleen, and intestines (<4% ID/g) except for the kidneys. A high renal-urinary excretion was observed for the radiopeptide. In nude mice, 89Zr-DOTA-AngII peptide displayed good tumor targeting in vivo, with 2.07% ID/g of radioactivity found in the tumors at 90 min p.i. The receptor specificity of the radiopeptide was confirmed by the receptor-blocking assay. ***Conclusion:*** Our initial findings indicate that the 89Zr-DOTA-AngII peptide can be a useful imaging agent for breast cancer. This work proposes the potential of this innovative class of peptides for efficient targeting of breast cancer and warrants further investigation.

OP-792

NOTA/NOTAGA-conjugated bombesin analogs for visualization of GRPR-positive tumors after labelling with the PET radionuclide Ga-68

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Aim/Introduction: Gastrin releasing peptide receptor (GRPR) has attracted a lot of attention over the years as a biomolecular target for radiopharmaceutical development. Its overexpression in various malignancies, including prostate and breast cancer, plus its negligible expression in the surrounding healthy tissues, strongly support that choice. Despite the many attempts over the years, none GRPR-targeting radiopharmaceutical has find its way into the everyday clinical praxis. Therefore, we designed and present two diagnostic GRPR-targeting, NOTA/NODAGA-conjugated radiotracers based on the in vivo stable motif PEG2-[Sar11]RM26 [1]. Aiming for use with positron emission tomography (PET) for diagnostic purposes both radioligands were labelled with Ga-68 and evaluated both in vitro and in vivo. ***Materials and Methods:*** The two new radioligands were designed and labelled with Ga-68. Their in vitro GRPR-specificity, as well as their cellular uptake over time was evaluated in PC-3 cells. The receptor affinity for NOTA/NODAGA-PEG2-[Sar11] RM26 and NOTA-PEG2-RM26, after coupling with natGa, was evaluated in competition binding experiments against [125I] I-Tyr4-bombesin in alive PC-3 cells. The biodistribution profile, in vivo specificity and imaging for was evaluated in Balb/c nu/nu mice bearing PC-3 xenografts. ***Results:*** Both new peptides were successfully labelled with Ga-68, with radiochemical yields and purity exceeding 95%. Both NOTA-/NODAGA-PEG2-[Sar11]RM26 displayed high GRPR-specific uptake in PC-3 cells (NOTA: 18±1%; NODAGA: 22.2±0.9% of added activity), while retaining the typical radioantagonist profile (the bulk of associated activity remaining on the cell membrane). After loading the peptides with natGa, in competition binding experiments, they exhibit a nanomolar affinity (6.6 nM and 4.3 nM, respectively), similar to the highly affine, previously reported, [natGa]Ga-NOTA-PEG2-RM26 (4.3 nM) [2]. In vivo, they displayed rapid background clearance with blockable receptor-driven uptake in tumors and in GRPR-rich organs, like pancreas. Among the two, [68Ga]Ga-NODAGA-PEG2-[Sar11] RM26 holds an edge with a slightly higher tumor-uptake and lower background (Tumors 1 h pi: NOTA -14±2%IA/g, NODAGA - 17±3%IA/g; Pancreas: NOTA -10±2%IA/g, NODAGA - 8±1%IA/g; Muscle: NOTA - 0.27±0.08%IA/g, NODAGA - 0.13±0.02%IA/g). Tumor/blood ratios started at 16-30 and increased 3-fold, while tumor/liver was 30 at 1h with >2-fold increase 3h pi. ***Conclusion:*** Based on the performance of [68Ga]Ga-NOTA-PEG2-[Sar11]RM26 and [68Ga]Ga-NODAGA-PEG2-[Sar11]RM26, both are considered as very promising PET probes for detection GRPR-positive lesions, due to their high tumor-targeting capabilities. Among the two, the NODAGA-conjugated one has a slight advantage and it is considered strong candidates for clinical translation. ***References:*** [1] Abouzayed et al. Biomolecules 2023, 13 (7), 1134. [2] Varasteh et al. Bioconjugate Chem. 2013, 24 (7), 1144–1153.

OP-793

Structure-property investigation of RM26 bombesin analogues with different hydrophobicity: impact on GRPR binding and prostate cancer imaging

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Aim/Introduction: The gastrin-releasing peptide receptor (GRPR) is overexpressed in multiple cancer types, including prostate, breast, lung, and colon tumours. RM26 bombesin analogue (d-Phe-Gln-Trp-Ala-Val-Gly-His-Sta-Leu-NH2) labeled with Ga-68 was proposed for imaging of GRPR-positive tumours [1]. Binding to GRPR and imaging properties of RM26 strongly depends on structure of linker between RM26 and chelator for labeling. Herein, a series of RM26-based peptides N-terminally conjugated with NOTA via o-methylanisole (NOTA-oMA-RM26), m-methylanisole (NOTA-mMA-RM26), or o-ethyltoluene (NOTA-oET-RM26) spacers were radiolabelled with Ga-68 and evaluated in vitro and in vivo for GRPR targeting in comparison with NOTA-(PEG)2-RM26. ***Materials and Methods:*** Three RM26 peptide analogues were radiolabelled with 68Ga via NOTA chelators and purified with Sep-Pak C8 columns. Labelling stability was evaluated using iTLC and radio-HPLC analysis. In vitro binding specificity and cellular processing was evaluated using PC-3 cells, overexpressed GRPR. Biodistribution of [68Ga]Ga-labelled peptides and PET imaging was performed in BALB/c nu/nu mice bearing PC3 tumours. ***Results:*** Radiochemical purity of [68Ga]Ga-labelled RM26 analogues was above 95%, radiochemical yield was above 90% after conjugation and above 99% after purification step. [68Ga]Ga-NOTA-oMA-RM26 has shown almost 1.5-fold higher binding to PC3 cells, compared to other tested proteins. Binding of new peptides was GRPR specific and can be blocked by addition of 1000-fold excess of non-labelled NOTA-(PEG)2-RM26 protein. Biodistribution 2 h post intravenous injection has shown the highest uptake in pancreas, following by GRPR-expressing tumours and kidneys. Tumour uptake did not differ between analogues, almost 12% IA/g. Nevertheless, hydrophobic analogue [68Ga]Ga-NOTA-oET-RM26 demonstrated lower non-specific uptake in normal organs, namely, pancreas, lungs, liver and spleen. Activity uptake of all proteins in tumours, pancreas, and gastrointestinal tract could be blocked by co-injection of NOTA-(PEG)2-RM26 that supports GRPR-specific accumulation of new peptides. High uptake of peptides in liver and small intestine supposed involvement of hepatobiliary excretion in clearance of RM26 analogues. PET imaging was in agreement with biodistribution data and enable identification of PC3 tumour on the background of excreted peptide in small intestine. ***Conclusion:*** RM26 analogues with different spacers between targeting part and chelator can be easily radiolabelled with Ga-68 with high radiochemical yield and stability. After labelling proteins perceived specific binding to GRPR-overexpressed cells. [68Ga]Ga-NOTA-oET-RM26 showed reduced non-specific activity uptake in body. Nevertheless, inclusion of any of the proposed spacers to RM26 peptide increases its accumulation in small intestine, which is not favourable for PET imaging. ***References:*** 1. Mitran et al. International journal of oncology. 2016, 48(5), 2124-2134.

1705

Wednesday, October 23, 2024, 08:00 - 09:30
Hall Y4-Y9

Cutting Edge Science Track - TROP Session: Physics Committee: Quantitative PET / CT Imaging

OP-794

The consistency of guideline recommendations for the use of FDG PET/CT in oncology by ACR, NCCN, and EANM

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Aim/Introduction: Reliable and consistent guideline recommendations improve the quality of practice. However, it is unclear whether guidelines recommendations for the appropriate use of FDG PET/CT vary between different specialties. Thus, we aim to compare recommendations for oncological FDG PET/CT indications from representative guidelines developed by the oncology group (National Comprehensive Cancer Network [NCCN]), the radiology group (American College of Radiology [ACR]), and the nuclear medicine group (European Association of Nuclear Medicine [EANM]), in order to examine consistency. ***Materials and Methods:*** We collected recommendations about the use of FDG PET/CT for oncological indications from guidelines developed by the NCCN and ACR, and compared them with those from the EANM guideline (Hossein Jadvar, J Nucl Med, 2017). ***Results:*** Recommendations for the use of FDG PET/CT for restaging and treatment response assessment in 7 cancers were compared (i.e., lymphoma, breast cancer, lung cancer, head and neck cancer, colorectal cancer, melanoma and sarcoma, presented as Table 1). Serious inconsistencies were observed for three indications (20%): breast cancer restaging for local recurrence, and colorectal cancer restaging and treatment response assessment, in which the use of FDG PET/CT was supported by the EANM, while explicitly recommended against by either the NCCN or the ACR. Potential inconsistencies were observed for 12 indications (80%): restaging and treatment response assessment for colorectal cancer, lymphoma, lung cancer, melanoma, and sarcoma, and treatment response assessment for breast cancer, in which the use of FDG PET/CT was supported by the EANM, while not mentioned under the corresponding indications by ACR. ***Conclusion:*** This is the first study to compare guidelines recommendations for FDG PET/CT indications developed by different specialties, and serious inconsistencies were noted in several indications. Efforts are needed to examine the underlying cause for inconsistent recommendations and to improve the quality of guideline recommendations for FDG PET/CT use.

OP-795

Quantitative accuracy of clinical PET systems in the UK (2019-2023)

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Aim/Introduction: Quantitative accuracy in PET is a critical factor when considering multi-centre comparability. To assess the comparability of PET systems in the UK a specialised traceably calibrated solid phantom was designed and distributed to UK PET centres. ***Materials and Methods:*** The phantom was adapted from the NEMA NU-2 Image quality phantom which consists of 6 spheres ranging in size from 10 mm to 37 mm diameter. A 7th sphere with a 5 mm diameter was added to the phantom in a position optimised using monte carlo techniques. The phantom was prepared with a 68Ge spiked epoxy resin and a total activity of 99.0(30) MBq (@ k=2) with a sphere:background ratio of 4:1. The phantom was shipped to the test sites for measurement between 2019 and 2023 with images acquired using a decay-corrected acquisition time simulating a 3 min per bed position scan at each site. An additional scan with a single frame centred over the sphere axis was also obtained at most sites and list-mode data was collected. The phantom was periodically returned to to coordinating site and scanned to confirm stability of the phantom. Images were reconstructed using typical clinical protocols at the participating site, and image analysis was performed centrally by two independent operators. Results were calculated for quantitative accuracy of background and sphere activities and recovery coefficient curves were generated for each scan made. ***Results:*** The results show statistical agreement between centres with no site returning activity values more than 10 % from the reference values. Uncertainties were estimated for each site using statistical information from the scans and estimated values based on measurements performed at the coordinating site (NPL). Recovery coefficient curves were generated and compared to the EARL recommended values for 18F and 68Ga. ***Conclusion:*** The comparison exercise demonstrated equivalence between centres for typical activity measurements in a simple geometry. The exercise highlighted the lack of knowledge at participating centres in performing uncertainty analysis of PET measurements and future work should be performed in this area. Further work will be undertaken using the list mode data from this study and a harmonised reconstruction platform to minimise reconstruction influences on the dataset and harmonise uncertainty components.

OP-796

Validation of a Fully Automated Deep Learning (DL)-Assisted Analysis Pipeline for Quantification of PET/CT Image Data in a Medical Data Integration Center

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Aim/Introduction: Nuclear medicine images are data and contain information suitable for automated analyses of physiological and biochemical processes. Here, we validated a prototypic analysis pipeline linked to a medical data integration center (DIC) of the German Medical Informatics Initiative (MII) for the automatic quantification of reference organs (aorta, liver, and bone marrow in L3 vertebra) in FDG PET/CT images. ***Materials and Methods:*** A Python script indexes molecular imaging series from PACS by extracting relevant DICOM metadata to be linked with case data in the searchable DIC database containing further clinical parameters and follow-up data. Exemplarily, we selected 74 consecutive cases with EARL-compliant FDG PET/CT for analysis in a Python-based pipeline. After voxel-resampling and SUV-scaled conversion to Nifti format, 104 organ regions were obtained from the CT component using the DL-tool TotalSegmentator [1] for PET quantification. To account for incongruent organ rims in PET and CT, CT-based segmentations underwent post-processing (demasking of cortical bone and erosion operations with optimized parameters). Physician supervised SUV measurements served as reference standard. ***Results:*** Indexing the image series expands the dataset in the DIC if procedure coding of imaging is missing or ambiguous. The EARL-compliant PET/CT images allow robust organ segmentation which takes 6-9 minutes per scan. Median SUVs in organ regions are less sensitive to shifts between PET and CT components than mean SUVs as shown by Bland-Altman analysis. The SUVs obtained from our pipeline are equivalent to conventional SUV measurements with a mean absolute error, correlation coefficient, linear slope, and intercept of 0.11, 0.92, 0.93, 0.09 in the aorta (analyzed volume: 6.5±4.0 mL), 0.1, 0.92, 1.0, 0.05 in the liver (332±337 mL), and 0.09, 0.99, 0.93, 0.1 in L3 (9.2±3.0 mL), respectively. ***Conclusion:*** The fully automated pipeline provides a robust and accurate quantification of PET data. CT-defined segmentations need proper post-processing prior to application for PET quantification to account for overlay inaccuracies. The use of median instead of mean SUVs results in more robust quantifications even if pathology (e.g. metastatic disease) is present in reference organs. Further prototype development aims at roll-out to the DIC sites at medical universities for both local operation and cross-site research. Its modular structure facilitates adaptation to local image archiving scenarios and integration of further analysis tools. Linking quantitative molecular imaging data to medical information in a DIC unlocks the large-scale use of image-based phenotyping for DIC-supported research with clinical and survival data. ***References:*** [1] DOI: 10.1148/ryai.230024

OP-797

Tracking of Ultra-Low Activity Sources in LAFOV PET Using Histo-Images

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Aim/Introduction: Insight of cell homing and trafficking can be crucial for the development and evaluation of novel cell-based therapies. Cell tracking algorithms based on Positron emission tomography (PET) have been proposed to track over one hundred cells, each labeled with a few becquerels of activity. However, these methods have been primarily evaluated with preclinical scanners or Monte Carlo simulations. Stepping towards a clinical setting, in this study, we explore the feasibility of histo-image-based [1] tracking of ultra-low activity sources using a commercially available long axial field of view (LAFOV) PET system. ***Materials and Methods:*** 22Na point sources with activities of 6.4 (L), 22.8 (M), and 726 (H) kBq were positioned with a calibrated robotic arm that was placed at the edge of the axial FOV of the PET scanner. Series of list-mode PET acquisitions were performed with the point source(s) moving on predefined linear or spiral trajectories at various constant velocities of 0.31 (s), 10 (m), and 35.6 (f) mm/s.

To emulate clinically comparable attenuation and scatter effects, additional PET acquisitions were performed in the presence of two cylindrical phantoms, 70 cm long and 20 cm diameter each. From the acquired data, histo-images were generated to visualize the coincidence events in image space. Two observers assessed the visibility of the trajectories on the maximum intensity projections (MIPs) of the resulting histo-images. ***Results:*** Without an attenuation medium, the histo-image method yielded visually identifiable trajectories of all activity sources with all tested velocities. We obtained similar results with the attenuation medium, except in the cases of (s) and (m) velocities using the (L) activity source, where the trajectories were unable to be discerned from the background noise. ***Conclusion:*** The histo-image-based method was capable of generating discernable trajectories of ultra-low activity sources using a clinical LAFOV PET system. Therefore, a source localization method based on histo-images can potentially be suitable for cell tracking applications. Currently, we are developing the necessary tools to estimate the location and the motion of the sources from dynamic histo-images before starting clinical evaluations. ***References:*** [1] Matej S, Surti S, Jayanthi S, Daube-Witherspoon ME, Lewitt RM, Karp JS. Efficient 3-D TOF PET Reconstruction Using View-Grouped Histo-Images: DIRECT—Direct Image Reconstruction for TOF. IEEE TMI. 2009; https://doi.org/10.1109/TMI.2008.2012034

OP-798

FastPET: fast quantitative end-to-end deep learning reconstructions

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Aim/Introduction: End-to-end deep learning (DL) positron emission tomography (PET) reconstruction was first proposed in 2018, offering benefits such as rapid reconstructions, being particularly advantageous for dynamic studies requiring the reconstruction of numerous frames, and the prospect of real-time PET imaging. Whiteley et al. (2021) introduced a novel data representation called "histo-images" as the network's input, replacing traditional sinograms. Histo-images directly map the detected events to the spatial dimensions of the image and, thus, are well suited to be processed by convolutional neural networks. This paper was the first to enable DL reconstructions of full 3D images. Feng et al. and Ote and Hashimoto have since used multi-view histo-images — one histo-image per set of azimuthal angles. However, these studies have shown non-systematic bias and blurry reconstructions. Therefore, to our knowledge, an end-to-end neural network capable of providing quantitative results had yet to be presented. This work introduces the first end-to-end network capable of quantitative reconstructions. ***Materials and Methods:*** We achieved that by using a multi-view histo-image containing the attenuation correction factors as an additional input. We also trained our network against noisier but sharper targets since the network tends to smooth the provided target. ***Results:*** We significantly improved image quantification, with the absolute relative difference from OSEM being 2.3 % on average over 16 regions of interest. Our proposed method also removes some artefacts in the image. It exhibits higher contrast and lower noise than the clinical OSEM. The reconstruction takes 20 seconds for a long axial field of view scanner (image size 440 × 440 × 645) using a GPU NVIDIA RTX A6000 with 47.5 GB memory. Creating the attenuation histo-image takes 2 minutes and can be performed after the CT before the PET acquisition starts. The time required to produce a PET histo-image varies according to the number of events. It is around 2 minutes for a typical 10-minute FDG scan of 2.7 billion prompts. In a clinical setting, this can be performed during the acquisition process. As a result, the waiting time after the scan finishes is only 20 seconds compared to the 7 minutes with the clinical OSEM currently in use. For long dynamic studies involving 100 frames, the difference is substantial. ***Conclusion:*** This study introduces the first end-to-end deep-learning technique capable of performing quantitative reconstructions in nearly real-time.

OP-799

Impact of different Patlak parametric imaging approaches with a long axial field-of-view (LAFOV) PET/CT in oncological patients

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Aim/Introduction: The recently introduced Long-Axial-Field-of-View (LAFOV) PET-CT scanners allow for the first-time whole-body dynamic- and parametric imaging. We, herein, aimed to evaluate whether Patlak imaging is feasible with the new LAFOV Biograph Vision Quadra PET/CT (Siemens Healthineers) system and whether it improves lesion detectability as compared with the 50-60-min standard uptake value (SUV) images. Furthermore, we investigated the differences between the direct and indirect parametric Patlak images and the impact of the time factor. ***Materials and Methods:*** 50 oncological patients with 346 tumor lesions were enrolled in the study. All patients underwent [18F]FDG PET/CT (skull to upper thigh). Four sets of images have been compared: short-time (30 minutes)-direct (STD) Patlak Ki images, short-time (30 minutes)-indirect (STI) and long-time (59.25 minutes)-indirect (LTI) Patlak Ki images, as well as 50-60-min SUV (sumSUV) images. All four sets of images were reviewed visually (qualitatively) by the reading physicians. Furthermore, 346 individual tumor lesions were quantitatively analyzed using the target-to-background (TBR) and contrast-to-noise ratio (CNR) metrics. ***Results:*** No significant differences were observed between the four approaches regarding the number of tumor lesions. However, we found three discordant results: a true positive liver lesion in all Patlak Ki images, a false positive liver lesion delineated only in LTI Ki which was a hemangioma according to MRI and a true negative example in a patient with an atelectasis next to a lung tumor. Quantitatively, parametric imaging showed that STD, STI and LTI Ki images had superior TBR in comparison with sumSUV images (2.9-, 3.3- and 4.3-fold mean increases in TBR, respectively). STD Ki images demonstrated 2.3-fold higher CNR in tumor lesions as compared with STI Ki images. Besides, TBR of LTI Ki was significantly higher than TBR of STD Ki in 306/346 lesions. ***Conclusion:*** Dynamic [18F]-FDG with the new LAFOV PET/CT scanner produces Patlak Ki images with better lesion contrast than SUV images but does not increase lesion detection rate. In few cases, Patlak images revealed discordant findings as compared to sumSUV and adds further useful clinical information. However, Patlak imaging does not increase lesion detection rate as compared with the sumSUV images. In addition, the TBR of LTI Ki images are significantly higher than STD Ki images. Our results demonstrate, that the time window used for Patlak reconstruction plays an important role than the use of (in)direct image reconstruction.

OP-800

Whole-body Patlak Parameter Estimation of Deep Learning Time-of-Flight Enhanced Dynamic PET Scans

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Aim/Introduction: To investigate the performance of [18F]FDG deep learning-based time-of-flight (DLToF) models for image quality enhancement in non-ToF [18F]FDG whole-body dynamic (WBD) and Patlak parametric imaging. ***Materials and Methods:*** Three residual U-NET DL-ToF models with varying contrast and noise properties: low (L), medium (M) and high (H), and trained on [18F]FDG data to transform non-ToF block sequential regularized expectation maximization (BSREM) based images, towards their TOF counterpart, were used on 12 [18F]FDG WBD datasets acquired on a 30cm 6-ring ToF PET/CT system [1]. Dynamic datasets consisted of a 10-min single bed dynamic acquisition over the heart followed by a number of WBD passes (6±2 bed positions, 53±3sec/bed position) up to 62±5min post injection. The dynamic datasets were subsequently processed using Patlak graphical analysis and with an image-derived input function from the descending aorta. Quantitative regions of interest analysis was performed on lesions, lung, liver and aorta, using the dynamic series reconstructed with non-ToF BSREM, ToF BSREM as well as the inferenced images using the three DL-ToF models. Similar analysis was repeated on the derivative Ki and DV parametric images of the five dynamic image series, as well as on the weight average static image. ***Results:*** Lesion SUVmax (%) difference in non-ToF BSREM, and DLToF-L, -M and -H images with respect to reference ToF BSREM ones was as followed: for WBD images across passes -31±3, -38±3, -27±4, -15±4 for mean (and standard deviation), for Ki -30, -33, -26, -12, for distribution volume (DV) -23, -30, -23, -14 and for weight average static -30, -35, -27 and -18. Input function area under the curve (AUC) % error was -5.6, -7.8, -4.4 and -4.1, with the DLToF-H moving the AUC closer toward ToF amongst image series. Finally, for the liver SUVmean (%) difference for the WBD images across passes was -1.1, -1.7, -0.8, -1.9 for the mean (and standard deviation), for Ki -26, -21, -11, -2, for DV 10, 11, 6, 5 and weight average static -1, -2, -1 and -2. Lung SUVmean and liver SUVstd also showed ToF-like performance for the DLToF models, with predictable contrast and noise trade-offs across the three model strengths. ***Conclusion:*** DL-ToF models can be utilized in non-ToF [18F]FDG WBD acquisitions for the estimation of voxel-wise quantitative Patlak parametric maps, with the DLToF-H providing the most accurate estimate towards ToF kinetic parameter estimation. ***References:*** [1] Mehranian A et al. Eur J Nucl Med Mol Imaging. 2022 Sep;49(11):3740-3749.

OP-801

Parametric mapping of dynamic Ga-68 FAPI-46 PET data of 43 patients with pancreatic diseases: feasibility and diagnostic value

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Aim/Introduction: Differential diagnoses of primary pancreatic lesions include pancreatic ductal adenocarcinomas (PDAC) and inflammatory lesions of the pancreas (ILP). Post pancreatectomy, differentiation of postoperative reactive tissue (PRT) and recurrent PDAC is a major challenge for oncological imaging. Static Ga-68 FAPI-PET-uptake is increased in all of these lesions with marked overlap in signal intensity, which hampers their FAPI-PET-based assessment. Here, we evaluated parametric mapping based on dynamic Ga-68 FAPI-46 PET with respect to assessment of pancreatic lesions in primary and post-operative scenarios. ***Materials and Methods:*** 43 Patients (26 primary, 17 recurrent) underwent static and dynamic 68 Ga-FAPI-PET/CT. Primary cases underwent surgical resection/biopsy after FAPI-PET imaging. Possible recurrences were classified according to CT- and clinical course (at least 18 months). Parametric maps (1 tissue compartment (1TC) and Logan plot (LP)) were generated with an image-based aortic input function using PMOD software. Pancreatic lesions were delineated on parametric and static maps and maximum signal intensities of different lesions were analyzed. ***Results:*** Histology revealed PDAC in 15 and ILP in 11 primary patients. In post-op setting, 9 cases were classified as recurrences and 8 cases as PRT. Differences in maximum signal intensity between PDAC and ILP were more pronounced in 1 TC (mean 12,37 vs. 7,99, p-value 0,019) and LP (mean 13,84 vs. 10,12, p-value 0,028 compared to static (mean 28,79 vs. 22,21, p-value 0,29) maps. With regard to the differentiation of recurrences versus postoperative tissue, static (mean 13,60 vs. 4,431, p-value 0,04) and LP (mean 4,23 versus 1,622, p-value 0,055) maps showed similarly marked, but 1TC only slight differences of their maximum signal intensities. ***Conclusion:*** Parametric mapping of dynamic Ga-68 FAPI-46 PET data has promising diagnostic potential for the assessment of pancreatic lesions.

OP-802

Validation of a Reversible Kinetic Model for 30-min Dynamic Whole-Body PET Imaging of the Total Distribution Volume

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Aim/Introduction: Dynamic whole-body (D-WB) PET/CT allows for multiparametric imaging with the irreversible Patlak model [1], but many organs require a reversible model for physiologically meaningful parametric imaging. The widely used reversible Logan Model (LM) requires complete dynamic tissue data and the full arterial input function to estimate the total distribution volume (Vt), which restricts Vt imaging to the scanner's axial field-of-view (FOV) and necessitates a long 70-min dynamic PET scan. This study validates a novel reversible Delayed Logan Model (DLM), only requiring late steady-state data and a scaled population-based input function (sPBIF). ***Materials and Methods:*** The DLM was validated using 20 patients examined with 18F-FDG using a 70-minute multiparametric PET acquisition protocol on a PET/CT scanner (26.3cm FOV, 214ps TOF). A deep learning model was used for automatic segmentation of selected organs in the chest region: spleen, kidneys, liver, pancreas, and lungs. Aorta image-derived input function (IDIF) was used to calculate a sPBIF [1]. Region-based kinetic analysis and voxel-based Vt imaging were conducted with LM (data: 0-70 min) and DLM (data: 40-70 min). The region-based LM kinetic analysis served as the gold standard.

Results: We found excellent agreement between Vt estimations in parametric images generated by DLM with IDIF and the gold standard with biases between [-3.8%; 2.1%]. Furthermore, there were no significant differences in any organs when using DLM with IDIF and DLM with sPBIF with biases between [0.9%; 2.3%]. In contrast, the traditional LM with IDIF generated Vt images that had significant biases between [-6.5%; -17.3%]. The Vt images generated by LM and DLM showed similar characteristics, but DLM images had fewer noise artifacts. ***Conclusion:*** The new DLM model allows multiparametric Vt imaging based on a clinically feasible 30-minute D-WB PET examination on a conventional PET/CT scanner. ***References:*** 1. Dias AH, EJNMMI Phys 2022 9(1):60

1706

Wednesday, October 23, 2024, 08:00 - 09:30
Hall Z

Clinical Oncology Track - TROP Session: Oncology & Theranostics Committee: Radioguided Surgery and Therapy Planning

OP-803

Intraoperative beta-probe for pathological tissue detection in GEP-NET patients: a prospective Phase II Trial.

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Aim/Introduction: Accurate localization of GEP-NETs lesions is crucial for successful radical surgery. Radioguided surgery (RGS) is recognized as an innovative and promising technique that could facilitate the identification of even the smallest lesions, improving the management of GEP-NET patients. The primary objective was to evaluate the diagnostic accuracy of the intra-operative positron detector (β-Probe) using pathology as the gold standard. ***Materials and Methods:*** This is a prospective, single-arm, single-center, non-interventional, registered phase II trial (NCT05448157). Inclusion criteria were:1)histological diagnosis of ileum GEP-NET; 2)positive 68Ga-DOTATOC PET/CT (SSR-PET) performed within the previous 4weeks; 3)>18yo. Exclusion criteria were:1)not eligible for a radical surgery; 2)SSR-PET not performed. Activity of 1.1 MBq/Kg of 68Ga-DOTATOC was intravenously administered in the surgery room. The in-vivo measurements with a β-Probe were performed by the surgeon using hand-held (for open-surgery procedures) or DROP-IN (for laparotomic procedures) devices. The tumor-to-background-ratio (TBR) was evaluated using real-time counts per second (CPS). Data derived from the SSR-PET, β-Probe and histopathological analysis were compared in an over-all analysis. ROC curve analysis was used to calculate the CPS cut-off with the highest accuracy. The absorbed dose of the surgeon has been measured using an electronic personal dosimeter (EPD). ***Results:*** We enrolled 26 patients from May 2022 to April 2024. A total of 209 specimens have been evaluated and surgically removed with a specificity, sensibility, PPV and NPN of 87%, 90%, 93%, 83% respectively, in comparison with the pathology results. When a single measurement taken on the omentum is used as a reference for the background specificity, sensibility, PPV and NPN were 82%, 81%, 89%, 69% respectively. The CPS cut-off with the higher performance was 1.3. No side effects have been observed during all procedures. The mean absorbed dose from the surgeon was 30 μSv (range 12-41 μSv). ***Conclusion:*** The intraoperative beta-probe showed higher accuracy in detecting pathological tissue compared to previously used gamma-probes. An additional advantage lies in using a measurement on the corresponding healthy tissue for background assessment, which significantly increases the accuracy compared to using a single measurement on the omentum. RGS with β-Probe can be considered as a useful approach in the management of GEP-NET patients. ***References:*** El Lakis M, Gianakou A, Nockel P, Wiseman D, Tirosh A, Quezado MA, Patel D, Nilubol N, Pacak K, Sadowski SM, Kebebew E. Radioguided Surgery With Gallium 68 Dotatate for Patients With Neuroendocrine Tumors. JAMA Surg. 2019 Jan 1;154(1):40-45. doi: 10.1001/jamasurg.2018.3475. PMID: 30267071; PMCID: PMC6439858

OP-804

RADar reflector localIsatiOn-Scout for breast carcinOma, a prospective monocentric trial: RADIOSO trial

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Aim/Introduction: Radio-guided occult lesion localization (ROLL) is the standard of care in non-palpable breast lesion localization in our Institute. Its main limitations are the necessity to have a nuclear medicine division, the radioexposure, the difficulty to localize two lesions in the same breast and its execution next to surgery. We designed a monocentric prospective observational study that aims to evaluate the impact of a new procedure of breast localization. SCOUT® Radar (Merit Medical) occult breast lesion Localization (SRL) exploits non-radioactive micropulse radar to provide real-time surgical localization. Primary endpoint is the rate of successful localization procedures. Secondary endpoints include the percentage of negative margins, the percentage of a second excision and the comparison of SCOUT® and ROLL. ***Materials and Methods:*** Inclusion criteria were: female gender, age 18-90 years old, pathological confirmed non-palpable breast lesions and referred for breast-conserving surgery. Exclusion criteria were suspected nickel allergy and any condition that may expose the individual to a higher risk or prevent the study from achieving full compliance or completion. ***Results:*** From June 2022 to March 2024, we evaluated 303 breast cancer patients. After a multidisciplinary tumor board consensus meeting 246 pts were considered eligible for SCOUT®. SRL was performed in 296 breast lesions: the majority (92%) in a monolateral breast lesion, under ultrasound guidance (97%). No adverse events have been reported by radiologists during positioning procedures. Among the patients included 190 have currently undergone radar-guided surgery. We observed a 99,6% success rate in localizing and harvesting the reflector during surgery. Confirmation was given by the presence of the reflector on the x-ray of the specimen or by the evaluation of the pathologist. There were no cases of re-intervention needed due to positive margins. Data analysis showed that the distance between the lesion and the margin is less than 1 mm in 2.5%. The use of radar technology has found

wide acceptance among clinicians: 98% of radiologist and 89% of surgeons declared themselves satisfied with the use of Scout® device. Among the patients, 89.7% declared themselves satisfied with the positioning procedure. ***Conclusion:*** SCOUT® Radar Localization System is a safe and reliable method in non-palpable breast lesions localization with a lower re-excision rate than wire-guided localization. Further benefits include high patient and clinician satisfaction, no radiation exposure, long-term positioning of the reflector in the breast and the possibility of placement of more than one reflector in patients with multifocal breast lesions.

OP-805

Freehand [^{99m}Tc]Tc-PSMA SPECT for back-table margin assessment during prostate cancer surgery

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Aim/Introduction: In prostate cancer care, prostate-specific membrane antigen (PSMA)-PET is increasingly being used to match patients to a personalized treatment plan. To enhance interventional precision in patients with local disease, ([99mTc]Tc-)PSMA-targeted surgery is currently explored [1]. While these studies tend to focus on intraoperative identification of nodal metastases, there is also need for margin assessment of the primary cancer site [2]. The aim of this study was to demonstrate how gantry-less freehand imaging can be used to generate high-end [99mTc]Tc-PSMA specimen scans. ***Materials and Methods:*** We included prostate cancer patients who, based on PSMA PET/CT and MRI, were selected for de novo robot-assisted [99mTc]Tc-PSMA targeted surgery (currently N=6 de novo surgeries performed). Following the excision of primary tumour and lymph nodes, three surgical samples were placed on a custom-built specimen tray, which presented a slot for excised tissues and integrated optical reference trackers. With this design, it allowed single-object scanning and focused field-of-view. To provide anatomical reference to SPECT scan, a handheld 3D surface scanner (16 frames per second, 0.5 mm resolution) was used. It employs patterns of structured white light that hit the specimens from different angles and positions. The scanner's camera captures light reflections distorted by the sample's surface, to obtain depth and distance data during surface acquisition. In this way, we were able to optically capture shape, texture and volume information of the excised specimens, creating accurate high-resolution three-dimensional models. Subsequently, freehand [99mTc]Tc-PSMA-SPECT scans were obtained using handheld gamma camera and freehandSPECT system [3]. ***Results:*** Back-table PSMA-imaging could be realized by integrating two existing 3D imaging technologies. The sequential morphologic and molecular imaging took approximately 3-4 minutes each. Registrations of surface and SPECT scans could be used to augment a video-view of specimens. The end result was a high-resolution model where ex vivo findings mirror in vivo measurements. Focal areas of intense [99mTc]Tc-PSMA uptake could be displayed, margins could be delineated and correlated with pre-operative imaging and histopathology. ***Conclusion:*** Hybrid [99mTc]Tc-PSMA specimen imaging is feasible by integration of readily available technologies. This strategy could help surgeons that already rely on [99mTc]Tc-PSMA for radioguided surgery, improving intraoperative surgical margin identification for frozen section confirmation. Thus, providing a single-tracer low radiation-dose strategy that fully aligns with surgical needs. ***References:*** 1] Berrens AC et al., Eur Urol Open Sci. 2023 2] Gandaglia G et al., Eur Urol. 2022 3] Engelen T et al., Am J Nucl Med Mol Imaging. 2015.

OP-806

Our experience in Minimally Invasive Radioguided Parathyroidectomy

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Aim/Introduction: Aim: To evaluate the results after four years of Minimally Invasive Radioguided Parathyroidectomy protocol in our Centre Minimally Invasive Radioguided Parathyroidectomy (MIRP) is an effective technique since it requires a minimal incision with few complications and short surgical times. It also allows immediate verification of the resection of the parathyroid lesion and is especially of interest in patients with ectopic adenomas or a history of cervical surgery. However, there is large variability in the protocol followed in each hospital. We describe the experience obtained during the application of our own protocol. ***Materials and Methods:*** A prospective study was carried out consecutively including 158 patients with primary hyperparathyroidism who met surgical criteria and underwent MIRP at the same tertiary center between January 2020 and February 2024. All patients underwent preoperative morphofunctional confirmation with US and MIBI SPECT-CT±PET-CT. The procedure consisted of the intravenous administration of 185 MBq. 99mTc-MIBI, approximately one hour before surgery (in all cases, preoperative imaging was acquired at the Nuclear Medicine Department in this interval). Intraoperative localization was performed with a portable gamma camera and a gamma probe, and counts were registered during the procedure. Surgical success was evaluated by intraoperative biopsy. ***Results:*** The mean age was 61 ± 11.36 years with 122 (77.2%) women. Time from MIBI administration to surgery was 88 ± 25min. Successful surgical localization of the parathyroid lesion occurred in 154 patients (98.7%). Imaging acquired the day of the intervention allowed localization of a second lesion in 3 patients, which had not been identified in previous studies.The mean surgical time was 35± 19.56 minutes. The mean weight of the removed lesion was 1276 mg (IQR 1075). The observed count rate in skin was 246.83±74.10 counts per second, adenoma in vivo 308.41±107.86 cps, thyroid bed 197.92±58.14 cps, background 149.46±37.92 cps, and ex vivo adenoma 176.14±115.46 cps. Mean in vivo adenoma/thyroid ratio: 1.61 Mean in vivo adenoma / background ratio: 2.11 ***Conclusion:*** The protocol used allowed us to locate the parathyroid lesion in a high percentage of patients (due to a significant difference in the count rate lesion compared to thyroid and background). Furthermore, in three patients, a second parathyroid lesion (previously unknown) was identified on the day of the intervention, changing the surgical approach protocol. ***References:*** § Isabel Blanco Saiz, Pilar Salvador Egea, Enma Anda Apiñaniz, Nikola Rudic Chipe, Elena Goñi Girones. Radio-guided procedure in minimally invasive surgery for primary

hyperparathyroidism. https://doi.org/10.1016/j.ciresp.2022.07.008 0009-739X/# 2022 AEC.

OP-807

PET and optical dual-modality image-guided surgery in prostate cancer using ^{68}Ga- PSMA-IRDye800CW

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Aim/Introduction: Although there are many treatment options for prostate cancer, radical prostatectomy is still the most effective treatment method and the first choice for early patients. However, maximum safe resection of prostate cancer lesions remains a major challenge. In order to preserve normal tissue and function as much as possible during surgery, more sensitive and accurate surgical boundary detection technology is needed. In this study, we developed a PET/near-infrared fluorescence (NIRF) dual-mode molecular probe, 68Ga-PSMA-IRDye800CW, for accurate diagnosis and precise resection. ***Materials and Methods:*** PSMA-IRDye800CW was synthesized and labeled with 68Ga. The microPET imaging study was performed in 22Rv1 tumor model with 68Ga-PSMA-IRDye800CW at 0.5, 1 and 2 h post injection (p.i.). Fluorescence imaging study was conducted with the same model using PSMA-IRDye800CW at 1, 3, 8, 24 and 30 h p.i.. ***Results:*** PSMA-IRDye800CW was successfully synthesized with a molecular weight of 2270.6. The radiochemical purity of 68Ga-PSMA-IRDye800CW was greater than 97% after purification. In the PET imaging, the organs with the highest accumulation were kidneys and bladder. Tumors can be clearly visualized with the uptake of 5.62 ± 0.56, 7.02 ± 0.59 and 8.27 ± 0.42 ID%/g at 0.5, 1 and 2 h, respectively. The fluorescence imaging study demonstrated that the highest tumor uptake was achieved at 1h p.i., with the value of 4.97 ± 0.75. After that, the uptake of PSMA-IRDye 800CW in tumors gradually decreased, with the value of 4.63 ± 0.55, 3.27 ± 0.32, 3.03 ± 0.25, and 2.60 ± 0.36 at 3, 8, 24, and 30 h, respectively. ***Conclusion:*** In this study, we reported a PET/NIRF dual-mode molecular probe of 68Ga-PSMA-IRDye800CW, which has high tumor uptake in both PET and fluorescence imaging, and is expected to be used for accurate diagnosis and precise resection of prostate cancer.

OP-808

Radio-Guided Localization of Small Pulmonary Nodules: Our Experience

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Aim/Introduction: Recent advances in diagnostic imaging have improved the detection of pulmonary nodules, some of which are small or deeply located in the lung, presenting challenges for intraoperative detection. Consequently, minimally invasive surgery (MIS) may not be possible. We evaluated the effectiveness of radio-guided occult lesion localization (ROLL) with [99mTc]-MAA for the detection of pulmonary nodules in our institution. ***Materials and Methods:*** In this retrospective study, 35 patients requiring surgical resection of pulmonary nodules were included. ROLL with [99mTc]-MAA (37 MBq-0.1mL/0.2mL) was performed the day before MIS, with verification of radiopharmaceutical localization using SPECT-CT. Lesion size, resection margins, histology, postoperative complications and recurrences were analyzed. ***Results:*** Between July 2020 and April 2024, 35 patients (27 males, 8 females; mean age: 67.03 years) with millimetric and/or non-palpable potentially resectable pulmonary lesions underwent [99mTc]-MAA injection. Six patients had a history of Chronic Obstructive Pulmonary Disease (17.14%), thirty had an oncological history (85.71%) and nine had previous lung surgery (25.71%). Localization of the lesions was as follows: thirteen in the right upper lobe (34.21%), nine in the left upper lobe (23.68%), nine in the left lower lobe (23.68%), five in the right lower lobe (13.16%) and two in the middle lobe (5.26%), with a mean size of 9.54 mm on CT. All injected lesions were successfully localized intraoperatively. Multiple nodules were observed in four cases, two lesions detected in three patients and three lesions in one patient, the resection of these nodules was performed simultaneously without complications. SPECT-CT identified one case of pleural diffusion, which did not interfere with intraoperative localization. ROLL was repeated in two patients, one due to radiopharmaceutical retention in the injection needle and the other due to induced pneumothorax during marking. Twelve postsurgical complications (34.29%), not associated with the ROLL technique, were identified and categorized into mild and more severe adverse events. Mild complications included surgical wound infection (4 patients, 11.43%) and pleural effusion (3 patients, 8.57%), whereas more serious complications comprised haemorrhage (2 patients, 5.71%), respiratory failure (2 patients, 5.71%) and pneumothorax (1 patient, 2.86%). Pathological findings revealed seventeen patients with primary pulmonary lesions (48.57%), thirteen patients with metastases (37.14%), and five benign lesions (14.29%), all with clear margins. Eleven recurrences were recorded. ***Conclusion:*** Preoperative marking using the ROLL technique has been proven effective and safe for precise intraoperative localization of small pulmonary nodules.

OP-809

Exploring Intra-Abdominal Nuclear Tomography: Robot-Assisted SPECT in Robotic Sentinel Lymph Node Surgery

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Aim/Introduction: The introduction of the 'drop-in' gamma probe has transformed the way image-guided robotic surgery

can be performed. This probe is now instrumental for radioguided sentinel node (SN) procedures (i.e., in prostate, cervical, endometrial and bladder cancer). Where typical 'drop-in' gamma probe guidance is based on acoustical and numerical feedback, we set out to further refine surgical perception and decision-making by providing intraoperative 3D imaging. Using a video-tracked 'drop-in' probe we've developed, and clinically evaluated, a gantry-free robot-assisted tomographic imaging approach called robotic-SPECT. ***Materials and Methods:*** We included 10 prostate cancer patients undergoing robotic SN surgery with the hybrid tracer, Indocyanine green (ICG)-99mTc-nanoscan. Following initial SN identification via SPECT/CT their resection was enabled by a combination of 'drop-in' radioguidance and Firefly fluorescence detection. Uniquely the 3 notches in the CE-marked 'drop-in' gamma probe were fitted with 3 sterilizable tracking markers. Custom computer-vision tracking software was used to track the probe's position within the laparoscopic video feed, while recording the probe readings (counts/s). These data streams were processed with a MLEM reconstruction algorithm using a look-up table (LUT) method. The LUT was generated using nuclear Monte Carlo simulations of the detector. The MLEM reconstructions yielded a tomographic SPECT image of the tracer distribution within the volume-of-interest. An image that was overlayed on the laparoscopic view using a custom video-augmentation program. ***Results:*** In the preoperative SPECT/CT scans, a total of 28 SNs were identified, (median 3 per patient, IQR: 2-3). 'Drop-in' empowered robotic-SPECT proved to be feasible and helped to provide a unique 3D-insight into the SN locations. Augmented reality overlays facilitated efficient visualization of target locations within the surgical video feed. The 'drop-in' probe pursued 25 SNs and successfully traced all these nodes with a median count-rate of 290 counts/s. For superficial nodes (19) there was direct concordance between 'drop-in' radioguidance and Firefly fluorescence guidance. However, for the 6 SNs located deeper beneath the tissue-surface only radioguidance helped provide accurate target localization. Pathological evaluation indicated tumor metastases in 3 of the retrieved SNs. ***Conclusion:*** The novel robot-assisted SPECT method was successfully integrated into a real-life robotic surgery setting. The robotic-SPECT visualizations help enhance the target perception within the abdominal cavity. Combining intraoperative SPECT with hybrid tracers compliments superficial Firefly fluorescence imaging techniques.

OP-810

Employing Multispectral Fluorescence Imaging to Distinguish Lymphatic Drainage Patterns During (Sentinel) Lymph Node Dissection in Prostate Cancer

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Aim/Introduction: Only 10% of removed lymph nodes (LNs) during an extended pelvic lymph node dissection (ePLND) contain prostate cancer metastases, while the resulting lymph edematous complications are around 20-50%. To see if we could omit removal of LNs not related to the cancer (LN-sparing ePLND, if you may) we employed multicolor and multispectral fluorescence imaging to differentiate lymphatic drainage patterns from the primary cancer and healthy tissue. ***Materials and Methods:*** This prospective study (NCT05120973) included 16 patients who underwent robot assisted radical prostatectomy (RARP) + ePLND + a sentinel node (SN) procedure. For the latter, patients received intraprostatic administration of indocyanine green (ICG)-99mTechnetium-nanocolloid and underwent preoperative Single Photon Emission Computed Tomography (SPECT)/CT imaging. Prior to RARP, a second fluorescent dye (Fluorescein) was injected unilaterally in two deposits into the intradermis of the upper leg (n=8) or abdominal wall (n=8). In and ex vivo multispectral fluorescence imaging was performed using an integrated camera in the robotic system and a separate fluorescence laparoscope. Fluorescence data was correlated to histopathological findings. ***Results:*** A median of 6 SNs (interquartile range [IQR] 3-8) were identified per patient on both SPECT/CT and intraoperative ICG imaging. Fluorescein was visible in the ePLND-template (coming from the upper leg; cloquet 5/8 (62.5%), obturator fossa 4/8 (50%), external iliac 4/8 (50%), internal iliac 0/8 (0%) and coming from the abdominal wall; cloquet 7/8 (87.5%), obturator fossa 8/8 (100%), external iliac 6/8 (50%), internal iliac 3/8 (37.5%). Although SNs containing ICG were visible in the lymphatic regions containing Fluorescein, both colors only visibly co-accumulated in two lymph vessels. At pathology, Fluorescein was seen in 10/370 LNs, none of which overlapped with ICG and none were tumor positive. Additional administration of Fluorescein did not result in discomfort at the injection site or abnormal postoperative recovery. ***Conclusion:*** Multispectral fluorescence imaging was feasible during RARP+ePLND+SN. Although we did not encounter 'two-color-staining' in LNs and LNs containing Fluorescein were not tumor-positive, our initial in-human findings indicate that lymphatic drainage patterns of the prostate overlap with those of the lower limbs and abdominal wall. Further studies could determine feasibility of LN-sparing ePLND.

OP-811

Imaging Peritoneal Cancer Index versus surgical Peritoneal Cancer Index in patients with peritoneal metastases

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Aim/Introduction: To determine the accuracy of imaging Peritoneal carcinoma index (PCI) in comparison with surgical PCI to assess the feasibility of cytoreductive surgery (CRS) and hyperthermic intraperitoneal chemotherapy (HIPEC) in patients with metastatic peritoneal disease ***Materials and Methods:*** 30 patients with metastatic peritoneal disease who underwent F18 FDG PET-CT and laparoscopy within four weeks of F^{18} FDG PET-CT were assessed. Imaging PCI (iPCI) was assessed by two Nuclear Medicine Physicians and surgical PCI (sPCI) was assessed by two Surgical Oncologists via laparoscopy. When available comparison was done with pathological PCI(pPCI) ***Results:*** We included 14 (47 %), 5 (17%), 4(13%), 3 (10%) and 4 (13%) patients with carcinoma ovary, carcinoma colon, carcinoma rectum, carcinoma stomach and miscellaneous tumors respectively. Median imaging PCI score was 10 (IQR:5-26) while that of surgical PCI was 12 (IQR: 5-24). Wilcoxon sign rank test showed that there was no significant difference in the median scores of imaging and surgical PCI (p=0.55). 26 (86 %) patients had a diagnostic PCI score in the range of +/- 4 when compared to imaging PCI. The reasons for difference in each case were noted and discussed. Imaging PCI and diagnostic PCI were not in-line in 04 (14%) patients because of large ascites in 2 patients, miliary bowel surface deposit in 1 patient and sPCI was not correlated with pPCI in 1 patient. In 2 (7%) of these patients imaging PCI correlated with pathological PCI rather than sPCI. In 2 other patients PCI was more than 20 and CRS was not feasible. There was no significant difference in the impact on management guided by iPCI in comparison with sPCI

Conclusion: sPCI is considered more accurate than iPCI which aids in decision-making to continue with CRS-HIPEC. Our study shows that iPCI is accurate in accessing PCI and will guide to avoid diagnostic laproscopy, especially in patients with higher PCI

1707

Wednesday, October 23, 2024, 08:00 – 09:30
Hall Y10-Y12

Special Symposium 4 - EANM and EJNMMI - The many Challenges in Scientific Writing

OP-812
Bottlenecks in translating ideas into the clinics
M. Schottelius;
Centre Hospitalier Universitaire Vaudois (CHUV), University of Lausanne (UNIL) and Ludwig Institute, Lausanne, SWITZERLAND.

OP-813
The Australian model to design and finalize successful clinical trials
A. Scott;
Molecular Imaging and Therapy, Melbourne, AUSTRALIA.

OP-814
Large Language Models: what is beyond the interface
L. Papp;
Medizinische Universitat Wien, Nuclear Medicine, Vienna, AUSTRIA.

1708

Wednesday, October 23, 2024, 08:00 - 09:30
Hall G2

Joint Symposium 8- Inflammation and Infection Committee / ESCMID - Are we Ready to Fight Global Infectious Diseases?

OP-821
Tuberculosis in the 21st Century: Challenges and Opportunities
J. Nemeth;
University Hospital Zurich, Department of Infectiology and General Internal Medicine, Zurich, SWITZERLAND.

OP-822
State-of-the-art imaging in tuberculosis and HIV
L. Maserumule;
University of Pretoria and NuMeRi, Department of Nuclear Medicine, Pretoria, SOUT AFRICA.

OP-823
Novel tracers and imaging approaches for tuberculosis and HIV
S. Jain;
Johns Hopkins University School of Medicine, Department of Paediatrics, Baltimore, UNITED STATES OF AMERICA.

1709

Wednesday, October 23, 2024, 08:00 - 09:30
Hall F

e-Poster Presentations Session 13: Translational Molecular Imaging & Therapy Committee: Molecular Imaging & Therapy

EPS-253
Drug library screens for identifying pharmaceuticals to enhance cancer response to radioligand therapy
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Aim/Introduction: The development of molecular strategies to enhance cancer radiosensitivity or tumor uptake of radiopharmaceuticals, while sparing healthy organs, has immense potential to improve the efficacy and safety of radioligand therapy (RLT). Drug library screens represent a promising avenue for identifying pharmaceuticals that can enhance response to cancer therapy. To reveal new therapeutic opportunities for RLT, this study developed drug library screens and validated obtained results employing two models with radiolabeled minigastrin analog (PP-F11N) targeting cholecystokinin B receptor (CCKBR), and PentixaTher (PTH) targeting C-X-C-motif chemokine receptor 4 (CXCR4) positive cancer cells, respectively. ***Materials and Methods:*** Drug library screens, followed by proliferation, internalization, and viability assays, were conducted to identify compounds that increase uptake or cytotoxicity of [177Lu]Lu-PP-F11N and [177Lu]Lu-PTH in human epidermoid carcinoma A431 cells (which overexpress CCKBR) and CXCR4-positive T cell leukemia Jurkat cells, respectively. An A431/CCKBR xenograft mouse model was utilized for biodistribution, SPECT imaging, and in vivo validation of the therapeutic effect of [177Lu]Lu-PP-F11N in combination with identified inhibitors. Dissected tumors and organs were subjected to histological analysis. ***Results:*** A kinase inhibitor library screen comprising 80 inhibitors, followed by in vitro and in vivo validation studies, demonstrated the potential of the mammalian target of rapamycin complex 1 (mTORC1) inhibitor RAD001 (everolimus) to substantially improve tumor-specific uptake (fold 1.79) and therapeutic efficacy of [177Lu]Lu-PP-F11N in A431/CCKBR tumors without adverse effects [1, 2]. An FDA-approved drug library screen with 211 compounds in Jurkat cells identified 21 small-molecule inhibitors that significantly improved the cytotoxicity of [177Lu]Lu-PTH, with 5 compounds showing synergistic interaction. The correlation coefficients for the biological replicates ranged from 0.70 to 0.99, indicating high reproducibility of the established screens. Validation of 10 screen-identified inhibitors confirmed radiosensitizing potential of 6 compounds, including bosutinib, crizotinib, etoposide, everolimus, talazoparib, and YM-155. Development of the combinatory treatments in other cancer models is currently underway. ***Conclusion:*** Our research has

established and optimized drug library screen-based workflows suitable for identifying compounds for tumor radiosensitization and enhancing the uptake of radiolabeled ligands. This work supports and recommends further development of the screen-based discovery of novel combinatory treatments for efficacious and clinically feasible RLT in cancer. ***References:*** 1. Grzmil M, et al. Pharmacological inhibition of mTORC1 increases CCKBR-specific tumor uptake of radiolabeled minigastrin analogue [177Lu]Lu-PP-F11N. Theranostics. 2020. 10:10861-10873. 2. Grzmil M, et al. Therapeutic Response of CCKBR-Positive Tumors to Combinatory Treatment with Everolimus and the Radiolabeled Minigastrin Analogue [177Lu]Lu-PP-F11N. Pharmaceutics. 2021. 13:2156.

EPS-254

Efficient α and ß- Radionuclide Therapy Targeting Fibroblast Activation Protein-α in a Fast-Growing Preclinical Tumour Model

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Aim/Introduction: Targeted radionuclide therapy (TRT) is an emerging cancer treatment, exhibiting promising therapeutic efficacy across various cancer types. Single domain antibodies (sdAbs), characterized by their compact size, are attractive targeting moieties for TRT due to enhanced tumour penetration and rapid clearance from circulation, thereby minimizing systemic radioactivity exposure. We studied the therapeutic potential of TRT using fibroblast activation protein-α targeting sdAbs (4AH29) labelled with 225Ac or 131I to treat cancer in immunocompetent mice and explored its combination with programmed cell death ligand 1 (PD-L1) immune checkpoint blockade (ICB). ***Materials and Methods:*** Long-term biodistributions of [131I]I-GMIB-4AH29 and [225Ac]Ac-DOTA-4AH29 were determined up to 192 hours post-injection (p.i.) by ex vivo gamma counting. TC-1-FAP lung tumour-bearing C57BL/6 mice received 6 intravenous injections with 18.5 or 37 MBq of [131I]I-GMIB-4AH29, 5 or 20 kBq of [225Ac]Ac-DOTA-4AH29 or vehicle solution over a three-week period. Tumours of [225Ac]Ac-DOTA-4AH29 treated mice were isolated 22 days post-inoculation for flow cytometric analysis. [225Ac]Ac-DOTA-4AH29 treatment was repeated in combination with intraperitoneal injection of anti-PD-L1 or isotype control antibodies on days 8, 15 and 22. Animal welfare was monitored by measuring weights and tumour volumes. ***Results:*** Long-term biodistribution showed high tumour uptake of [131I]I-GMIB-4AH29 with 3.48 ± 0.45% IA/g 1h p.i. decreasing to 0.94 ± 0.13% IA/g after 24h. Tumour uptake of [225Ac]Ac-DOTA-4AH29 was high with 2.10 ± 0.49% IA/g 1h p.i. decreasing to 1.72 ± 0.18% IA/g after 24h. For both radionuclides, elevated kidney retention is seen early after tracer administration due to renal clearance, followed by fast clearance for [131I]I-GMIB-4AH29 while [225Ac]Ac-DOTA-4AH29 had a prolonged renal retention. Survival was significantly improved after treatment with low and high dose [131I]I-GMIB-4AH29 or [225Ac]Ac-DOTA-4AH29 compared to vehicle solution. When comparing treatment efficacy of [225Ac]Ac-DOTA-4AH29 versus [131I]I-GMIB-4AH29, tumour burden was significantly lower for [225Ac]Ac-DOTA-4AH29 treated mice on day 22 and mean survival was more beneficial with 39 days compared to 35.5 days. We observed significantly higher PD-L1 expression in tumours of mice treated with [225Ac]Ac-DOTA-4AH29 compared to vehicle solution on day 22. Therefore, we combined high dose [225Ac]Ac-DOTA-4AH29 with PD-L1 ICB showing delay in tumour growth compared to [225Ac]Ac-DOTA-4AH29 alone. ***Conclusion:*** [225Ac]Ac-DOTA-4AH29 and [131I]I-GMIB-4AH29 exhibit high and persistent tumour targeting, which translated into prolonged survival in mice bearing aggressive tumours. Moreover, we demonstrate the potential of combining [225Ac]Ac-DOTA-4AH29 with PD-L1 ICB, though further optimization of the treatment regimen is required to translate the delay in tumour growth to significantly improved survival.

EPS-255

Intra-patient comparison of normal organ uptake and biodistribution of the [^{68}Ga]FAPI-46 vs [^{18F}]FAPI-74 radiopharmaceutical

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Aim/Introduction: The development of fibroblast activation protein inhibitor (FAPI) radiopharmaceuticals has opened doors for possible groundbreaking research into FAP as a stromal target in different oncologic and nononcologic pathologies. A range of FAPI ligands coupled to different radionuclides has emerged, all showing high lesion-to-background ratios. However, few studies have compared different FAPI radiopharmaceuticals regarding their biodistribution. The aim of this study is to compare the normal organ uptake and imaging properties of the [68Ga]FAPI-46 and the [18F]FAPI-74 radiopharmaceutical in an intra-patient study design. ***Materials and Methods:*** 5 patients underwent both a [68Ga]FAPI-46 and a [18F]FAPI-74 PET/CT with a maximum interval of 12 days between both exams. The activity injected was 3 MBq/kg for [18F]FAPI-74 (with a maximum of 300 MBq) and 2 MBq/kg for [68Ga]FAPI-46. On the 1 hour post injection images of both exams, volumes of interest (VOIs) were drawn in uniform regions of healthy tissues, blood pool sites and reactive uptake foci. VOI diameters ranged from 10 to 15 mm depending on the size of the target tissue. The FAPI uptake was visually analyzed and quantitative PET parameters (SUVmean, SUVmax) were compared using a paired samples t test. ***Results:*** Visual and statistical interpretation of the PET images revealed a significantly higher blood pool activity of [18F]FAPI-74 compared to [68Ga]FAPI-46 at both aortic and left ventricle regions. The p-value of the difference in uptake at the descending aortic VOI was 0,009 for SUVmean and 0,03 for SUVmax values. The spleen SUVmax ($p = 0,04$) and SUVmean ($p = 0,004$) was also significantly higher for [18F]FAPI-74 compared to [68Ga]FAPI-46. Other normal organs as well as reactive tissues showed similar uptake values. Furthermore, a non-negligible intestinal activity was detected at visual interpretation of the [18F]FAPI-74 PET/CT in some patients. Finally, tracer uptake in the nipple regions as well as in the gall bladder fundus was seen for both radiopharmaceuticals. ***Conclusion:*** [18F]FAPI-74 shows a significant higher blood pool activity and similar normal organ uptake values compared to [68Ga]FAPI-46 at 1 hour post injection, making it less appropriate for certain FAPI PET/CT indications such as cardiovascular diseases, as well as for early imaging acquisition protocols.

EPS-256

The impact of different cell models on the preclinical evaluation of FAP-targeting radiopharmaceuticals

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Aim/Introduction: Fibroblast activation protein (FAP) is an attractive cancer-specific biomarker for targeted radionuclide theranostics. Accordingly, FAP-targeting radiopharmaceuticals have shown clinical success for PET/CT imaging. Unfortunately, results with FAP-targeted radionuclide therapy (TRT) have been suboptimal to date. Preclinical research plays a key role in improving FAP-TRT efficacy and selecting the best FAP-targeting radiopharmaceutical for this purpose. For this, selecting an appropriate and clinically relevant tumor model is crucial. Although FAP is mainly expressed by cancer-associated fibroblasts and not by cancer cells, transduced human (hu) FAP-expressing cancer cells are often used as a model. To what extent these models are appropriate for studying FAP-targeting radionuclide theranostics remains unknown. Therefore, we aimed to compare tracer behavior in two commonly used FAP-transduced cancer cell lines (HT1080 (fibrosarcoma) and HEK293 (human embryonic kidney)), one endogenous FAP-expressing glioblastoma cell line (U87MG), and an endogenous FAP-expressing pancreatic stellate cell line (PS-1). ***Materials and Methods:*** Tracer uptake studies were performed by incubating cells with 1 nM 20MBq/nmol [111In]In-FAPI-46 or 10 nM RTX-1370S, a fluorescent FAP-targeting tracer (kindly provided by Ratio Therapeutics). Additionally, membrane-bound versus internalized [111In]In-FAPI-46 was separated using Glycine-NaCl and NaOH, respectively. Radioactivity was measured in a γ-counter and RTX-1370S was imaged by confocal microscopy. Moreover, [111In]In-FAPI-46 autoradiography was performed on HT1080huFAP, HEK293ThuFAP, and U87MG xenografts. Lastly, the expression of human (hu)FAP and murine (mu)FAP was analyzed by IHC and RT-qPCR. ***Results:*** HT1080huFAP had the highest [111In]In-FAPI-46 uptake in vitro (22.4%), followed by HEK293huFAP (17.3%). Unexpectedly, higher FAP expression did not result in higher uptake, as a more intense FAP staining and a 3.5-fold higher mRNA expression were observed for HEK293huFAP vs HT1080huFAP. U87MG and PS-1 demonstrated much lower [111In]In-FAPI-46 uptake (2.2% and 2.9%, respectively). Autoradiography studies indicated similar [111In]In-FAPI-46 binding to HT1080huFAP and HEK293huFAP (31.6% vs 32.6%, respectively), and contrary to in vitro uptake, a remarkable ex vivo binding to U87MG xenograft (15.4%). The presence of muFAP mRNA levels was measured in all xenografts, indicating radiotracer binding is partly facilitated by the infiltration of murine fibroblasts in this model. In addition, confocal microscopy demonstrated potent uptake of RTX-1370S, and while [111In]In-FAPI-46 was mainly internalized in all cell lines, membrane-bound RTX-1370S was visible in one cell line, illustrating that tracer localization can be impacted by the model. ***Conclusion:*** Our data shows that FAP (radio)tracer behavior is model specific and that, depending on the research question, appropriate model selection is crucial for evaluating and understanding FAP-targeting radiopharmaceuticals.

EPS-257

Oxidation-stress related PET imaging monitors therapeutic efficacy of combining PAPR inhibitor with immunotherapy in hepatocellular carcinoma treatment

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Aim/Introduction: Combining poly ADP-ribose polymerase inhibitor (PAPRi), which simultaneously inhibits DNA-based excision repair and cystine transporter SLC7A11, with immunotherapy holds the potential to improve the efficacy of hepatocellular carcinoma (HCC) management. However, monitoring tumor response to the above therapeutic modality remains challenging. Herein, 5-[18F] Fluoroaminosubic acid ([18F]-FASu), an oxidation-stress related positron emission tomography (PET) tracer that targets SLC7A11, was used to assist in the early assessment of tumor responses post combination therapy of PAPRi and anti-PDL1 in Hepa1-6 cell-bearing C57BL/6 mice model. ***Materials and Methods:*** Thirty-two Hepa1-6 cell-bearing C57BL/6 mice were randomly divided into four groups. They were then administered with either a vehicle control, Olaparib (a PARPi) alone, anti-PDL1 alone, or a combination of Olaparib and anti-PDL1 treatment. The effects of treatment in each group were evaluated based on changes in tumor volume and Ki67 staining. Tumor response was further assessed in vivo using [18F]-FASu for PET/CT imaging. PET/CT imaging was performed at Day 8 and Day 10 by tail vein injection of [18F]-FASu and [18F]-FDG. The static images at 60 min p.i. were acquired for 10 min. We also analyzed the correlation between the percentage area of CD8-positive cells and images ***Results:*** The combination of PAPRi and anti-PDL1 had a significant therapeutic effect on tumors, with a statistically markedly difference at day 15. Meanwhile, the expression of the corresponding Ki67 was reduced in the combined treatment group compared to the control group. For [18F]-FASu PET/CT imaging data, SUVmax and Tumor-to-background ratio (TBR) were appreciably lower in the combination treatment group. However, no difference between groups was observed on [18F]-FDG. Pathological analysis at the corresponding time points showed a significant reduction in SLC7A11 expression in the combination treatment group, along with elevated CD8 expression within the tumor. In addition, the percentage of cell area with pathologically positive CD8 expression was negatively correlated with the SUVmax value of [18F]-FASu. ***Conclusion:*** Combination therapy with PAPRi and anti-PDL1 is a promising treatment for HCC. [18F]-FASu PET/CT imaging is powerful in assessing tumor immunity and response to immunotherapy in Hepa1-6 cell-bearing C57BL/6 mice model. This study supports future clinical application of [18F]-FASu PET/CT to guide HCC patients for precise PAPRi plus immunotherapy.

EPS-258

A Mathematical Model for the Investigation of Combined Treatment of Radiopharmaceutical Therapy and PARPi

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Aim/Introduction: As radiopharmaceutical therapy (RPT

continues to evolve and the need for mathematical optimization techniques in cancer treatment planning grows, this study introduces a mathematical model that facilitates in silico investigations of combined treatments involving RPT and poly (ADP-ribose) polymerase inhibitors (PARPi). This model incorporates adaptations related to DNA damage response, such as homologous recombination deficiency (HRD) as a prognostic factor, and the radiosensitizing properties of PARPi. It aims to provide an accurate representation of phenotypical variations in radiobiological responses and enable patient-specific customization of therapeutic schedules. ***Materials and Methods:*** The proposed mathematical model uses probabilistic statuses as average to simulate cells in different stages of the cell cycle. It assesses the absorbed dose by DNA based on the decay of 177Lu in various cellular compartments, considering cellular geometry. The effect of PARPi is modeled by the accelerated conversion of single-strand breaks (SSBs) to double-strand breaks (DSBs) due to PARP-trapping in the S phase, while homologous recombination deficiency (HRD) is represented by defects in DSB repair in replicated DNA. The model predicts therapeutic outcomes based on the absorbed radioactive doses by DNA and the resulting radiobiological responses, with DNA DSBs being the critical determinant of cancer cell fate. The model parameters were calibrated using experimental data on cell culture. ***Results:*** Model calibration was performed according to treatment of NCI-H69 cells with 177Lu-DOTA-TOC and PARPi. Three days of PARPi monotherapy reduces cancer cell abundance by 32.3% (Olaparib) and 47.7% (Rucaparib). Rucaparib radiosensitization reduces tumor cells during lutetium therapy by 99.2% and 99.99% (HRD). Established model is used to compare simulated results with in vivo experiments where tumor xenografts are treated with lutetium therapy and radiosensitizers. Highest effect shows Talazoparib (21.9% per ng), followed by Rucaparib (70.2% per µg) and the DNA protein kinase inhibitor Nedisertib (48.3% per µg). Considering protocols of clinical trials, presented model predicts relative tumor shrinking after 14 days of Olaparib (250 mg) combination treatment according to the body weight of the patient (e.g. 60 kg: 99.6%; 90kg: 98.0%). ***Conclusion:*** This study presents a mathematical RPT model that is adjustable for conditions affecting cellular DNA damage response, whereby the effects of PARPi and HRD already are included. This model provides a tool for systematic exploration and optimization of clinical protocols. Further directions will involve enhancement of whole-tissue and whole-body considerations as well as PARPi concentration effects. This study marks a significant step towards the digital twin.

EPS-259

Side-by-side Assessment of $^{[18F]}$Olaparib and $^{[18F]}$Talazoparib for Next-generation PARP Imaging in an HR-Deficient Breast Cancer Xenograft Mouse Model

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Aim/Introduction: The clinical relevance of poly (ADP-ribose) polymerase (PARP) as an anti-cancer therapy target warrants the necessity for novel PARP imaging probes with enhanced performance. Isotopologically radiolabeled PARP inhibitors can serve as imaging probes and give insight into drug and target distribution. The first approved PARP inhibitor, olaparib, and the most potent, talazoparib, exhibit considerable differences in their mode of action.1 We preclinically compared 18F-labeled olaparib and talazoparib to assess how these differences influence compound biodistribution and PET imaging performance. ***Materials and Methods:*** $^{[18F]}$Olaparib and enantiomerically pure $^{[18F]}$talazoparib synthesized via previously published procedures.2,3 Binding to PARP1 was validated through uptake assays in HCC1937 cells. In vivo, NOD.CB17-Prkdcscid/J mice bearing HCC1937 xenografts (n=5) underwent PET imaging (1h dynamic immediately p.i. and 10 min static 2h p.i. of 12.6±0.6MBq $^{[18F]}$olaparib or 13.1±0.7MBq $^{[18F]}$talazoparib) and an anatomical MR scan. Both dynamic PET data and ex vivo by gamma-counting of selected organs were used for biodistribution analysis. Xenograft tissue was probed for PARP1 expression by immunofluorescence microscopy. ***Results:*** Both radiotracers exhibited excellent binding to HCC1937 cells in vitro, with over 99% blockability by non-radioactive talazoparib and olaparib. Notably, talazoparib significantly inhibited more radiotracer signal than olaparib in both cell-based and in vivo competition assays. In vivo, $^{[18F]}$olaparib showed less renal uptake compared to $^{[18F]}$talazoparib as indicated by a significant difference in absolute kidney uptake ($p < 0.0001$). Both exhibited rapid blood clearance (calculated blood half-lives: 2.2 min ($^{[18F]}$olaparib) and 3.3 min ($^{[18F]}$talazoparib). The majority of radiotracer signal localized in excretion-related abdominal tissues (liver, kidney, and intestine). Interestingly, significant differences in spleen ($p<0.0001$) and lung ($p=0.004$) uptake were observed, suggesting a potential secondary target of $^{[18F]}$talazoparib due to differential selectivity. The HCC1937 xenografts exhibited comparable $^{[18F]}$olaparib and $^{[18F]}$talazoparib signals over time, with mean tumor-to-muscle ratios of 2.3±0.7 and 1.82 ± 0.44, respectively, 3h p.i.. ***Conclusion:*** Both radiotracers displayed comparable tumor uptake; however, the variance in lung uptake may indicate additional binding of $^{[18F]}$talazoparib to other targets such as PARP5a and b. The distinct mode of action suggests that $^{[18F]}$talazoparib may offer new insights into studying PARP enzymes beyond PARP1.4 Our data support the feasibility of $^{[18F]}$olaparib and $^{[18F]}$talazoparib-PET in mice and advocate for further exploration of secondary targets for $^{[18F]}$talazoparib in genetically engineered tumor models and ultimately in patients. ***References:*** 1LaFargue et al., LancetOncol, 2019 2Bowden et al., OrgBiomolChem, 2021 3Bowden et al., JMedChem, 2021 4Carney et al., NatCommun, 2018

EPS-260

Early chemotherapeutic imaging response assessed by FDG-PET, T2-weighted and diffusion-weighted MRI in patient-derived endometrial cancer mouse models

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Aim/Introduction: Chemotherapy with combined carboplatin and paclitaxel is often used as first-line treatment in advanced or recurrent endometrial cancer. Evaluation of treatment response routinely includes diagnostic imaging weeks to months after treatment, and the assessments are mostly based on changes in tumor size or appearance of new metastases. The aim of this study was to evaluate early chemotherapeutic response in two subcutaneous organoid-based patient-derived

(O-PDX) endometrial cancer models using T2-weighted (T2w) magnetic resonance imaging (MRI), diffusion-weighted (DW) MRI and dynamic fluorodeoxyglucose (FDG) positron emission tomography (PET). ***Materials and Methods:*** Mice had bilateral subcutaneous injections of chemotherapy-responding (nr=8 mice) or mixed/poor response (nm=7 mice) organoids from two different grade 3 endometrioid endometrial cancers. Mice were monitored biweekly by palpation and when the mean tumor size was >80 mm3, mice were randomized into treatment (combined carboplatin and paclitaxel, nr=8 tumors /nm=6 tumors) or control (saline, nr=8 tumors/nm=8 tumors) groups. The mice underwent T2-weighted MRI, DW-MRI and FDG-PET at baseline/day 0 (before start of treatment), at day 3 and at day 10/endpoint using a sequential PET-MRI small-animal scanner. All tumors were manually segmented on T2w-MRI, and tumor volume (vMRI) and mean tumor apparent diffusion coefficient (ADCmean) were measured. Standard uptake values (SUV) from the 10 most FDG-avid tumor voxels (SUV10) and tumor metabolic rate (MRFDG) were calculated from static and dynamic FDG-PET, respectively. At endpoint, cell density was calculated by semi-automatically counting tumor cells on hematoxylin and eosin (HE)-stained tissue sections. ***Results:*** In the responding model, tumor MRFDG was significantly lower on day 3 in the treatment- compared to the control group (p=0.03). At endpoint, MRFDG, SUV10, vMRI and cell density were significantly lower, whereas tumor ADCmean was significantly higher in the treatment groups vs. control group (p≤0.04), all suggesting treatment response. In the mixed-response model, vMRI and SUV10 were significantly lower in the treatment group compared to control at endpoint (p≤0.04), and tumor ADCmean was significantly higher in the treatment group (p=0.03), suggesting treatment response. Cell density tended to be lower in treated vs. control tumors (p=0.09). None of the imaging parameters were significantly different between the two groups in this model at the early timepoint (day 3). ***Conclusion:*** Multimodal imaging by MRI and dynamic FDG-PET is feasible for evaluating treatment response in subcutaneous preclinical endometrial cancer models. MRFDG from dynamic PET may particularly represent a promising imaging marker for detecting early treatment response following chemotherapy.

EPS-261

In Vitro Interaction Studies of PSMA-617 with Human ABC and SLC Transporters

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Aim/Introduction: Globally, advanced metastatic castration-resistant prostate cancer (mCRPC) remains a lethal challenge for patients and healthcare systems with low 5-year survival rates, desperately calling for improved treatment regimens. Many novel treatment modalities have arisen and, recently, [177Lu]Lu-PSMA-617 has been successfully approved by the FDA, MHRA, Health Canada and EMA as Pluvicto®. However, shortcomings remain as undesired radioligand uptakes in healthy salivary glands (SG) and kidneys, with much lower PSMA expression levels, account for main dose-limiting side-effects such as xerostomia and renal dysfunction. Non-PSMA-specific uptake mechanisms are hypothesized to factor in [1], which remain unclear and call for urgent elucidation. Recently, different ATP-binding cassette (ABC; BCRP, MDR1, MRP1, MRP4) and solute cassette (SLC; MATE1, MATE2-K, OAT1, OAT2v1, OAT3, OAT4) transporters have been verified in humans SGs and kidneys [2]. In this study, it was examined whether these ABC and SLC transporters account for the efflux and uptake of [177Lu]Lu- and [225Ac]Ac-PSMA-617 in SGs and kidneys. ***Materials and Methods:*** For in vitro transporter inhibition (ABC) and substrate (SLC) studies ([α,β-3H]Nal)Lu-PSMA-617 [3], an isotopologue of [177Lu]Lu-PSMA-617, was used as the test substance (TS) in HEK293, Sf9, CHO-K1 and MDCKII cell lines or vesicles expressing human ABC (BCRP, MDR1, MRP1 and MRP4) and SLC (MATE1, MATE2-K, OAT1, OAT2v1, OAT3, OAT4) transporters. Corresponding probe substrates and reference inhibitors were used as appropriate controls. ***Results:*** Vesicular transport inhibition (ABC) assays were conducted at two different TS concentrations (0.3, 3.0 nM) and indicated no significant inhibition as values remained far under 20%. Vesicular transport substrate (SLC) assays were conducted at two different TS concentrations (0.03, 0.3 nM) and incubation periods (2, 20 min) indicating no active accumulation of ([α,β-3H]Nal)Lu-PSMA-617 to any examined cell lines. The results were further verified by fold accumulation calculations. In all assays, positive control probe substrates and inhibitors worked as anticipated. ***Conclusion:*** Our results conclude that human ABC and SLC transporters do not contribute to the uptake and retention of [177Lu]Lu-PSMA-617 and [225Ac]Ac-PSMA-617 in healthy SGs and kidneys. Hypothesizing that molecular sizes, ionic charges and potential binding sites of PSMA-targeted ligands remain crucial in understanding non-PSMA-specific transport mechanisms, further investigations are mandatory in future instances. ***References:*** [1] Rupp et al., J. Nucl. Med. 2019, 60, 1270-1276. [2] Lapczuk-Romanska et al., Int. J. Mol. Sci. 2019, 20. [3] Bauder-Wüst et al., Appl. Radiat. Isotopes 2023, 197, 110819.

EPS-262

Validation of 6-bromo-7-[^{11}C]methylpurine for measuring the function of multidrug resistance-associated proteins in various human tissues using long axial-field-of-view PET/CT

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Aim/Introduction: The adenosine triphosphate-binding cassette transporter multidrug resistance-associated protein 1 (MRP1) has a widespread tissue distribution. It effluxes various exogenous and endogenous compounds from cells and has been implicated in the pathophysiology of Alzheimer's and chronic respiratory disease. The novel radiotracer 6-bromo-7-[^{11}C]methylpurine ([^{11}C]BMP) has been used to measure MRP1 function in the mouse brain and lungs with PET. [^{11}C]BMP crosses cellular membranes by passive diffusion followed by intracellular conjugation with glutathione (GSH) and MRP1-mediated efflux of the radiolabelled GSH-conjugate. The aim of this first-in-human study was to validate [^{11}C]BMP for measuring the function of MRP1 and other MRP subtypes in various tissues. ***Materials and Methods:*** 13 healthy volunteers underwent dynamic whole-body PET-imaging on a long axial-field-of-view (LAFOV) PET/CT system (FOV:106 cm) after i.v. injection of [^{11}C]BMP (374±30 MBq). Seven subjects underwent a second [^{11}C]BMP PET scan after oral administration of the prototypical organic anion transporter inhibitor probenecid. Venous blood was collected during and urine after the PET scan and analysed with HPLC for GSH-conjugate conversion. Volumes of interest were outlined for the aorta descendens, lungs, cerebral cortex, kidneys, urinary bladder, liver, myocardium, and retina to extract time-activity curves (TACs). The elimination rate constant

(kE) for radioactivity washout from different organs was estimated by linear regression analysis of the natural logarithm-transformed organ TACs from 15 to 90 min after radiotracer injection. In addition, the renal plasma clearance (CLrenal, mL/min) of the radiolabelled GSH-conjugate was calculated. ***Results:*** At 5 min after [^{11}C]BMP administration, 64±6% of radioactivity in plasma represented the corresponding GSH-conjugate. Radioactivity was primarily excreted into the urinary bladder. In contrast to mice, radioactivity was very slowly eliminated from the human brain (cortex: kE: mouse: 1.3±0.06 1/h, human: 0.05±0.01 1/h). Following probenecid administration, kE values were significantly decreased in plasma (-40±10%), lungs (-18±12%), kidneys (-32±45%), liver (-19±13%), and retina (-57±28%), while no significant changes were found in the brain and myocardium. CLrenal of the radiolabelled GSH-conjugate was significantly decreased after probenecid administration (-63±19%). ***Conclusion:*** The use of LAFOV PET/CT enabled a simultaneous assessment of the function of MRP transporters with [^{11}C]BMP in various human tissues. Following administration of probenecid, radioactivity elimination was significantly decreased in the lungs, kidneys, liver, and retina, suggesting an involvement of different MRP subtypes. As opposed to mice, radioactivity was very slowly eliminated from the human brain, indicating substantial species differences in the abundance of transporters involved in the brain elimination of the radiolabelled GSH-conjugate.

EPS-263

Construction of multi-modal integrated probe targeting TfR and synergistic enhancement of immune response in triple negative breast cancer

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Aim/Introduction: This study aims to design a theranostic nanoprobe GA-Fe@Tf-131I and investigate its anti-tumor and enhanced immune therapy performances against triple-negative breast cancer (TNBC). ***Materials and Methods:*** GA-Fe@Tf-131I nanoprobe was prepared by a three-step method, and then a series of physical and chemical characterization were conducted on their morphology, structure, stability, etc. The targeting, therapeutic, immunosensitizing properties and biocompatibility of GA-Fe@Tf-131I nanoprobe were verified in vitro and in vivo. The anti-tumor activity and immune sensitization of GA-Fe@Tf-131I nanoprobe were investigated with TNBC tumor bearing mice. ***Results:*** The hydration particle size of GA-Fe@Tf-131I nanoprobe was 11.7 nm. MR T1 relaxation rate of GA-Fe@Tf-131I nanoprobe was 0.98 mmol·L-1·S-1. The photothermal conversion efficiency was about 66.84%. On the cellular level, CCK-8 assay showed that GA-Fe@Tf nanoprobe had no side effects, while labeled with radionuclide 131I or irradiated with NIR laser could kill TNBC cells. The results of cell radionuclide assays showed that GA-Fe@Tf-131I nanoprobe could specifically target TNBC cells. Calcein-AM/PI fluorescence experiment and Annexin V/PI apoptosis experiment results showed that a low temperature thermal (43°C) or a low dose of radionuclide (200 μCi/mL) could inhibit tumor growth, and the combined effect of both was better. Multimodal imaging showed that GA-Fe@Tf-131I nanoprobe could specifically aggregate in TNBC tumor tissue, and was mainly metabolized through liver and kidney. In vivo anti-tumor results showed that low temperature photothermal combined with low dose radionuclide treatment could effectively inhibit tumor growth and induce auto-immune response in collaboration with KN046. The contents of immunopositively regulated cells, such as DCs, CD4+ T and CD8+ T cells, in tumor tissue were significantly increased, while the number of immunonegatively regulated cells, such as Treg cells, decreased significantly. GA-Fe@Tf-131I nanoprobe had no obvious toxic and side effects on normal tissues and organs and functions, representing a good biocompatibility. ***Conclusion:*** The GA-Fe@Tf-131I nanoprobe prepared in this study has tumor-specific targeting performance, anti-tumor property and immune sensitization performance, and can be used for multi-modal imaging and multi-means treatment, which is expected to provide a new, effective and safe integrated nanoprobe for diagnosis and treatment of patients with TNBC.

EPS-264

Evaluating the immune response activation by targeted radionuclide therapy: towards a correlation between dose and response

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Aim/Introduction: Targeted radionuclide therapy (TRT) consists of the injection of a radiolabeled vector targeting cancer cells. This allows the irradiation of the primary tumor and metastases while mostly sparing the healthy tissues. This led to clinical successes in neuroendocrine and prostate cancer for a proportion of the patients, but current treatments do not lead to cure. Furthermore, there is still little known about the immunogenic potential of TRT and thus whether it could synergize with immunotherapies which has shown potential for external beam radiotherapy. The aim of our study is to assess the immunogenicity of TRT using available literature data. ***Materials and Methods:*** Among the 1074 studies included in our search, 25 met inclusion criteria. To compare the large variety of TRT strategies used, the dose (rate) delivered at the tumor site in vivo or to cultured cells in vitro was calculated. Next, the correlation between the delivered dose (rate) and the % of change in various immune parameters between the control and TRT condition was evaluated. ***Results:*** A strong, significant correlation ($R>0.7$, $p<0.05$) was observed between early factors of the immune response, such as calreticulin tumor expression and TNF-α secretion, and the absorbed dose of TRT. Interestingly, a stronger correlation was observed when the dose rate was taken into account rather than the cumulated dose, suggesting the dose rate is better suited to predict TRT immunogenicity. Immune markers related to the tumor specific lysis also seemed to show a dose rate-dependent increase, however not enough data was available to establish a correlation. At the opposite, later immune parameters like CD8 or CD4 T cells tumor infiltrate did not show any correlation with the absorbed dose or dose rate. ***Conclusion:*** This highlights that TRT can be immunogenic, and a correlation with the dose (rate) is observed for some elements of the immune response. However, the various way of measuring each immune markers and the different time points used in literature introduce a bias in our analysis. This might explain why, even though some parameters are increased after TRT, no correlation with the dose is observed. Nevertheless, increased knowledge on which dose (rate) is necessary for TRT to modulate the immune microenvironment is crucial to move forward with immunotherapy combination. Further experiments aiming to understand the underlying mechanisms of the observed correlations will allow to identify which dose is best suited to induce immunogenic effects.

EPS-265

Potassium Channel Kv1.3 Targeted Immuno-PET Imaging for Diagnosing and Monitoring Active Rheumatoid Arthritis

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Aim/Introduction: Rheumatoid arthritis (RA) is a chronic inflammatory disease afflicting approximately 1% of the population worldwide. Current methods for diagnosing and monitoring early-stage RA have limited sensitivity and do not aid in identifying potential candidates for immune-mediated therapy. The Kv1.3 potassium channel plays a crucial role in regulating the activation of effector memory T lymphocytes (TEM cells), which are major drivers of inflammation in active RA(1). Herein, we developed and evaluated the potential of a new Kv1.3 targeting radiopharmaceutical, 68Ga-NOTA-AbKv1.3, in accurately monitoring and quantifying joint inflammation in a mouse model of RA. ***Materials and Methods:*** We developed a Kv1.3-targeted radiotracer by labeling gallium-68 (68Ga, T1/2=68 min) to an anti-Kv1.3 antibody (AbKv1.3) after its chelation with NOTA. After evaluating the radiolabeling yield, radiochemical purity, and stability, we performed micro-PET/CT imaging on DBA/1 mice with type II collagen-induced unilateral arthritis. Joint tissues were subsequently collected for further immunohistochemical and immunofluorescence staining. ***Results:*** 68Ga-NOTA-AbKv1.3 was synthesized with high radiolabeling yields and radiochemical purity. PET results reveled a significantly higher concentration of radioactivity in inflamed joints compared to normal joints at different time points. ROI analysis demonstrated that arthritis sites exhibited the highest uptake of 11.73 %ID/g at 4 h, while non-inflamed joints had only 1.55 %ID/g. Histological analysis further confirmed the distribution of T cells at the inflammatory sites and their high expression of Kv1.3 channels. ***Conclusion:*** We successfully developed 68Ga-labeled Kv1.3-targeting antibody probes. Targeting Kv1.3 expression in activated T cells enabled the visualization of active inflammation in arthritis joints. The results demonstrate the potential of 68Ga-NOTA-AbKv1.3 immuno-PET imaging for sensitively and accurately diagnosis of RA at early stage. ***References:*** (1) Wulff H, Castle NA, Pardo LA. Voltage-gated potassium channels as therapeutic targets. Nat Rev Drug Discov. 2009;8:982-1001.

EPS-266

Multi-time-point [18F]FDG-PET/CT for monitoring a combined anti-PD-L1/anti-CTLA-4 immunotherapy in a murine melanoma model with multiparametric immunohistochemical validation

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Aim/Introduction: Immune checkpoint inhibition (ICI) has shown promising results in malignant melanoma, but not all patients respond equally well, which necessitates early and accurate monitoring of immunotherapy response. [18F]FDG-PET/CT aids in characterizing therapy response beyond morphology, but validated imaging biomarkers of immunotherapy response are currently unavailable. Therefore, the aim of this study was to investigate a three-time point [18F]FDG-PET/CT protocol to monitor a combined anti-PD-1/anti-CTLA-4 immunotherapy in melanoma allografts. In vivo semi-quantitative PET parameters were validated by a multiparametric immunohistochemical reference standard as imaging biomarkers of therapy response. ***Materials and Methods:*** Melanoma cells (B16-F10) were injected subcutaneously into the left flank of C57BL/6 mice (n=40). 7 days post-inoculation, baseline [18F]FDG-PET/CT was conducted. Animals were randomized into two groups; the therapy group received 5 i.p.-injections of anti-PD-L1 and anti-CTLA-4 antibodies (20 µg/kg) on days 7, 9, 11, 13 and 15, while the control group received sham treatment. Follow-up PET/CT was performed on days 13 (FU1) and 19 (FU2). Tumor allografts were harvested at each time point for immunohistochemistry (CD8, Ki-67, TUNEL) to validate imaging parameters (MTV, SUVmax). ***Results:*** At FU1, a significantly lower MTV was observed in the therapy group than in the control group (0.12 ccm vs. 0.35 ccm, p= 0.017). At FU2, both MTV and SUVmax were significantly lower in the therapy than in the control group (MTV: 0.36 ccm vs. 1.01 ccm, p= 0.0012; SUVmax: 4.73 vs. 7.17, p= 0.000025). Ex vivo immunohistochemical validation at FU1 and FU2 showed significantly higher apoptosis in the therapy than in the control group (FU1: 43.85% vs. 14.71%, p= 0.028; FU2: 56.43% vs. 20.28%; p= 0.0000078) as well as a significantly higher number of CD8-positive cells at FU2 (225.83 vs. 55.3, p= 0.019). At FU1 and FU2, tumor cell proliferation was significantly lower in the therapy group than in the control group (FU1: 31.88% vs. 61.31%, p= 0.0042; FU2: 32.23% vs. 55.56%, p= 0.001). ***Conclusion:*** Multi-time point [18F]FDG-PET/CT allowed for the early non-invasive monitoring of a combined immunotherapy with anti-PD-1/anti-CTLA-4 in experimental melanomas, validated by multiparametric immunohistochemistry. The significantly lower tumor glucose metabolism was paralleled by significant pro-immunogenic, pro-apoptotic and anti-proliferative effects of the combined immunotherapy.

EPS-267

Reprogramming the tumor microenvironment by targeting tumor-associated macrophages with mannosylated liposomes that deliver zoledronic acid

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Aim/Introduction: Immune checkpoint inhibitors (ICIs) are less effective in cold tumors characterized by a prevalence of M2-like, anti-inflammatory tumor-associated macrophages (TAMs). To address this, we developed mannosylated liposomes (M-lipo) to target M2-like TAMs and deliver zoledronic acid (ZA), which blocks M2-like polarization and promotes M1-like polarization. This study aims to evaluate the ability of ZA-encapsulated M-lipo (M-lipo/ZA) to modulate the tumor microenvironment (TME), transforming cold tumors into immunologically hot tumors to enhance ICI efficacy. ***Materials and Methods:*** Female C57BL/6 mice (8-week-old, n=10) were used for tumor inoculation. After subcutaneously inoculating Nanoluciferase-expressing MC38 (MC38-Nluc) into the left leg and B16F10 (B16F10-Nluc) into the right leg, the mice were then divided into two groups. For ZA treatment, mice received 2 mg/kg ZA, and for ICI combination therapy, they were given 100 µg/kg ZA and 1 mg/kg anti-PD-1 monoclonal antibody (mAb) every two days. TAMs were analyzed

using flow cytometry and immunohistochemistry. Liposomes and M-lipo were radiolabeled with 111In-NOTA-N3 for SPECT/CT imaging of mice which was acquired at time points. ***Results:*** In vitro flow cytometry and Western blot results demonstrated that treatment of RAW264.7 cells with M-lipo/ZA reduced CD206 and Arg1 (M2 marker) expression by more than half. In a mouse model, flow cytometry analysis showed that treatment of B16F10 ("cold") tissues with M-lipo/ZA resulted increased iNOS expression by 3.4% and decreased CD206 expression by 29.9% compared to controls. These indicate a similar percentage of TAMs as in MC38 ("hot") controls, suggesting the potential for converting cold tumors to hot tumors. This is consistent with immunohistochemistry showing a similar phenotype of TAM infiltration in these two groups. Tumor volumes of the M-lipo/ZA treatment group and ICI combination treatment group were significantly smaller than those of the control group ($P < 0.01$). Importantly, a high anti-tumor effects was confirmed even in cold tumors. SPECT/CT results showed hepatic uptake of M-lipo was too high to confirm tumor targeting, but the pattern of liposomes migration into tumor tissue was confirmed. Further research is needed by optimizing the conditions. ***Conclusion:*** M-lipo/ZA effectively targets TAMs in the TME and induces a phenotypic shift from M2 to M1, supporting its potential to enhance ICI responsiveness. It is worth noting that M-lipo exhibited a trend of improved inhibitory effect on the M2 polarization of macrophages compared to free ZA, which may be attributed to the dual function of active targeting and promoting polarization of mannosylated nanocarriers.

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Detection of inflammation-related blood-brain barrier disorders using PET and MRI imaging - a pilot study

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Aim/Introduction: Precise techniques for monitoring brain barrier dysfunction following a neuroinflammatory state after, e.g., traumatic brain injury are among the most important targets in both trauma research and care, as they pose the potential for organ dysfunction or even failure. While various blood markers have been investigated, some of which indicate the presence of blood brain barrier (BBB) dysfunction, they have proven insufficient to provide specific insights into the localization or severity of such dysfunction. In a transgenic mouse model displayed intracerebral neuroinflammation, initial attempts have been made to evaluate [89Zr]Zr-DFO-HSA as a potential radiotracer for non-invasive monitoring of brain barrier dysfunction by PET and MRI scans. ***Materials and Methods:*** The radioligand [89Zr]Zr-DFO-HSA was injected i.v. into mice exhibiting neuroinflammation (n = 3) and control mice (n = 4). PET and MR imaging were conducted to assess in vivo biodistribution of [89Zr]Zr-DFO-HSA over 24h. Subsequently, intracerebral accumulation of labeled HSA was verfied via ex vivo γ-counter analysis and autoradiography. Intracerebral morphological alterations were further assessed on a cellular level by histological staining analysis. The PET and MRI data were analyzed in PMOD, the statistical analysis in GraphPad Prism. Ver. 10 ***Results:*** Based on PET and MR imaging, a noticeably higher tracer signal was observed in the cerebellum region of the intervention mice. Quantitative analysis of the in vivo PET data revealed an elevated intracerebral tracer concentration over the measurement period in the neuroinflammatory mice (0.99 ± 0.08%IA/mL), compared to the control animals (0.81 ± 0.06%IA/mL), a trend further supported by ex vivo analysis. Autoradiography subsequently confirmed the PET findings, demonstrating an increased tracer signal within the cerebellum of the neuroinflammatory mice. ***Conclusion:*** The application of [89Zr]Zr-DFO-HSA has proven successful in monitoring BBB dysfunctions in a neuroinflammatory mouse model. PET and MRI data depicted a heightened concentration of labeled HSA, validating the anticipated alterations in BBB permeability linked to neuroinflammation. Beyond discerning differences in barrier permeability, the study highlighted the accumulation of the radiotracer in areas known to be most heavily influenced by neuroinflammation, the cerebellum. Consequently, the efficacy of labeled albumin as the radiotracer in this study highlighted its sensitivity in detecting BBB disruption and established it as a valuable tool for monitoring disease progression. The non-invasive nature of PET imaging with [89Zr]Zr-DFO-HSA enhances its translational potential and makes it a promising candidate for further preclinical investigations of various barrier disorders and possibly for future clinical applications.

EPS-269

Preclinical Evaluation of DNA Damage Response Inhibitors and ^{225}Ac-DOTA-girentuximab Combination Therapy

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Aim/Introduction: Cancer cells can repair therapy-induced DNA damage through DNA Damage Response (DDR) mechanisms, leading to therapeutic resistance. DDR inhibitors (DDRi) have been developed to overcome this challenge. In the field of radioimmunotherapy, enhancing the biologic effect of radiation dose to tumour could widen the therapeutic window, and achieve greater responses to treatment and lower doses. This study aims to investigate anti-tumour effect of combining DDRi with 225Ac-DOTA-girentuximab that targets CAIX expressed by SK-RC-52 renal cancer cells. ***Materials and Methods:*** Girentuximab was conjugated with DOTA (1,4,7,10-Tetraazacyclododecane-1,4,7,10-tetraacetic acid) chelator for 225Ac radiolabelling. To assess cytotoxicity, we performed clonogenic assays to determine half-maximal inhibitory concentration (IC50) values for 225Ac-DOTA-girentuximab and DDRi, specifically lartesertib targeting ataxia telangiectasia mutated protein (ATM) and peposertib targeting DNA-dependent protein kinase (DNA-PK). Levels of different molecular markers related to DDR were quantified by Meso Scale Discovery (MSD) and Luminex assays Additionally, we investigated the in vitro anti-tumour efficacy of the combined treatment comprising 225Ac-DOTA-girentuximab and DDRi. ***Results:*** Lartesertib and peposertib exhibited IC50 values of 3.543 µM and 0.7712 µM, respectively, for SK-RC-52 cells. The IC50 value for 225Ac-DOTA-girentuximab in SK-RC-52 cells was 0.1505 kBq/mL. Synergy mapping analysis of the clonogenic assays, which included the combination treatment of 225Ac-DOTA-girentuximab and lartesertib, revealed an additive effect. The combination of 225Ac-DOTA-girentuximab with peposertib, in contrast, exhibited a synergistic effect. Combination Index (CI) analysis revealed a CI value of 0.760 for the 225Ac-DOTA-girentuximab

+ peposertib combination therapy, corroborating the observed synergistic effect (defined by CI ≤ 0.8). The CI value for 225Ac-DOTA-girentuximab + lartesertib was 0.985, indicating an additive effect (defined by 0.8 < CI < 1.2). The MSD assay demonstrated a positive correlation between DNA-PK phosphorylation and the doses/treatment duration of 225Ac-DOTA-girentuximab. While increased phosphorylation of ATM and KRAB-associated protein (KAP) was also observed with higher doses and longer treatment durations of 225Ac-DOTA-girentuximab, the trend was less pronounced compared to phosphorylated DNA-PK. ***Conclusion:*** The combination of 225Ac-DOTA-girentuximab and DDRi proved to be more effective than either monotherapy alone. The synergistic effect was evident with 225Ac-DOTA-girentuximab + peposertib, whereas 225Ac-DOTA-girentuximab + lartesertib exhibited an additive effect. Analysis of DDR biomarkers indicated elevated levels of DNA-PK phosphorylation, with phosphorylated ATM showing a comparatively lesser increase. Future studies will be extended to in vivo models to determine the optimal dosing combination for potential human trials.

EPS-270

Development of Girentuximab as a theranostic tool in non-renal indications

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Aim/Introduction: Girentuximab is a human antibody targeting carbonic anhydrase IX (CA9), intracellular pH maintaining enzyme. Its upregulation in the majority of renal cell carcinomas (RCC) as a result of inactivation of VHL oncogene creates pseudo-hypoxia, whereas CA9 upregulation in non-renal cancers is associated with tumour hypoxic state. The aim of this study was to validate DOTA-Girentuximab binding in multiple cell lines representative of non-renal indications of interest and test imaging and therapeutic potential of 177Lu-labelled Girentuximab in selected xenograft models. ***Materials and Methods:*** A range of cell lines representative of tumour types known to express CA9 were tested for binding to increasing concentrations of Girentuximab (GmAb) under hypoxia. Kd and Bmax were established. Nude mice carrying AsPc-1, FaDu and HT-29 xenografts were randomized into imaging/biodistribution (N = 4) and therapy (N = 6) groups, and treated with 20-22MBq or 9MBq of 177Lu-GmAb in imaging and therapy study arms respectively. Body weight and tumour volume were monitored up to 10-weeks post treatment in the therapy arm. SPECT imaging was performed at 24 and 72 hrs, and biodistribution was analysed ex vivo in heart, liver, spleen, kidneys, tumour and blood. Imaging results were quantified and correlated to the ex vivo biodistribution. ***Results:*** The imaging and biodistribution analysis of 177Lu-GmAb in Swiss Nude mice carrying FaDu, AsPc-1 and HT-29 xenografts demonstrated tumour targeting in AsPc-1 and HT-29 xenografts, accompanied by accumulation in main clearance organs as predicted based on radiolabelled antibody clearance. Ex vivo quantification of the % injected dose in the tumour confirmed the flow cytometry results , where highest uptake reaching ~30% at 72 hrs post-injection was detected in HT-29, and the lowest in FaDu xenografts. Remarkably, in therapy studies monitoring tumour volume and mice survival, treatment with 9MBq of 177Lu-GmAb resulted in inhibition of tumour growth in FaDu xenografts and extension of survival despite non-significant binding to tumour cells as determined with FACS and imaging. Both AsPc-1 and HT-29, characterised by relatively slow and rapid xenograft growth respectively, responded to the treatment, however responses in HT-29 xenografts were less pronounced despite highest levels of CA9 expression among tested three cell lines. ***Conclusion:*** The results support a potential of radiolabelled Girentuximab as a theranostic agent in non-renal cancer indications and demonstrate that in addition to efficient tumour targeting intrinsic tumour radiosensitivity or effects on tumour stroma might play a role in determining tumour responses.

EPS-271

Radiolabeling of embolization microspheres for SPECT/CT and PET/CT : feasibility on swine model.

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Aim/Introduction: Arterial embolization is a mini-invasive treatment for a wide range of vascular conditions such as hemorrhages, cancers treatment or vascular disorders. Even if this practice proved his efficient, the size of optimal embolization devices and the proportion of their off-target release are unknown. In this context, we aim to radiolabel various types and sizes of embolic microspheres (EM) to follow their biodistribution by SPECT/CT and PET/CT imaging. ***Materials and Methods:*** Cook PVA® (Cook Medical), Embosphères® (Merit Medical), Embozenes® (Varian) and DC Beads® (Boston Scientific) have been studied from 300 µm to 1300 µm. Radiolabelling was performed using technetium-99m (4GBq/2ml) reduced by 2 mg tin-chloride. Gallium-68 radiolabelling was conjugated via NODAGA-NHS-ester following the protocol [REF1]. The radiolabeling was carried out at room temperature for 10 minutes or 60 minutes respectively for gallium-68 and technecium-99m. Stability tests were performed for 4 hours (gallium-68) and 24 hours (technecium-99m) in human serum. SPECT/CT and PET/CT were performed at two hours post-injection after arterial splenic embolization in a swine model. Signals were quantified as injected dose (%ID). ***Results:*** For SPECT/CT radiolabelling ; radiochemical yields (RCY) of 33.4% for DC Beads® ; 19.0% for Cook PVA® ; 15.3% for Embozenes® and 10.6% for Embosphères® were observed. Followed these tests, RCY of 14.0%, 7.1%, and 11.3% for Embosphere® EMs respectively for 700 µm, 900 µm, and 1300 µm. The final radiochemical purity excedeed 90% for each batches. For both stabilities were superior to 80% for 4 or 24 hours in human serum. Optical analyses showed no difference between no-radiolabelled and radiolabelled EMs in term of size homogeneity; sphericity and roughness. Embozenes® 700 µm and 500 µm were selected for preclinical injection to SPECT/CT and PET/CT. In both cases, signal quantifications showed no off-target sites with 93 %ID and 92 %ID into the spleen. ***Conclusion:*** Radiolabeling and in vivo proof-of-concept have been considerate conclusive for both SPECT/CT and PET/CT imaging. These results raise the question of screening others radionuclides for monitoring interventional radiology practices, as well as potential perspectives for vectorized internal radiotherapy with adjustments of agents sides used according to the indications. ***References:*** 1-STRATEGIES FOR TARGETED AND IMAGE GUIDED DRUG DELIVERY FOR SOLID TUMOR THERAPY - Ayele Hailu Negussie

EPS-272

Brachytherapy-photothermal Therapy Integrated $^{32}P/Ag_2S$-loaded Microneedle Patches for Preventing Postoperative Recurrence and Infection of Melanoma

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Aim/Introduction: Melanoma is one of the most common and lethal forms of skin cancer. Current treatment options for melanoma include surgery, chemotherapy, and radiotherapy. Unfortunately, traditional methods such as surgery and chemotherapy fall short in preventing postoperative recurrence, while radiotherapy is limited by factors like radiation dose and distance, resulting in low tumor absorption and toxicity to surrounding healthy tissues. Furthermore, postoperative bacterial infection can impede wound healing, exacerbating the dilemma in melanoma treatment. To address these constraints, this study synthesized Ag2S@Ca32P and employed microneedles (MNs) as delivery platforms. This enabled the direct delivery of high-dose β rays emitted by 32P to tumor area, achieving nuclide brachytherapy. Meanwhile, this approach synergized with the photothermal capability of Ag2S, significantly suppressing postoperative recurrence and infection of melanoma. ***Materials and Methods:*** This study explored the therapeutic effects of Ag2S@Ca32P MN at both cellular and animal levels. At cellular level, this study evaluated the cytotoxic effects of Ag2S@Ca32P via mechanisms like DNA damage and ROS production. At animal level, this study established animal models like primary melanoma, recurrent melanoma, and wound infection to assess its treatment effects on inhibiting postoperative recurrence and infection. Ultimately, this study delved the mechanisms involved in inducing tumor cell apoptosis, inhibiting postoperative recurrence, and wound healing using immunohistochemistry and other methodologies. ***Results:*** At cellular level, the dose of 32P at 100 μCi/mL resulted in a 70.45% cell death rate in tumor cells. When combined with photothermal therapy, 79.23% of tumor cells were killed. Immunofluorescence results of DNA damage and ROS generation showed that the group treated with 32P combined with Ag2S exhibited the most significant DNA damage and higher ROS production capabilities. When Ag2S@Ca32P was delivered to tumor area, 32P itself was able to conspicuously inhibited the growth and recurrence of melanoma. Of note, after combining with photothermal therapy, considerable reduction of tumor volume, inhibition of tumor postoperative recurrence, suppression of bacterial proliferation and facilitation of wound healing were observed. ***Conclusion:*** This study introduces a novel nuclide microneedle platform designed to prevent postoperative recurrence and infection in melanoma. The platform delivers 32P directly to the tumor, enabling effective brachytherapy. In addition, when radionuclide treatment is combined with photothermal therapy, it can further inhibit tumor recurrence, reduce bacterial infection and promote wound healing. In conclusion, this research offers a promising approach for addressing postoperative recurrence and infection in melanoma, demonstrating significant potential in the realm of nuclide therapy.

EPS-273

The study of multi-targets PET tracer on early monitoring ICI curative effect of lung cancer

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Aim/Introduction: Immune checkpoint inhibitors (ICI) are considered one of the most promising new anti-cancer drugs. However, the efficacy of ICI varies greatly in different patients because of the complex immune microenvironment, in which the neutrophil/lymphocyte ratio may play a key role. Here, we hypothesized that imaging of granzyme B (GZB) with 68Ga-DOTA-grazytracer and myeloperoxidase (MPO) with 68Ga-NOTA-bis-5HT could predict the ICI responders of lung cancer, which are the effective protein of CD8+ T cell and the core protein of neutrophil trapping net (NETs), respectively. ***Materials and Methods:*** The radioactive labeling yield and radiochemical purity of 68Ga-DOTA-grazytracer and 68Ga-NOTA-bis-5HT were analyzed by HPLC. The stability in physiological saline and serum were evaluated and the Log P was determined to make sure the biological characteristics. Then, the LLC tumor-bearing mice were treated with PD-L1 mAb (200μg) every three days intraperitoneally. Then, the uptake before and after treatment were evaluated by double PET probes with micro-PET/CT. Meanwhile, the immunotherapy effect was analyzed by determining the volumes of tumor and the weight changes every 3 days. ***Results:*** The radioactive labeling yield of 68Ga-DOTA-grazytracer and 68Ga-NOTA-bis-5HT were 63% and 40%, and the radiochemical purity were>95% and>90%. They kept stability in salt and serum at 37°C within 4h. The lipid/water partition coefficient of the two tracers were -0.22±0.05 and -0.49±0.05, respectively, which showed the good hydrophilicity. The results of 68Ga-DOTA-grazytracer PET imaging showed that the PET signal value of tumor was increased after treatment ($P<0.05$), indicating that PD-L1 stimulated the release of GZB and activated immune system cytotoxicity. Meanwhile, the PET signal of 68Ga-NOTA-bis-5HT was correlated with tumor volume after PD-L1 treatment ($r=0.94$), which suggesting the potential of 68Ga-NOTA-bis-5HT to predict the tumor immunotherapy response. In addition, by monitoring the dynamic PET signal changes of GZB and MPO, it was found that the secretion of GZB and MPO were reached maximum value within 4h after the last treatment, and declined gradually, which provided new ideas for further combination therapy and clinical research. ***Conclusion:*** GZB expression in tumor was increased by PD-L1 stimulation and the change of MPO had the potential to predict the immunotherapy response of lung cancer. The GZB and MPO expression were limited by time. Molecular imaging of 68Ga-DOTA-grazytracer and 68Ga-NOTA-bis-5HT may help to predict the immune efficacy early and perfect the novel therapies.

1710a

Wednesday, October 23, 2024, 08:00 - 09:00
Hall G1

Mini Course 1 - Technologists Committee

OP-892

Workflow in Radiotherapy

S. Rajala;
HUS Comprehensive Cancer Center, Molecular Radiotherapy Unit, Helsinki, FINLAND.

OP-893

Workflow in Nuclear Medicine Imaging

A. Ruzza;
Santa Maria Goretti Hospital, Department of Nuclear Medicine, Latina, ITALY.

1710b

Wednesday, October 23, 2024, 09:05 - 10:05
Hall G1

Mini Course 2 - Technologists Committee

OP-894
Clinical and research applications of Gallium Generator
S. Vieira e Vieira;
Institut Jules Bordet, Radiopharmacy, Brussels, BELGIUM.

OP-895
Clinical and research applications of Rubidium Generator
G. Testanera;
PET Service Manager, School of Biomedical Engineering and Imaging Sciences, King's College London, London, UNITED KINGDOM.

1710c

Wednesday, October 23, 2024, 10:15 - 11:15
Hall G1

Mini Course 3 - Technologists Committee

OP-896
Quality Management System – why we need it?
J. Vredenbregt;
Erasmus MC Rotterdam and Cyclotron Rotterdam B.V., Rotterdam, NETHERLANDS.

OP-897
Good Manufacturing Practice – step by step
Z. Wimana;
HUB-Institut Jules Bordet, Radiopharmacy , Brussels, BELGIUM.

OP-898
From being "basic" to becoming "advanced" – procedures, documentation, Standard Operating Procedures
J. Thys;
Chief Nurse, Imelda Hospital, Bonheiden, BELGIUM.

1711

Wednesday, October 23, 2024, 08:00 - 09:30
Hall Y1-Y3

TROP Session: Case Report Session 2: You Won't Believe the Things I've Seen!

OP-824
The Emerging Role of [89Zr]Zr-DFO-Girentuximab PET/CT in Accurate Characterisation and Staging of ccRCC: early experience with three Patients
F. Gelardi[1,2], *L. Antunovic[2], A. Larcher[1,2], G. Musso[1,2], C. Re[1,2], F. Cei[1,2], F. Belladelli[1,2], A. Salonia[1,2], R. Luciano[1,2], N. Tenace[1,2], M. Olivieri[1,2], A. Savi[2], M. Sollini[1,2], A. Chiti[1,2];*
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[2]IRCCS Ospedale San Raffaele, Milano, ITALY.

Aim/Introduction: Accurate characterisation of solid renal masses using conventional imaging is a major challenge, often leading to unnecessary surgery in patients with benign lesions. Carbonic anhydrase IX (CAIX) is known to be overexpressed in clear cell renal cell carcinoma (ccRCC) and offers potential as either diagnostic and therapeutic target. Here we present the results of first three patients who underwent [89Zr]Zr-DFO-girentuximab PET/CT for renal mass characterisation and staging in our Institution. ***Materials and Methods:*** Three patients with renal lesions suspicious for ccRCC on morphological imaging, all candidates for radical nephrectomy, were enrolled. Pre-operative staging was performed using whole-body PET/CT with [89Zr]Zr-DFO-girentuximab under the compassionate use programme. In addition, ex-vivo microPET/CT imaging of the surgical specimen was performed in two patients showing increased tracer uptake in renal mass, who underwent surgery one week after injection of [89Zr]Zr-DFO-girentuximab. ***Results:*** All patients had a known renal mass suspicious for ccRCC. In addition, preoperative imaging revealed suspicious lymph nodes on CT in patients 1 and 2, while patient 3 had a suspicious alteration in the right tibia on bone scintigraphy. [89Zr]Zr-DFO-girentuximab PET/CT showed increased uptake in the renal lesion with no uptake in the locoregional lymph nodes in patients 1 and 2. Of note, a rib lesion was detected in patient 1, who underwent further assessment. Ex vivo imaging in patients 1 and 2 showed consistent increased uptake in the region of the tumour mass with no uptake in the normal renal parenchyma. In contrast, patient 3 showed no uptake in the renal mass and in the tibial lesion. Final pathology confirmed the diagnosis of ccRCC with high levels of CAIX expression in patients 1 and 2 (positive on PET imaging), with no evidence of spread to the omolateral lymph nodes or adrenal gland. Final pathology confirmed cromophobe RCC in patient 3 (negative on PET imaging). In addition, biopsy of the tibial lesion was found to be a benign alteration. ***Conclusion:*** [89Zr]Zr-DFO-girentuximab PET/CT is emerging as a promising tool for the accurate characterisation and staging of renal masses suspicious for ccRCC. This modality provides critical information to guide treatment strategies, improving overall clinical management with the advantage of whole-body imaging. In addition, the high specificity of CAIX targeting can identify ccRCC preoperatively, potentially sparing patients with benign renal masses from unnecessary surgery.

OP-825
An Extremely Rare MEN4 case with Multimodality Imaging
O. Kodaz, *G. Kaya, M. Tuncel, M. Caglar Tuncali;*
Hacettepe University Department of Nuclear Medicine, Ankara, TÜRKIYE.

Aim/Introduction: Multiple endocrine neoplasia (MEN) is a syndrome characterized by endocrinological neoplasias in multiple region or organ in a patient. Subgroups defined as MEN1, MEN2(a), MEN3(2b), MEN4 and MEN5. Diagnosis is made by family history and genetic examinations, and more than one endocrinological neoplasia is shown. MEN4 is extremely rare and related to CDKN1B mutation. In our case, we discussed the patient diagnosed with MEN4 with various imaging modalities. ***Materials and Methods:*** We discuss Tc-99m-MIBI SPECT-CT, Ultrasound (US), FDG PET-CT, Somatostatin receptor (SSTR) PET-CT images of genetically proven rare MEN4 syndrome. ***Results:*** A 32-year-old male who had a family history of parathyroid adenoma was referred for parathyroid scintigraphy due to hypercalcemia and suspected hyperparathyroidism. Focal Tc-99m-MIBI retention

was detected at the inferior poles of both thyroid lobes and US showed two nodular lesion (24x18 mm and 9x5 mm). While evaluating CT part of SPECT-CT images, 3 lung nodules were detected incidentally. FDG PET-CT was performed to evaluate pulmonary nodules. Pulmonary nodules were not FDG avid but parathyroid lesion detected on the MIBI was unexpectedly FDG avid (SUVmax: 11.7). All of the findings were suspicious for MEN syndrome so i to evaluate adrenal glands, an abdomen MRI was done, and it was unremarkable at first sight except nodular lesion in vicinity of pancreas head. Thus, SSTR PET imaging was performed. Parathyroid lesions and pulmonary nodules showed low SSTR expression and multiple nodular peripancreatic lesions with high SSTR expression were detected (SUVmax: 168, not FDG avid). Hypophysis-MRI revealed pituitary microadenoma. Thereupon, genetic analysis for MEN syndrome was performed. Genetic analysis for MEN syndrome was performed. No mutations related to MEN and RET genes were found, but CDKN1B mutation was detected. The patient was diagnosed with MEN4 syndrome. Parathyroid lesions with intense FDG uptake could be related parathyroid adenoma with high mitotic activity or parathyroid carcinoma. Lung nodules are considered to be carcinoid tumors or less likely to be metastases. The lesions in the and around pancreas could be related to neuroendocrine neoplasia and paraganglioma respectively. ***Conclusion:*** The patient had a very rare MEN4 syndrome, and multimodality imaging solved many problems, but SSTR PET-CT was a real problem solver that revealed all of the suspicious lesions. Thus somatostatin receptor imaging (SSRI) may be a first-line modality for imaging MEN-related syndromes.

OP-826

Brain FDG-PET/CT through years as a marker of disease activity in CASPR2 limbic encephalitis: a case report

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University of Florence, Firenze, ITALY.

Aim/Introduction: Autoimmune encephalitis (AE) is a heterogeneous group of inflammatory diseases of the central nervous system characterised by an acute or subacute onset, inflammation of the brain parenchyma, rapidly progressive neurological dysfunction and positive laboratory tests for anti-neuronal antibodies, although a substantial percentage of patients may be seronegative. Currently, MRI is the main neuroimaging method for the diagnosis of AE, however, a significant number of AE do not show any MRI abnormalities. Hence, this case report aims to highlight how in these cases, FDG-PET/CT can be a valuable aid in supporting the diagnosis of AE. ***Materials and Methods:*** In 2014, a 60-year-old male presented with epileptic seizures characterized by pshyco-motor arrest and oro-buccal automatism. While brain MRI was normal, FDG-PET/CT scan showed the presence of an intensely hypermetabolic focality in the left temporo-mesial region, along with a smaller, less intense area in the same location but in the contralateral hemisphere. He was diagnosed with limbic encephalitis due to anti-CASPR2 antibodies, in acute phase. Initial treatments included plasmapheresis, corticosteroids, and Rituximab, leading to a dramatic improvement of the seizures, but mood changes and memory disturbances persisted. The FDG-PET/CT scan performed three months after the first one showed a marked reduction of hypermetabolism on the left temporo-mesial region and the disappearance of hypermetabolism on the right; then, despite the presence of residual fluctuating symptoms, follow-up FDG-PET/CT scans (eight in total) showed stable metabolism outcomes, consistent with a remission phase on imaging. In 2018 the patient experienced increased seizures with marked, subacute, cognitive decline and a new brain FDG-PET/CT revealed bilateral mesial temporal hypometabolism (relapse phase). Treatment with corticosteroids, cyclophosphamide and Tocilizumab led to a complete clinical remission with a concordant reduction of the FDG-PET/CT hypermetabolism. ***Results:*** This case illustrates the potential role that FDG-PET/CT could play in the diagnosis of autoimmune encephalitis and in follow-up, since the metabolic alterations shown on imaging seem to correlate with the patient's different disease phases (acute phase, remission, relapse) even when standard neuroimaging methods show no alteration. ***Conclusion:*** For this reason, we believe that FDG-PET is a valuable tool for the diagnosis and management of autoimmune encephalitis and should be included in the main criteria for the diagnostic work-up of patients with limbic AE.

OP-827

^{18}F-FDOPA negative insulinomas in paediatric population

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Aim/Introduction: Insulinomas are pancreatic neuroendocrine tumours. Their occurrence in paediatric group is rare. They are usually benign, sporadic and solitary. They are often curative if successfully identified and surgically removed. Insulinomas are also expected to be ^{18}F-FDOPA avid. Our aim is to highlight that Insulinomas can be ^{18}F-FDOPA non avid. We here report three cases where ^{18}F-FDOPA PET scan did not show uptake in the lesion. ***Materials and Methods:*** We are one of the few centres in the world who perform ^{18}F-FDOPA studies for hyperinsulinemia in children. We here share 3 paediatric patients with suspected insulinomas who had ^{18}F-FDOPA PET scans,. Carbidopa was not administered to any of these children. The scan was performed at different time intervals starting from 5 minutes up to 60 minutes post tracer injection. The information on histology and patient outcome were obtained from electronic patient record system. All cases were reviewed by two Nuclear Medicine physicians and one paediatric radiologist. Comparison was made with other modalities of imaging such as MR. ***Results:*** All three children had MR scan prior to ^{18}F-FDOPA PET. Interestingly, all children had no uptake of ^{18}F-FDOPA in the insulinoma lesions and two of them were in fact photopenic. All three children underwent surgical resection. Insulinoma was confirmed in all of them histologically and underwent screening for MEN1 syndrome. One child is now 23 years of age with no requirement of medication. The other two children are being followed up, currently keeping well and not requiring medications. ***Conclusion:*** ^{18}F-FDOPA is recommended for diagnosing suspected congenital hyperinsulinism and other hypoglycaemic syndromes such as insulinomas. Large majority of insulinomas are known to be ^{18}F-FDOPA avid. This poster highlights limitation of ^{18}F-FDOPA PET in Insulinomas in paediatric age group and recognising that some insulinomas do not take up ^{18}F-FDOPA and in fact two of our cases were typically photopenic. More studies are required in future in the paediatric age group to assess the behaviour of insulinomas on functional imaging.

OP-828

(68)Ga-FAPI-46 compared to ^{18}F-FDG, (68)Ga-DOTANOC and diagnostic (123)I-MIBG detects the largest number of secondary lesions in a pediatric patient with multi-metastatic paraganglioma

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Aim/Introduction: Paraganglioma is a rare extra-adrenal neuroendocrine tumor. First line-diagnostic procedures involve CT and MRI imaging. While isolated paraganglioma are surgically treated, metastatic disease requires systemic treatments including radiometabolic therapy(RmT). Functional imaging PET/TC scan using different radionuclides allows a personalized therapy in a theragnostic approach. ***Materials and Methods:*** A 17-year-old male presents with drug-resistant dorsal pain. MRI investigation and CT scan showed a dorsal intracanal solid tissue from D3 to D5 with extracompartimental paravertebral extension, involving respective vertebral soma together with that of L2 with extension anterior to the left iliopsoas muscle(LIPM). He underwent surgical spinal stabilization and decompression at D2-D6 level. The diagnosis at biopsy was paraganglioma with focal nuclear pleomorphism, tumor necrosis and microfoci in bone, muscle and fibrocartilaginous tissue. He was referred to our nuclear medicine department to complete staging and treatment decision. ***Results:*** An initial ^{18}F-FDG PET/CT scan showed mild uptake in the paravertebral region at D4-D5 and L2 level and equivocal uptake anterior to the LIPM and bone marrow. Subsequent 68Ga-DOTANOC PET/CT revealed mild uptake at the same sites identified at ^{18}F-FDG PET/CT and additionally uptake anterior to the left kidney and LIPM and at the skeletal level of C1, occipital clivus and L3. Diagnostic (123)I-MIBG scintigraphy was performed to evaluate RmT feasibility. The latter showed uptake in the soma and paravertebral tissues of L2, multiple skeletal localisations(SL) (dorsolumbar spine, shoulder, iliac bones, femurs) and two areas close to the liver and heart wall. No paravertebral uptake at C1, clivus and D3-D5 levels. Included in an experimental protocol, 68Ga-FAPI PET/CT was performed with evidence of uptake in the abdominal lesion of the left flank/mesogastrium, paravertebral tissue(PT) of D4 and L2, multiple SL (frontal bone, basicranium, C1-C4, C7, D4-L5, ribs, left glenoid, humeri, sternum, sacrum, iliac bones, ischio-pubic branches and proximal femurs) and some para-aortic adenopathies. The patient underwent therapeutic 131I-MIBG with subsequent scintigraphic evidence of uptake in all lesions detected by FAPI-PET. Following finding of ALK mutation, the patient started Lorlatinib. A follow up CT scan, at 6 months, demonstrated a reduction of PT, adenopathies and structural changes of D7 to D12 and L5 vertebral soma. ***Conclusion:*** 68(Ga) FAPI-PET/CT showed the largest number of disease localisations compared to PET-FDG, PET-DOTANOC and diagnostic 123I-MIBG scintigraphy. This finding may play a role in the theragnostic use of FAPI in multi-metastic paraganglioma.

OP-829

[68Ga]Ga-FAPI-46 PET/CT Impacts on Management of a Incidentally Detected Lung Adenocarcinoma, Upstaging Lymph Node Metastases Over Conventional [18F]F-FDG, Diagnostic CT and EBUS

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Aim/Introduction: A 16 mm nodular lung lesion in the right inferior lobe was incidentally detected in a 57y.o. male patient, ex-smoker and without relevant and known diseases, undergoing diagnostic computed tomography(dCT). ***Materials and Methods:*** The patient was referred to our Centre for staging [18F] F-FDG PET/CT to evaluate the nodular lung lesion in the right inferior lobe and, in the suspect of lung cancer, enrolled to perform a subsequent [68Ga]Ga-FAPI-46 PET/CT(14days later) within an ongoing prospective monocentric investigational trial(EudraCTnumber:2021-006570-23). ***Results:*** [18F]F-FDG PET/CT detected significant uptake (SUVmax=4.2) only in the lung lesion, absent in lymph nodes(according to TNM8th: FDG-T1bN0). Interestingly, endobronchial ultrasound-guided biopsies resulted inconclusive in lung but positive for metastases of lung adenocarcinoma in right lower paratracheal(#4R), right interlobar peribronchial(#11R) and subcarinal(#7) lymph nodes (EBUS-TxN2). [68Ga]Ga-FAPI-46 PET/CT showed similar uptake in the lung lesion (SUVmax=3.6) and significant uptake in right prevascular (#3, SUVmax=5.7) and in the known metastatic lymph-nodes #4R (SUVmax=8.4), #11R (SUVmax=7.9) and #7 (SUVmax=4.2), but interestingly also in bilateral supraclavicular nodes (FAPI-T1bN3M0). A right supraclavicular lymph node soon became enlarged and suspicious at US, and was finally confirmed malignant (adenocarcinoma) at fine-needle-aspiration. FAPI correctly upstaged from T1bN0M0(dCT+FDG only) to T1bN3M0, excluding patient from surgery. The restaging after 6 months of Osimertinib(EGFR+) revealed a dimensional decrease of both T and N lesions at dCT, and residual faint FDG uptake in the lung lesion (SUVmax=4.2). ***Conclusion:*** It was preliminarily reported that FAPI has similar sensitivity to FDG for primary lung cancer, and overall a higher performance for metastases[1-3], although not frequently significantly changing TNM and patient management. This is an interesting example of upstaging N in lung adenocarcinoma, confirming the superior performance of experimental [68Ga] Ga-FAPI PET/CT over conventional [18F]F-FDG for the evaluation of lymph-nodal metastasis[4]. ***References:*** [1]Yang Q, Huang D, Wu J, et al. Performance of [18F]FDG PET/CT versus FAPI PET/CT for lung cancer assessment: a systematic review and meta-analysis. Eur Radiol. Published online August 17,2023. [2]Wang L, Tang G, Hu K, et al. Comparison of 68Ga-FAPI and 18F-FDG PET/CT in the Evaluation of Advanced Lung Cancer. Radiology. 2022;303(1):191-199. [3] Can C, Kepenek F, Kömek H, et al. Comparison of ^{18}F-FDG PET/CT and 68 Ga-FAPI-04 PET/CT in patients with non-small cell lung cancer. Nucl Med Commun.2022;43(10):1084-1091. [4] Wu J, Deng H, Zhong H, et al. Comparison of 68Ga-FAPI and ^{18}F-FDG PET/CT in the Evaluation of Patients With Newly Diagnosed Non-Small Cell Lung Cancer. Front Oncol. 2022;12:924223. Published 2022 Jul 4.

OP-830

An Example of Higher Accuracy of [68Ga]Ga-FAPI-46 PET/CT in Staging Mediastinal Lymph Nodes Compared to [18F]F-FDG PET/CT in a Lung Cancer Patient

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Aim/Introduction: A 60 y.o. woman underwent a diagnostic-CT in order to investigate the onset of persistent cough, asthenia, weight loss, fever and hemoptysis. Diagnostic-CT revealed the presence of a voluminous lung lesion in the right superior lobe, which needed to be staged with PET/CT. ***Materials and Methods:*** She underwent a standard [18F]F-FDG PET/CT to stage the lung lesion in the right superior lobe and, after three days, an additional [68Ga]Ga-FAPI-46 PET/CT was performed, within an ongoing prospective monocentric investigational trial (EudraCT number: 2021-006570-23) conducted in our Nuclear Medicine Department. All images were acquired 60 minutes after the radiopharmaceutical injection, with a field-of-view from the vertex to the proximal thighs. ***Results:*** [18F]F-FDG PET/CT detected intense and inhomogeneous uptake (SUVmax=28.8) in correspondence of the known lung lesion in the right superior lobe, less intense in the lesion centre for possible necrotic phenomena. Significant uptake was also described respectively in right lower paratracheal (#4; SUVmax=4.3), subcarinal (#7, SUVmax=4.9) and right hilar (#10, SUVmax=8.9) lymph nodes,suggestive for metastases (T3N2M0). [68Ga]Ga-FAPI-46 PET/CT also confirmed the intense and inhomogeneous uptake of the lung lesion (SUVmax=22.5), but did not detect any significant lymph nodal uptake (T3N0M0). Endobronchial ultrasound-guided biopsies resulted positive in lung for squamous cell carcinoma but negative for metastasis in right lower paratracheal, subcarinal and right hilar lymph nodes. Surgery confirmed biopsies ***results:*** a poorly differentiated squamous cell carcinoma, with pleural, bronchial and vascular invasion was diagnosed, without lymph nodal involvement (pT3N0Mx). Subsequently, she started chemotherapy. Last diagnostic-CT, five months after surgery, excluded relapse. ***Conclusion:*** The correct evaluation of the mediastinal lymph nodes staging is of primary importance to select patient eligible for surgery. Recently, [68Ga]Ga-FAPI-46 PET/CT showed a better performance in discriminating lymph node metastasis compared to [18F]F-FDG PET/CT [1]. This case report is a clear example of the potential impact of [68Ga]Ga-FAPI-46 PET/CT for lymph node staging, which could cover a fundamental role in decreasing false-positive results before surgery. ***References:*** [1]Kang YK, Na KJ, Park J, et al. Preoperative evaluation of mediastinal lymph nodes in non-small cell lung cancer using [68Ga]FAPI-46 PET/CT: a prospective pilot study. Eur J Nucl Med Mol Imaging. Published online March 7, 2024. doi:10.1007/s00259-024-06669-y

OP-831

Triple whole-body cross-sectional imaging ([18F]FDG PET, [99mTc]Tc-HMDP SPECT, MRI) to successfully decrypt a "PPP syndrome" (Pancreatitis, Panniculitis, Polyarthritis)

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Aim/Introduction: Patients with underlying pancreatic disease may develop extra pancreatic manifestations. The triad of pancreatitis, panniculitis, and polyarthritis, "PPP-syndrome", is rare and can be misdiagnosed. Depending on the nature of the underlying pancreatic condition, treatment can lead to complete remission, highlighting the importance of early diagnosis. ***Materials and Methods:*** A 55-yr-old man with medical history of alcoholism and previous episodes of alcoholic pancreatitis was admitted for peripheral bone pain worsening over time with heat, redness, and swelling of peripheral joints of upper and lower limbs. In addition, the patient presented many ill-defined inflammatory skin nodules suggestive of erythema nodosum. Biology tests elicited an increased CRP: 283 mg/mL and a hyperlipasemia (41000 U/L,N<53 U/L) without abdominal pain. The [18F]FDG PET scan exhibited multiple sites of hypermetabolic foci corresponding to skin nodules without pancreatic abnormal metabolism. A dual phase [99mTc]Tc-HMDP whole-body SPECT-CT demonstrated multiple areas of intense and irregular bone-seeking tracer uptake in the long bones of both extremities, both calcanei and several other tarsal bones, sparing axial skeleton. No obvious abnormal findings on twinned whole-body computed tomography were noted. These SPECT anomalies matched on MRI with areas of extensive intramedullary necrosis with multiple medullar foci of ill-defined, garland-like, T1-hypointense and T2 STIR-hyperintense lesions. ***Results:*** This pattern of abnormalities in triple whole-body cross-sectional imaging ([18F]FDG PET, [99mTc]Tc-HMDP SPECT, MRI) together with the presence of underlying pancreatic disease and a hyperlipasemia correctly pointed to pancreatitis, panniculitis, and polyarthritis syndrome, "PPP syndrome", and waived for the necessity of bone biopsy. Characteristic imaging anomalies in "PPP syndrome" include peripheral bilateral bone and joint increased uptake on whole-body 99mTc-HMDP SPECT with multiple intramedullary necrosis foci over peripheral long bones on MRI. In contrast, whole-body 18F-FDG PET shows faint metabolism of bone lesions. This syndrome is caused by the release of pancreatic enzymes into the systemic circulation (pancreatitis) with lipolysis of the subcutaneous tissue (panniculitis) and fat necrosis of bone marrow (polyarthritis). Suspicion of a pancreatic duct-vena cava fistula led to placement of a pancreatic endo-prosthesis resulting in significant regression of skeletal manifestations. ***Conclusion:*** We described a case of "PPP syndrome" in which pancreatitis with systemic release of pancreatic enzymes causes cutaneous and osteo-medullary fat necrosis. Diagnosis could be challenging because abdominal pain is often mild or lacking. However, multimodality whole-body imaging (FDG PET, bone SPECT, MRI) correctly pointed to the etiological diagnosis and obviated a bone biopsy, by displaying characteristic peripheral multiple intramedullary necrosis.

OP-832

Variable Patterns and Telltale Signs for Venous Thrombosis on Positron Emission Tomography

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Aim/Introduction: [18F]Fluorodeoxyglucose (FDG) positron emission tomography-computed tomography (PET-CT) has become a standard investigation for various malignancies, which could be associated with a higher risk of venous thrombosis. There were some studies on the diagnostic performance of PET-CT on venous thrombosis (for example, detection of venous thrombosis by focal or linear FDG hyperactivity at or along venous structure, and differentiation between tumour thrombus and bland thrombus), but the available literature remains sparse and illustrations are limited particularly for venous thrombosis presenting with FDG hypoactivity. We aim to review imaging features of venous thrombosis and to identify specific patterns on FDG PET-CT. ***Materials and Methods:*** All PET-CT using FDG in a large regional hospital within a 3-year period were reviewed for concurrent presence of venous thrombosis, their associated imaging features and patterns, as well as their causes and outcomes. ***Results:*** We identified 40 out of 8647 (0.46%) cases confirmed or suspected to have concurrent venous thrombosis. Twenty-eight cases (70%) showed FDG hyperactivity in a focal or linear pattern at or along thrombosed veins, whereas four cases (10%) showed intraluminal FDG hypoactivity located within venous structure. The latter was depicted as a linear pattern of intravenous cold defect surrounded by blood-pool or vascular-wall FDG activity, thus conforming to an "FDG railway track" sign in the plane parallel to the vessel and an "FDG polo mint" sign in the plane perpendicular to it, which were also analogous to the findings originally described for diagnosing acute pulmonary embolism on computed tomography pulmonary angiography. One case (2.5%) showed a co-existence of FDG hyper- and hypoactivity pattern, and the remaining seven cases had no observable abnormal FDG activity pattern. All of the cases with intravenous cold defects were confirmed to have bland venous thrombosis, one of which could only be unravelled by FDG PET-CT after a false-negative doppler ultrasound study, and that illustrative PET-CT also had auxiliary imaging features of limb swelling, dermal and subcutaneous oedema. ***Conclusion:*** Venous thrombosis was found to have variable patterns of FDG hyper- or hypoactivity on PET-CT. Of note, the aforementioned "FDG railway track" and "FDG polo mint" were deemed to be telltale signs in revealing the presence of bland venous thrombosis. ***References:*** 1. Hess S, Frary EC, Gerke O, et al. FDG-PET/CT in venous thromboembolism. Clin Transl Imaging. 2018;6(5):369-378. 2. Wittram C, Maher MM, Yoo AJ, et al. CT angiography of pulmonary embolism: diagnostic criteria and causes of misdiagnosis. Radiographics. 2004;24(5):1219-1238.

1801

Wednesday, October 23, 2024, 09:45 - 11:15
Hall 1

CME 14 - Translational Molecular Imaging & Therapy Committee - CXCR4 targeted Theranostics in Hematological Cancers and Beyond

OP-833

CXCR4-targeted imaging in multiple myeloma

B. Jamet;
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OP-834

PentixaFor and PentxaTher-based theranostics

A. Buck;
Universitätsklinikum Würzburg, Dpt. of Nuclear Medicine, Würzburg, GERMANY.

OP-835

Moving towards CXCR4-targeted clinical SPECT

J. Enke;
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OP-836

Imaging CXCR4 expression in cardiovascular disease and inflammation

R. Werner;
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1802

Wednesday, October 23, 2024, 09:45 - 11:15
Hall 4

Special Track 14 - Neuroimaging Committee - Debate: Fluid vs. PET Biomarkers in Neurodegenerative Disorders

OP-837

Point of View: In favor of fluid biomarkers

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Department of Neurochemistry, Amsterdam University Medical Centre, Amsterdam, NETHERLANDS.

OP-838

Point of View: In favor of PET biomarkers

A. Drzezga;
Department of Nuclear Medicine at the University Hospital of Koln, Cologne, GERMANY.

1803

Wednesday, October 23, 2024, 09:45 - 11:15
Hall X9-X12

LIPS Session 14 - Dosimetry Committee - Advanced Techniques for AI in Dosimetry

OP-839
Advanced imaging devices and reconstructions
S. McQuaid;
Barts Health NHS Trust, London, UNITED KINGDOM.

OP-840
Technical review/teaching of AI and MC methods applied in nuclear medicine IQ and dosimetry
S. Vandenberghe;
Ghent University, Ghent, BELGIUM.

OP-841
Clinical applications of AI for IQ and dosimetry
K. Shi;
Department of Nuclear Medicine, University of Bern, Bern, SWITZERLAND.

1804

Wednesday, October 23, 2024, 09:45 - 11:15
Hall X1-X4

M2M Track - TROP Session: Radiopharmaceutical Sciences + Translational Molecular Imaging & Therapy Committee: PET & SPECT Imaging in Neurology

OP-842
PET imaging using a Copper-64 labeled TREM2 antibody with blood-brain barrier transport vehicle facilitates selective assessment of tumor associated immune cells in glioblastoma mice
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Aim/Introduction: There is a high need to identify patients with glioblastoma who could benefit from novel immunomodulatory therapy approaches. PET imaging can be used to non-invasively characterize immune cells in the tumor microenvironment (TME) in living patients prior to therapy initiation. However, currently available radiotracers (i.e. translocator protein (TSPO) PET tracers) lack specificity as they bind to immune cells, tumor cells and endothelial cells. Hence, we aimed to develop an antibody-based radiotracers targeting the triggering receptor of myeloid cells 2 (TREM2) as a key biomarker of tumor associated microglia/macrophages (TAMs). ***Materials and Methods:*** A TREM2 antibody engineered with a monovalent-human transferrin receptor binding site in the Fc domain, known as the antibody transport vehicle (ATV:4D9) was covalently modified with pNCS-benzyl-NODAGA and labeled with copper-64. Syngeneic mouse models with implanted SB28 glioblastoma cells in wild-type mice (week-2) received PET imaging and cell sorting 20h after radiotracer injection. Autoradiography was performed in a subset of mice. Furthermore, we used an ATV-enabled radiolabeled human-specific TREM2 antibody (ATV:14D3) together with a transgenic mouse model expressing human TREM2. PET and autoradiography signals (tumor-to-background-ratio, TBR) as well as cellular specificity of radiolabeled ATV:TREM2 antibodies were benchmarked against TSPO PET. ***Results:*** ATV:4D9 TREM2 PET and autoradiography showed strong signals (PET TBR: 8.8 ± 0.4, autoradiography TBR: 14.9 ± 0.3) following circular distribution of TAMs in the infiltration zone. Cell sorting revealed strong selectivity of the radiolabeled TREM2 antibody for TAMs over tumor cells (16-fold) and other remaining cells (19-fold). Translation of copper-64 labeling to ATV:14D3 confirmed strong PET and autoradiography signals and TAM over tumor cell specificity (18-fold) in mice with human TREM2 expression. TREM2 PET outperformed TSPO PET by 20-fold in terms of TBR assessment of TAMs. ***Conclusion:*** PET imaging with radiolabeled ATV:TREM2 antibodies indicated high specificity for immune cells and facilitated sufficient targeting of TAMs within the TME. Successful performance of a human ATV:TREM2 antibody holds promise for translation towards imaging of patients with glioblastoma.

OP-843
Comparative assessment of nigrostriatal and mesolimbocortical D2 receptor binding after GABA(A) receptor and NMDA receptor agonist and antagonist treatment
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Aim/Introduction: GABA is the main inhibitory neurotransmitter in the CNS and believed to counteract the excitatory neurotransmitter glutamate (GLU). We assessed the impact of the GABA(A) receptor (R) agonist and antagonist muscimol (MUS) and bicucullin (BIC) and the NMDAR agonist and antagonist D-cycloserin (DCS) and amantadine (AMA) on regional D2R binding in the rat brain. ***Materials and Methods:*** In 70 rats, D2R binding was measured in baseline (BAS) and after injection of MUS (1 mg/kg), BIC (1 mg/kg), DCS (20 mg/kg) or AMA (40 mg/kg). Iodine-123-IBZM (26±4 MBq i.v.) was injected 30 min post-challenge. Imaging data were acquired 45 min later with the TierSPECT. The following regions (with a diameter ≥ FWHM of the TierSPECT) were defined on SPECT-MRI overlays: caudateputamen (CP), nucleus accumbens (NAC), substantia nigra/ventral tegmental area (SN/VTA), thalamus (THAL), frontal cortex (FC), motor cortex (MC), parietal cortex (PC), dorsal hippocampus (dHIPP) and ventral hippocampus (vHIPP). Estimations of the binding potentials (BPs) in BAS and post-challenge were obtained by computing ratios of the specifically bound compartments to the cerebellar

reference region. The regional BPs were normalized to BAS (BPn) and compared between groups. ***Results:*** BPn was reduced after MUS (A) relative to BIC in CP, NAC, FC, vHIPP, SN/VTA and THAL, (B) relative to AMA in PC, and (C) relative to DCS in CP, NAC, FC, MC, PC, dHIPP, vHIPP, SN/VTA and THAL. BPn was reduced after AMA (A) relative to DCS in CP, NAC, FC, MC, PC, dHIPP, vHIPP and THAL, and (B) relative to BIC in CP, NAC, SN/VTA and THAL. Moreover, BPn was reduced after BIC relative to DCS in PC and vHIPP. ***Conclusion:*** MUS exerted opposite effects relative to BIC and DCS throughout the nigrostriatal (NSS) and mesolimbocortical system (MSCS) with MUS increasing and BIC and DCS decreasing regional dopamine (DA) levels. In FC and MC, the impacts of MUS and BIC relative to BAS were similar. Also, the effects of AMA and DCS were opposed throughout NSS and MSCS with AMA increasing and DCS decreasing DA. However, in SN/VTA the impact relative to BAS was similar. AMA and BIC exerted opposite effects only at the site of origin and the primary projection areas of the NSS and MLCS with AMA increasing and BIC decreasing DA. GABA(A)R and NMDAR play differentiated, region-specific roles in regulating DA levels.

OP-844

Metabolic Imaging of the Brain and Brown Adipose Tissue as a Biomarker for Chronic Stress

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Aim/Introduction: Assessing chronic stress and its impact on health and disease progression is a complex task in modern medicine. Previous studies have used $^{[18F]}$FDG as a biomarker for depression, anxiety, or chronic stress in cancer patients. However, they lack specific brain patterns and assessment in preclinical models, limiting their translational potential. In this study, we present a novel approach exploring $^{[18F]}$FDG and $^{[18F]}$FTHA to image glucose and free fatty acid metabolism of the brain and brown adipose tissue (BAT) as biomarkers for chronic stress in vivo. ***Materials and Methods:*** Female and male C57BL/6J mice were subjected to different chronic stressors, including cooling, restraint, and surgery (n = 6-8/group). Static µPET/CT scans (Siemens Inveon®) were performed on fasted mice under isoflurane anesthesia after a 60-minute distribution phase in an awakened state following i.v. administration of $^{[18F]}$FDG or $^{[18F]}$FTHA. Blood glucose and fecal corticosterone metabolites (FCM) were assessed throughout the experiments. Spatial and intensity normalization, segmentation, and quantification of images were performed with PMOD software and voxel-wise analysis was done with statistical parametric mapping (SPM12). ***Results:*** FCM levels were significantly increased in chronically stressed mice over one week of stress exposure, peaking after two to three days (109 → 213 ng/50 mg). We observed significantly higher $^{[18F]}$FDG uptake in BAT of mice that were chronically cooled (2.1 SUVmean) compared to mice that were chronically restrained (1.5 SUVmean) and not stressed (1.3 SUVmean). In the surgery group, $^{[18F]}$FDG uptake in BAT even showed a five-fold increase at one day post-surgery (8.1 SUVmean). Moreover, $^{[18F]}$FTHA showed a 1.5-fold increase (1.0 SUVmean) compared to pre-surgery scans (1.5 SUVmean, 0.7 SUVmean, respectively). Whole brain $^{[18F]}$FDG uptake was significantly decreased by 50% in all stressed animals, partly related to increased blood glucose levels. Using brain atlas analysis (M. Mirrione) and statistical parametric mapping, we saw significant stressor-specific differences in regional brain uptake, e.g., in the basal forebrain septum, olfactory bulb, and brain stem following chronic restraint and surgery. ***Conclusion:*** Our findings suggest that metabolic µPET/CT imaging could be a valuable tool for noninvasively assessing brain patterns in chronic stress models and a suitable translational tool for stress and disease research in mice. Moving forward, we will focus on investigating mechanistic differences in the brain-BAT axis of different stressors and plan to extend our research to investigate the effects of chronic stress in lung cancer mouse models.

OP-845

Synthesis and evaluation of novel α-synuclein targeting probes for PD PET Imaging

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Aim/Introduction: Accumulation of α-synuclein is a major hallmark of Parkinson's disease. The development of PET tracers to visualize aggregated α-synuclein is helpful for early diagnosis and treatment of Parkinson's disease. In this study, a series of novel radiolabeled small molecule compounds targeting α-synuclein was designed and synthesized. Also, their utility as α-synuclein imaging probes in the living body was evaluated. ***Materials and Methods:*** Small molecule compounds based on benzothiazole, benzodioxole, and oxadiazole scaffolds were prepared and labeled using Cu(II) mediated radiofluorination methods, respectively. The imaging properties of the tracers were primarily screened through PET imaging at A53T mice and normal mice. Then, in vivo, PET/MR imaging was further performed on rodents after the administration of the optimal tracer. The imaging properties of the probe were also investigated through biodistribution experiments as well as ex vivo autoradiography and pathological analysis. ***Results:*** 18F-labeled small molecule compounds were obtained with an average labeling yield of 10%, and the radiochemical purity was greater than 95%. Among these tracers, in vivo PET imaging revealed that more radioactivity was significantly detected in the brain of A53T mice than those of normal mice after administration of 18F labeled benzothiazole analog, 18F-YM1. Further PET/MR images in A53T mice revealed that 18F-YM1 retained in regions with abundant expression of aggregated α-synuclein, including the striatum, thalamus, hippocampus, etc. Quantitative analysis showed that the ratios of uptake values in these regions between A53T mice and normal mice were nearly 1.6 and 1.3 at 10 min and 30 min postinjection, respectively. Furthermore, ex vivo autoradiography and histological examination confirmed the possibility of detection of aggregated α-synuclein using 18F-YM1. A biodistribution study in normal mice found that 18F-YM1 displayed moderate uptake (2% ID/g at 5min postinjection) in the brain and gradually cleared (0.4% ID/g at 60min postinjection). Metabolite analysis showed that the radioactivity signals detected by PET scanners in the brain mainly originated from the parent compounds. ***Conclusion:*** The preclinical study demonstrated that the small molecule compound based on benzothiazole scaffold owned preferable imaging prosperities, including high targeting capacity, low non-specific uptake, and favorable pharmacokinetics, etc. It may be a new candidate for α-synuclein PET imaging, and further appropriate modification might be beneficial for improving the performance.

OP-846

Development and Evaluation of [18F]FS9, Novel PET tracer for α-Synucleinopathies in PFF mouse model of Parkinson's Disease

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Aim/Introduction: Development of a specific 18F-labeled PET tracer, based on diarylbisthiazole, with excellent binding affinity to α-synuclein fibrils (α-syn), admirable selectivity over Aβ and tau fibrils in addition to favorable brain uptake and pharmacokinetics (PK) as well as its in vitro and in vivo evaluation in post-mortem patient-brain and animal models of Parkinson's disease (PD). ***Materials and Methods:*** [18F]FS9 was chosen from several leads as a result of its promising preclinical results: binding affinity and selectivity to α-syn, biodistribution, metabolite analyses, lipophilicity, PK, Blood-Brain-Barrier permeability, postmortem autoradiography of human brain with α-Synucleinopathies, and PET imaging in mouse models. FS9 was then radiolabeled, purified and utilized directly within a longitudinal study of 90-minute dynamic PET/CT scans in 12-24 weeks post intrastriatal injection of preparation of mouse α-synuclein preformed fibrils (PFF) mice (n≥3) versus age-matched post intrastriatal injection of monomeric α-synuclein mice (ctrl, n≥3). The brain regions were segmented using the Ma-Benveniste-Mirrione mouse-brain template to evaluate uptake values, time activity curves, and parametric mapping analysis. The left stratum was considered a region of interest then the left ventricle was used for an arterial input function corrected with metabolite analyses through the parametric mapping analysis. Additionally, PFF and control mice brains were used for ex vivo immunohistochemical (IHC) confirmation. ***Results:*** [18F]FS9 shows high binding affinity (Ki 2nM), excellent selectivity toward Aβ plaques over NFT (>100 fold), suitable lipophilicity (logD=2.8±0.1), plasma protein binding 0.97± 0.12 and favorable pharmacokinetics (RCY 25±5% and Purity ≥99.5%). It shows high binding to α-synucleinopathies in patients´ brains versus no binding to healthy control brains also confirmed by IHC. Besides, it shows initial brain uptake >7 %ID/g (5 min p.i.) and fast washout from the brain, as well as exceptional stability in brain (t1/2 > 8h). It shows excellent PET results in the longitudinal study in PFF (SUV between 2.0-3.9) vs control with initial uptake >10%ID/g and fast washout down to 1%ID/g (90 min). The distribution volume ratio (DVR) PET is significantly higher on the left stratum of PFF brain (DVR 1.8-2.7 ml/cm3), versus no specific signal (DVR 0.8 ml/cm3) in control mice brain. ***Conclusion:*** The rational optimization helped us to develop the groundbreaking and highly desirable tracers as a tool to detect and quantify the presence, severity, and regional distribution of α-syn and its clinical manifestations in individuals with α-synucleinopathies. [18F]FS9 shows promising binding, selectivity and imaging properties encouraging us to further investigate it first in human study. ***References:*** The project is supported by ParkinsonFonds-Deutschland.

OP-847

Translational development of [18F]FC0324, a PET radiotracer for CB_2 receptors imaging

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Aim/Introduction: Upregulation of the cannabinoid type 2 receptors (CB2R) unveils pathological processes such as neuroinflammation. We have described [18F]FC0324 as a promising PET radiotracer to image CB2R. For clinical translation, we report in vivo PET imaging studies in hCB2-AAV local overexpressed rat model and in non-human primates (NHPs). ***Materials and Methods:*** [18F]FC0324 (33±5MBq) µPET scan (120min) were performed in hCB2-AAV rats (n=6), including blocking studies with i.p. injections of CB2-selective NE40 (1 and 10mg/kg). The standardized uptake values (SUV) were recorded in the right (ipsilateral) and left (contralateral) striata. Test-retest brain PET scans (120 min) after [18F]FC0324 injection (254±26MBq) were performed on four male rhesus NHPs (9.5±2.8kg). Whole brain and regional total volumes of distribution (VT) were estimated using a compartmental model including separate input function and compartment for radiometabolites. Competitions experiments with CB1-selective (rimonabant 1 mg/kg, n=1) and CB2-selective (FC0324 and NE40, 1 mg/kg n=1 each) compounds were performed. Whole-body PET-CT scans (212±18MBq, 70 min) were performed on 3 NHPs including after blocking by NE40 (1 mg/kg; n=1). Image analysis was performed using the PMOD software. Ex vivo (NHP and human microsomes) and in vivo NHP metabolism was explored. ***Results:*** [18F]FC0324 uptake in hCB2-AAV rats showed an 8-fold increase in the ispilateral striatum compared to the contralateral. Blocking with NE40 decreased the SUV in the right striatum up to 77%. Brain time-activity curves in NHPs displayed a fast distribution followed by a rapid washout. Brain radioactivity was homogenous, with no significant difference in regional VT. Whole brain VT was 0.86±0.22 mL.cm-3 with a within-subject variability of 4.2%. Competition studies did not show any significant modification of the regional [18F]FC0324 brain kinetics. Whole-body PET-CT display a high and specific uptake of the radiotracer in the spleen, a CB2R-rich organ. In vivo metabolism in NHP was relatively fast (16% parent at 60min) but should be highly reduced in humans as suggested by in vitro metabolism study (30% vs 5% at 60 min) ***Conclusion:*** [18F]FC0324 crosses the blood brain barrier and binds to hCB2R. [18F]FC0324 displays interesting kinetics with selectivity over the CB1R. Despite a fast but not detrimental metabolism, [18F]FC0324 is a promising tracer for CB2R clinical investigation in neuroinflammation.

OP-848

Advancing Antibody-Based Brain Pretargeted PET Imaging: Assessing a Novel ^{18}F-Labeled BBB-Penetrating Tetrazine and Strategies to Improve Brain-to-Blood Contrast

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Aim/Introduction: In this study, we evaluate whether an in-house developed blood-brain barrier (BBB) penetrable tetrazine (BBBTz) with rapid trans-cyclooctene (TCO) ligation kinetics can be used for brain pretargeted PET imaging. The BBBTz was tested in an amyloid-beta (Aβ) mouse model using a TCO-modified bispecific construct (TCO-bsAb) of the Aβ targeting antibody mAb31 connected to a single-chain Fab fragment of the BBB-penetrating antibody 8D3. Additionally, we explored the potential of using a masking-Tz to enhance the brain-to-blood contrast in brain pretargeted PET imaging. ***Materials and Methods:*** The bsAb was TCO-functionalized, and affinity for Aβ and mouse transferrin receptor (mTfR), as well as antibody integrity, were assessed by ELISA and size-exclusion HPLC. TCO load was determined by radio-SDS-PAGE. Aβ imaging was evaluated in 6-8 months old 5xFAD or age-matched wild-type (WT) mice. TCO-bsAb (40 nmol/kg), was administered intravenously, and after 72h, brains were extracted, frozen, and sectioned. Sections were incubated with [18F]BBBTz, and exposed to a phosphor imager screen. Specific binding of [18F]BBBTz in the brain was assessed by comparing Aβ-rich regions (cortex and thalamus) with an Aβ-lacking region (cerebellum). Aβ pathology was confirmed with thioflavin-S staining. Next, WT mice received 15 nmol/kg TCO-bsAb. After 3h, a polar, non-BBB penetrating masking-Tz was administered intravenously at a molar Tz:TCO ratio of 20:1 or 80:1, with saline as control. After 1.5h, [18F]BBBTz (5 MBq/mouse, 200 nmol/kg) was administered intravenously. Tissue uptake of [18F] BBBTz was measured ex vivo after 2h by gamma-counting and expressed as %ID/g tissue. ***Results:*** TCO-bsAb (10 TCOs/bsAb) exhibited minor affinity alteration to Aβ and mTfR, and no change in antibody integrity. On-section Tz-TCO ligation on 5xFAD brain sections revealed a [18F]BBBTz binding pattern colocalizing with Aβ pathology, yielding a cortical/thalamic-to-cerebellar ratio of 3-6. Conversely, in WT mice, no region-specific binding of [18F]BBBTz was detected, with a cortical/thalamic-to-cerebellar ratio of 1. Notably, mice treated with masking-Tz showed markedly reduced blood concentration (20:1, -90 %; 80:1, -91%) of [18F]BBBTz, while brain uptake was reduced to a minor degree when comparing 20:1 (-33%) and 80:1 (-43%) relative to control. This led to overall cerebrum-to-blood ratios relative to control improving by a factor of 6.97 (20:1) and 6.17 (80:1). ***Conclusion:*** Our newly developed BBBTz demonstrates significant promise in brain pretargeting by successfully transversing the BBB and ligating with TCO-bsAb in the brain. When combined with a peripheral masking-Tz, brain-to-blood contrast can dramatically be improved, underscoring the potential of masking agents in brain pretargeting.

OP-849

Neuronal but not Astrocytic Tau Dominates the Signal Source of in vivo PET Signaling in 4-Repeat Tauopathies

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Aim/Introduction: Tau-PET emerged as a valuable biomarker for the differentiation of the 4-repeat (4R) tauopathy progressive supranuclear palsy (PSP) from healthy and disease controls. However, the translation of in vitro 4R-tau binding to in vivo tau-PET signals is still unclear. ***Materials and Methods:*** We conducted a longitudinal [18F]PI-2620 PET/MRI study in a 4R-tau mouse model (PS19) and age matched wild-type mice (n=10 each). Next, we performed immunohistochemistry in a subset of these PS19 and wild-type mice (n=4 each) to characterize regional tau abundance and cellular contributions to tau pathology. Cell sorting after tau radiotracer injection was applied in another subset of PS19 and wild-type mice (n=5 each) to determine the cellular origin of tau-PET signals. A key experiment of the study consisted of a correlation analysis between regional [18F]PI-2620 tau-PET signals and abundance of fibrillary tau pathology in autopsy samples of patients with definite PSP (n=6) and disease controls (n=2). In this sample, we performed a quantitative correlation analysis between tau-PET binding, autoradiography binding and abundance of AT8-positive tau pathology. An additional autopsy sample of deceased patients with PSP with limited co-pathology (n=16) was used to determine the contribution of tau-positive neurons and tau-positive astrocytes to [18F]PI-2620 autoradiography signals. ***Results:*** We found elevated PET signals in presence of high neuronal but low astroglial tau. Furthermore, we a observed higher tracer uptake in single neurons compared to astrocytes of PS19 mice. Regional [18F]PI-2620 tau-PET signals in vivo correlated strongly with abundance of fibrillary tau in subsequent autopsy samples of PSP patients and disease controls. In an additional autopsy sample of deceased patients with PSP, tau-positive neurons with high AT8 density but not tau-positive astrocytes were the driver of [18F]PI-2620 autoradiography signals. ***Conclusion:*** In summary, neuronal tau constitutes the dominant signal source of tau-PET signal increases in 4R-tauopathies, yielding the capacity to translate to an in vivo signal.

OP-850

Fibrillar amyloidosis and synaptic vesicle protein expression progress jointly in the cortex of a mouse model with β-amyloid pathology

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Aim/Introduction: Neurodegeneration and accumulation

of amyloid-β plaques are two major hallmarks in Alzheimer's disease. There is evidence that amyloid-β can trigger neuronal hyperactivity but has also been found to be neurotoxic. Thus, we aimed to investigate the temporal and spatial association between amyloid-β plaque load and synaptic density in an amyloid-β mouse model. ***Materials and Methods:*** 26 APPSL70 and 15 C57Bl/6 mice underwent longitudinal PET-scans with 18F-UCB-H to define the synaptic vesicle protein 2A (Sv2a) density, as well as with 18F-florbetaben (FBB) to determine the amyloid-β plaque load. Statistical parametric mapping was performed to uncover similarities between the binding patterns of 18F-FBB and 18F-UCB-H. ***Results:*** As expected, we found a continuous longitudinal increase of FBB in APPSL70 mice with predominance in the frontal cortex from six to twelve months of age, resulting in a significantly higher 18F-FBB-PET in cortex ($p<0.0001$), hippocampus ($p<0.0001$), and thalamus ($p=0.0007$) of APPSL70 mice compared to C57Bl/6 mice at twelve months of age. Interestingly, we also found a significant increase in Sv2a PET signals of cortex ($p=0.023$) and thalamus ($p=0.032$), as well as a trend to significance in the hippocampus ($p=0.061$) of APPSL70 mice compared to C57Bl/6 mice at 12 months of age. Statistical parametric mapping revealed a similar pattern for differences in 18F-FBB and 18F-UCB-H binding. ***Conclusion:*** This study suggests a close temporal and spatial association between synaptic density and amyloid-β plaque load. Furthermore, we found a significant increase of 18F-UCB-H PET-signal. This adds to the observed hyperexcitability of neurons in close vicinity to amyloid-β plaques as described by Busche et al. (2008) for APP23xPS45 mice, here now shown in a longitudinal PET-imaging study in APPSL70 mice and connected with the amyloid-β plaque load as measured by 18F-FBB PET. ***References:*** Busche, M. A., Eichhoff, G., Adelsberger, H., Abramowski, D., Wiederhold, K.-H., Haass, C., Staufenbiel, M., Konnerth, A., & Garaschuk, O. (2008). Clusters of Hyperactive Neurons Near Amyloid Plaques in a Mouse Model of Alzheimer's Disease. Science, 321(5896), 1686-1689. https://doi.org/10.1126/science.1162844

1805

Wednesday, October 23, 2024, 09:45 - 11:15
Hall Y4-Y9

Cutting Edge Science Track - TROP Session: Physics Committee: Data Analysis: Neuro & Cardio

OP-851

Improving visual assessment of ^{18}F-Florbetaben PET scans through the adjunctive use of quantitation: A retrospective analysis in challenging close-to-pathology cases across 18 software methods.

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Aim/Introduction: Visual interpretation of 18F-Florbetaben PET is approved and reliable for assessing brain amyloid-beta (Aβ) deposition. However, PET images of patients with Aβ levels close-to-pathology thresholds can be challenging to read. This study assessed the robustness and added value of amyloid PET quantification in a sample of challenging scans with Aβ levels close-to-pathology thresholds. ***Materials and Methods:*** 18F-Florbetaben PET scans (n = 81) from end-of-life subjects with post-mortem histopathological confirmation of the presence or absence of Aβ neuritic plaques on a 4-point scale (Aβ-: none, sparse; Aβ+: moderate, frequent) were analysed. PET scans were visually assessed by 8 independent and blinded readers (3 experts and 5 newly trained readers). PET scans were quantified using 18 software methods excluding those cases that did not pass quality control. Sensitivity and specificity of quantitative and visual assessment were determined in the close-to-pathology threshold subpopulation (n=36) (i.e. Aβ load was sparse or moderate by Bielschowsky silver staining and/or immunohistochemistry, scans with none or frequent Aβ plaques were excluded). In this subpopulation, the frequency of discordant visual and quantitative assessments and their respective agreement with histopathology was assessed. ***Results:*** Sensitivity and specificity (mean±SD) across software packages in the close-to-pathology threshold subpopulation were 96±4% and 92±4%, respectively. Expert readers' sensitivity and specificity were 93±5% and 85±5%, respectively, newly trained readers had 93±7% and 68±25%, respectively. Across all possible pairs of readers and software methods (n=4896) where visual and quantitative assessment was discordant (n=412, 8.4%), quantitation agreed more often with histopathology than visual assessment. In the Aβ-positive discordant subset, readers correctly identified plaque presence, but quantification did not in 1.3% instances, while quantitation correctly identified plaque presence, but readers did not in 2.7% instances. In the Aβ-negative discordant subset, there were no instances in which readers correctly identified plaque absence, but quantification did not. Furthermore, quantitation correctly identified plaque absence in 4.4% instances where readers failed. ***Conclusion:*** This study demonstrated the excellent sensitivity and specificity of quantitative methods in close-to-pathology threshold cases, supporting their use as an adjunct to visual assessment in this population. A benefit of quantification in this challenging population was observed in newly trained readers to identify Aβ-negative scans.

OP-852

Comparing Models for Myocardial Blood Flow Quantification of Flurpiridaz F^{18} PET

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Aim/Introduction: Flurpiridaz F^{18} is a novel PET myocardial perfusion imaging tracer that is currently being evaluated in clinical trials. Its high first pass extraction and small positron range make it an ideal tracer for myocardial blood flow (MBF) quantification. Various models to quantify MBF from time activity curves (TAC) have been proposed. The aim of this study is to compare these models in terms of error in MBF estimation and goodness of fit on data from clinical scans. ***Materials and Methods:*** 10 min dynamic Flurpiridaz PET imaging was performed in 13 patients with suspected coronary artery disease (CAD) in a 1-day rest/

stress protocol using 110/240 MBq respectively. TACs from three coronary artery territories (LAD, LCX, RCA) and 17 segments (AHA model) were analyzed using a two tissue compartment model (2TC, [1]), one tissue compartment model (1TC) and Packard model (1TC with no efflux (k2=0) fitted only over the first 90s after injection, [2]). Standard error on fitted K1 (a measure for MBF) was compared and goodness of fit was evaluated using the Akaike information criterion with small sample size correction (AICc) which penalizes models with more parameters. ***Results:*** Mean K1 values for all patients and models combined were 0.87 and 2.09 ml/min/g for rest and stress scans respectively. The mean MBF per model deviated at maximum 5% from the overall mean. However, only the 2TC model resulted in outliers (K1 > mean+3SD): 1/39 for territories, 6/221 for segments. The standard error (SE) on the fitted K1 parameter was comparable for 2TC and Packard models but significantly lower for 1TC, especially for rest scans. Comparing the goodness of fit by means of the AICc showed that for territorial analysis 2TC, 1TC and Packard were preferred in 32%, 68% and 0% of exams. For segmental analysis this was 33%, 66% and 1% for 2TC, 1TC and Packard respectively. ***Conclusion:*** All three models can estimate MBF and result in comparable absolute values. The 2TC model was least robust, especially for noisier data from smaller ROIs. The Packard model was robust, but rarely the preferred model based on the AICc. Therefore 1TC seems to be the optimal model for MBF quantification. When using the 2TC model care should be taken to implement quality control for the fit result since this model can result in erroneous MBF estimation, especially for noisier TACs. ***References:*** [1] Nekolla et al. 2009; [2] Packard et al. 2014.

OP-853

From coarse to refined: Fully automated amyloid brain PET spatial normalization pipeline using Convolutional Neural Networks without MRI

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Aim/Introduction: Spatial normalization (SN) of Amyloid Brain PET images is crucial for tasks like amyloid burden quantification. Traditional methods rely on MRI images and require computation from scratch for each new registration process. Neural networks could store patterns of the PET images, significantly accelerating the registration process. However, manual coarse registration is still necessary beforehand to ensure approximate alignment of input images, since the raw input may undergo rotations, translations, or inversions. Therefore, we propose a fully automated pipeline based on convolutional neural networks (CNNs) to tackle challenges from coarse to refined registration, enabling rapid and accurate SN procedure of PET images to the MNI space. ***Materials and Methods:*** We introduce a multitask CNN that simultaneously predicts the anterior commissure's position and head directions for rigid transformations. We've enhanced the standard VoxelMorph algorithm with data augmentation and an Amyloid PET template, enabling refined registration through local displacement field predictions. SPM12 registration results serve as the Ground Truth to match the Centiloid Scale. We use WHUH (nPiB=115, nAV45=255) and ADNI-Patho (nPiB=13, nAV45=115) for training and validation, with external testing on the GAINN-PiB, GAINN-AV45, GAINN-FBB, and GAINN-Flutemetamol datasets. ***Results:*** Our multitask convolutional neural network predicts the anterior commissure position with an error of 5.31±3.46mm, 5.33±2.84mm, 4.46±2.06 mm, and 5.72±2.86mm, the anterior commissure-posterior commissure direction with an error of 5.31±3.62°, 5.43±4.16°, 5.38±3.61°, and 5.61±3.95°, and the anterior commissure-superior direction with an error of 4.60±2.44°, 5.04±3.72°, 5.19±3.56°, and 5.10±3.43° respectively on the testing dataset. Following the standard Centiloid procedure, we recalculated the PiB Centiloid Scale, achieving an R2 value of 0.99 compared with the result reported in the Centiloid paper. We also computed the SUVr suggested by the Centiloid project on the testing datasets, with an error of 3.55±2.42%, 3.92±3.23%, 4.07±2.83%, and 6.68±4.52% respectively. Compared to the standard SPM registration process, which takes an average of 170±18s per image and requires manual coarse registration beforehand, our automated SN pipeline requires no human intervention and registers images in an average time of 1.37±0.71s. ***Conclusion:*** Our fully automated normalization pipeline demonstrates excellent accuracy, aligns well with the Centiloid Scale, and exhibits good generalization performance across tracers. Our method can handle transformations including rotation, translation, and flipping in PET images, making it promising for application in fast, automated, and large-scale data normalization across centers, and scenarios where MRI images are not available.

OP-854

^{68}Ga-FAPI-04 PET/CT for cardiotoxicity visualization of cancer therapy: kill two birds with one stone

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Aim/Introduction: The development of cancer therapy extends the survival time for cancer patients. However, exposure to corresponding therapy contributes to cardiac toxicity, which could compromise the quality life of cancer patients. While fibroblast activating protein inhibitor (FAPI) PET is increasingly utilized for cancer staging, its application for damaged myocardium induced by cancer therapy still needs to be investigated. ***Materials and Methods:*** The retrospective study included 35 patients who underwent 68Ga-FAPI-04 PET/CT between August 2021 and November 2023. All of them were examined pre- and post-cancer therapy. Cardiac FAPI uptake was analyzed based on the uptake location, pattern and value. Cardiovascular risk factors, cardiac serum biomarker, electrocardiogram (ECG) and left ventricular ejection fraction (LVEF) from transthoracic echocardiography (TTE) were also analyzed. Myocardial FAPI uptake was further assessed based on different cancer therapy classification and the corresponding cycles. ***Results:*** All 35 patients (22 men, 13 female; 58.7±12.3) were pathologically diagnosed as malignant. The baseline 68Ga-FAPI-04 PET/CT demonstrated FAPI-negative myocardium uptake, while FAPI-positive myocardium uptake was observed in 11 patients (31.4%) after cancer therapy. 2 out of 11 patients (18.2%) showed diffuse myocardial FAPI uptake pattern, 3 patients (27.3%) demonstrated focal on diffuse uptake pattern, and the other 6 patients (54.5%) presented focal uptake pattern. In addition, a total of 19 uptake lesions were identified. 8 lesions (42.1%) were located in interventricular septum, 5 lesions (26.3%) were in inferior wall, 3 lesions were (15.8%) in apical part, 2 lesions (10.5%) were in anterior wall, and the 1 remaining lesion (5.3%) was in lateral wall. The lesion SUVmax value was 3.6±1.6 and the tumor-to-background ratio (TBR) was 3.3±1.5. The linear regression analysis demonstrated both LVEF and smoking had a strong correlation with myocardial FAPI SUVmax value ($r = -0.72$, $p < 0.01$; $r = 0.61$, $p < 0.05$), while diabetes and BNP displayed the

moderate and weak correlation with SUVmax value respectively (r = 0.45, p < 0.01; r = 0.27, P < 0.05), whereas moderate correlation was demonstrated between TBR and LVEF (r = 0.52, P < 0.05). Additionally, myocardial FAPI uptake was more likely to occur after the second cycle (P < 0.05). ***Conclusion:*** 68Ga-FAPI-04 PET /CT could be the one-stop shop for cancer TNM staging and therapy evaluation, along with detecting therapy-induced cardiac damage.

OP-855

Findings from a medical algorithmic audit of a clinical decision support system for the detection of cardiac amyloidosis based on ^{99m}Tc-scintigraphy images

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Aim/Introduction: Research on clinical decision support systems (CDSS) for medical imaging typically focuses on performance metrics, but even high-performing systems can fail when deployed in real-world clinical environments, potentially posing a danger to patients' lives. Therefore, thorough evaluation of CDSSs is essential for successful clinical implementation. This study conducted a medical algorithmic audit (MAA)(1) for a CDSS previously evaluated to have high diagnostic accuracy in detecting cardiac amyloidosis using bone scintigraphy imaging(2). The study aimed to critically assess the CDSS's robustness, safety, clinical applicability, and limitations. ***Materials and Methods:*** Overall, the MAA involved 22613 bone scintigraphy scans from 19453 patients across nine international medical centers. Imaging data included four 99mTc-tracers including DPD, HMDP, MDP, and PYP. Parameters related to patients, image acquisition, and predictions were gathered. The audit was conducted by a team of three nuclear medicine specialists, two artificial intelligence experts, and a cardiologist. The audit included scoping, mapping, artifact collection, testing, and reflection phases. The CDSS was tested for variations in tracers, imaging protocols, scanners, centers, and patient demographics, and failure modes were explored and quantified using a failure modes and effects analysis (FMEA). ***Results:*** The CDSS demonstrated robust performance across various scanners (AUC 0.933-1.000), tracers (0.925-1.000), centers (0.925-1.000), and demographic factors (0.985-0.996). Lower performances were consistently associated with two centers using substantially different imaging protocols including [99mTc]Tc-PYP. Systematic validation using images acquired after development of the AI system did not indicate data drift over time (p<0.05). In the exploratory error analysis, seven common failure modes were identified from 64 misclassifications (0.3%), with extracardiac uptake being the most frequent. As a consequence of intermediate findings of the MAA, an attention map validator algorithm was developed. This algorithm reduced false positives by 7/16 (44%). The FMEA assessed multiple clinical implementation scenarios, identifying the safest as integrating the CDSS in tandem with nuclear medicine physician reading, including alerts for positive detections. ***Conclusion:*** This audit highlighted the CDSS weaknesses and their mitigation, underscoring the importance of comprehensive evaluations of medical AI systems, especially in the context of real-world clinical environments. Through the MAA, we defined operational boundaries and conditions for safe CDSS Usage, facilitating clinical integration and emphasizing the need for ongoing improvement and monitoring of deployed medical AI-systems. We believe that the evaluation framework provided by the MAA can enable critical and systematic assessment, allowing for developing effective, reliable, and safe CDSSs in nuclear medicine. ***References:*** (1)Liu,-X.-et-al.-Lancet-Digit-Health (2022) (2)Spielvogel,-C.-P.-et-al.-Lancet-Digit-Health-(2024)

OP-856

Energy demands of resting state brain connectivity

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Aim/Introduction: Resting-state functional connectivity (rsFC) has been one of the most active research areas of systems neuroscience in the last 20 years. Intriguingly enough, it is still unclear if and how much energy rsFC demands, in general and relative to structural connectivity (SC). Previous studies reported that SC and rsFC were significantly correlated; SC was highly predictive of the presence and strength of rsFC, but SC could not be reliably inferred from rsFC; indirect SC accounted for some FC observed between regions lacking direct SC. ***Materials and Methods:*** We analyzed diffusion-tensor imaging (DWI), functional-magnetic-resonance-imaging (fMRI), and fluorodeoxyglucose (FDG) positron-emission-tomography (PET) data of 55 healthy, middle-aged individuals. Each subject underwent 2 identical scanning sessions. Images were spatially parcellated into 106 brain regions. SC was measured by probabilistic tractography. rsFC was estimated from fMRI data as Pearson correlation between blood-oxygen-level-dependent signals of each pair of regions. We fitted 3 sets of regression models: one set with SC as predictors, another with rsFC as predictors, and a third set with both SC and rsFC as predictors. Each set included 5 regression models, one linear and 4 non-linear. The complete dataset was split into a training (80%) and test set (20%), grouped by subject. All regression models were trained using the same training set, with 5-fold cross validation repeated 5 times. Mean and standard deviation of the adjusted R2 scores and root-mean-squared-error (RMSE) were reported as model performance metrics. ***Results:*** SC explained up to 74% variance in glucose metabolism. In contrast, rsFC explained only up to 29% variance. SC-based models significantly outperformed rsFC-based models across all regression models - the mean adj. R2 of each SC model was more than double that of its counterpart FC model, and the mean RMSE of each SC model was lower than its counterpart FC model. Critically, rsFC did not add to the predictive power when combined with SC. These results were reproducible. ***Conclusion:*** SC outperformed rsFC in predicting brain glucose metabolism across various model complexities, and rsFC did not provide additional predictive power. These results are in line with the view that white matter infrastructure is essential for maintaining the baseline level of brain function, and is the key consumer of energy at rest. Even if rsFC truly reflects indirect SC, these connections do not impact glucose metabolism, thus being energetically irrelevant. Our results question the unique role of rsFC for brain function at rest.

OP-857

Support vector machine classification of ^{18}F-FDG PET scans in ALS patients with and without C9orf72 mutations versus controls

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Aim/Introduction: Previous studies underscored the diagnostic value of 18F-FDG PET in Amyotrophic Lateral Sclerosis (ALS) (1), consistently revealing group-level differences between ALS patients and controls, and differences in cerebral glucose metabolism between patients with and without a C9orf72 repeat expansion (2, 3). Yet, refining diagnostic algorithms and managing inter-centre variability is imperative to improve the reliability and generalizability of diagnostic methods in ALS using 18F-FDG PET. In this study, we employed support vector machines (SVM) to further explore the diagnostic potential of 18F-FDG PET in ALS, and its ability to classify patients with or without C9orf72 mutations. ***Materials and Methods:*** 20 healthy controls (HC; 62.4 ± 6.2 y, 12F/8M), 46 ALS patients with a C9orf72 repeat expansion (C9-ALS; 57.9 ± 8.0 y, 20F/26M) and 182 sporadic ALS patients (sALS; 65.7 ± 10.7 y, 82 F/100 M) underwent a 18F-FDG PET scan, 30 - 60 min post injection. All patients were diagnosed by an experienced neurologist. 18F-FDG PET images were spatially normalized to MNI space and subsequently converted to vectors with unit length. Soft margin SVMs with the linear kernel (Python v3.9, scikit-learn v0.24.2) were trained with 10-fold cross-validation which was repeated over 10 times with subjects being randomly reshuffled. Class weights were applied to balance the group sizes. The trained SVM classifiers were evaluated by sensitivity, specificity, and accuracy. ***Results:*** The binary SVM resulted in an sensitivity (mean ± std) of 0.902 ± 0.011, specificity of 0.895 ± 0.015 and overall accuracy of 0.900 ± 0.010 for classification between C9-ALS and HC, and of 0.919 ± 0.005, 0.870 ± 0.024 and 0.914 ± 0.005 respectively between sALS and HC. For the SVM classification between C9-ALS and sALS, the accuracy was 0.709 ± 0.014 for C9-ALS and 0.740 ± 0.012 for sALS. ***Conclusion:*** Binary SVM classified 18F-FDG PET scans of HCs and ALS patients with high sensitivity. The classification between C9-ALS and sALS achieved accuracies higher than 0.700 for both classes, showing that the pattern of brain involvement in C9-ALS considerably differs from sALS. These findings underscore the evolving role of PET imaging in diagnosing ALS, and in elucidating its heterogeneity. However, to further ensure the robustness of our findings across diverse populations, validation in larger cohorts is essential. ***References:*** 1. L. D'hulst et al., Amyotroph Lateral Scler Frontotemporal Degener. 19, 570-577 (2018).2. A. Cistaro, P. Alongi, F. Caobelli, L. Cassalia, Curr Med Chem. 25, 3131-3140 (2018).3. J. De Vocht et al., Cells. 12, 933 (2023).

OP-858

Multimodal Deep Fusion of MRI and DaT Scans for unsupervised stratification of Parkinson's Disease

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Aim/Introduction: Parkinson's disease (PD) is a progressive neurodegenerative disorder affecting over 6.2 million individuals worldwide [1]. The FP-CIT SPECT (DaT scan) is the most commonly used neuroimaging technique for PD diagnosis. This study aims to develop a deep learning model that synthesizes DaT scans using a multimodal approach, integrating structural information from T1-weighted MRIs, and to generate a low-dimensional representation of DaT images to facilitate unsupervised analysis and stratification of PD. ***Materials and Methods:*** Data were sourced from the Parkinson's Progression Markers Initiative, encompassing 145 healthy controls, 455 PD subjects, and 54 scans without evidence of dopaminergic deficit (SWEDD) with baseline structural T1-weighted MRI available. T1-weighted MRI and DaT scans were co-registered and normalized to MNI space. The BRATS-MRI generative diffusion model was adapted to process joint inputs of T1 and DaT scans, synthesizing DaT images and compressing them into a latent space. Evaluation metrics included mean squared error (MSE), normalized difference, contrast-to-noise ratio (CNR), and ROI-wise analysis in regions such as the putamen, caudate, hippocampus, amygdala and cingulate. An unsupervised clustering algorithm, optimized by the Calinski-Harabasz score, was employed to explore inherent variations within the PD spectrum. ***Results:*** The reconstructed DaT scans exhibited a low MSE (0.00065 ± 0.00078), indicating minimal intensity discrepancies. Normalized difference and CNR analyses confirmed unbiased reconstructions. No statistically significant differences were found in ROI-wise comparisons. The clustering algorithm discerned three distinct clusters: majority of healthy controls were categorized into one cluster and the majority of PD subjects into another. Interestingly, the majority of SWEDD subjects were grouped predominantly with the PD patients. This suggests that despite the lack of dopaminergic deficit, SWEDD subjects share certain imaging characteristics with the PD group, which might indicate a subset of PD or a different neurodegenerative trajectory. ***Conclusion:*** This study demonstrates the potential of a multimodal deep learning approach to synthesize DaT scans from T1-weighted MRIs and to derive meaningful low-dimensional embeddings for PD stratification. The inclusion of SWEDD subjects in the PD cluster underscores the complexity of neurodegenerative disease diagnosis and highlights the utility of this approach in potentially redefining neurodegenerative spectra. ***References:*** [1]Caminiti,doi:10.1002/mds.28818;[2] Rombach, https://doi.org/10.48550/arXiv.2112.10752

1806

Wednesday, October 23, 2024, 09:45 - 11:15

Hall Z

Clinical Oncology Track - TROP Session: Oncology & Theranostics Committee: Radioembolisation and Therapy

OP-860

Transarterial radioembolization (TARE) inCOlorectalMEtastasis of liver (TACOME) Trial

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Aim/Introduction: Investigate effective tumor and safe healthy liver doses in radioembolization for colorectal cancer liver metastasis (CRLM) using multicompartment dosimetry. ***Materials***

and Methods: This multicenter retrospective single-arm study (NCT06030232), included adult patients with metastatic colorectal cancer (mCRC) treated using 90Y glass microspheres from January 2014 to December 2021 in 8 centers in Turkey. All 99mTc-MAA sessions data were reviewed and pretreatment dose estimations were performed centrally by using Simplicit90Y software. Mean tumor, perfused volume, normal and whole liver doses were calculated. Treatment response was evaluated by 18F-FDG PET images. Pre and posttreatment total lesion glycolysis (TLG)s were calculated from all lesions in the perfused liver volume. Metabolic tumor response was categorized as follows; A change in metabolic activity of -100% was considered a complete response (CR), -45% to -99% was considered a partial response (PR), +75% to -44% was considered stable disease (SD), and +75% was considered progressive disease (PD). The categories were subsequently grouped into objective response (CR + PR) and non-response (SD + PD). All adverse events were evaluated using the Common Terminology Criteria for Adverse Events (CTCAE) version 5. ***Results:*** 202 patients form 8 centers were recruited. Following exclusion of patients with suboptimal imaging for response evaluation or Tc-99m MAA dose calculations, 177 (112M; 64F, mean age:61,8±0.8) patients were included to the final analysis. Mean absorbed tumor doses of responder and non-responder patients were found significantly different (250.41±126.61 vs 106.28±41.17 p=0.001). A strong correlation was observed between mean absorbed tumor dose and response to treatment (p=0.001) (figure 1 and 2). In the ROC analyses cut-off values; 109.3 Gy (sens:68%, spec:73%, AUC: 0.728, p=0.001) for mean perfused volume dose and 151.9 Gy (sens:93%, spec:89%, AUC: 0.945, p=0.001) for mean absorbed tumor dose were calculated (figure 3). There was no difference between treatment response rates related to KRAS mutation status (60% vs 59%, p=0.97). In the multivariate regression model, the only predictive factor for response was mean absorbed tumor dose (p=0.001). Baseline CEA levels (p=0.66), Ca-19-9 levels (p=0.65), location of the primary tumor (right vs other) (p=0.66) and K-RAS mut vs wt (p=0.99) were not predictive of response. In the whole patient group while ALBI scores were upgraded in 38 (26%) patients after treatment, Grade 3 hepatotoxicity was seen in 1 patient representing with transient hyperbilirubinemia. ***Conclusion:*** In patients with CRLM delivery of at least 152 Gy dose to tumor strongly correlated with tumour metabolic response.

OP-861

Predictive value of [^{99m}Tc]Tc-MAA SPECT/CT personalised dosimetry in ^{90}Y radioembolization of hepatocellular carcinoma: DOSISPERE-01 post-hoc study

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Aim/Introduction: The landmark DOSISPHERE-01 study underscored the importance of multi-compartmental dosimetry in radioembolization. Dosimetry-guided treatment planning relies on the predictive accuracy of [99mTc]Tc-MAA-SPECT/CT. The purpose of this work was to determine the agreement between tumour absorbed dose (TAD) and normal tissue absorbed dose (NTAD) measured pre and post-procedurally in the DOSISPHERE-01 study. ***Materials and Methods:*** A post-hoc, validation analysis of prospectively acquired data from the DOSISPHERE-01 study. Patients with pre-procedural [99mTc]Tc-MAA-SPECT/CT and 90Y imaging (Bremsstrahlung-SPECT/CT or 90Y-PET/CT) were eligible for inclusion. Pre and post-treatment dosimetry was performed using a multi-compartment method, using two distinct segmentation approaches: anatomic (CT/MRI-based) and functional ([99mTc]Tc-MAA count threshold-based). Association between predicted TAD and NTAD from pre-treatment dosimetry and actual delivered doses were assessed using Pearson's correlation coefficient (PCC) and Bland-Altman analysis. ***Results:*** For the anatomical workflow, 37 patients were evaluated. A strong correlation between simulation and therapy TAD and NTAD was noted (PCC of 0.92 and 0.78 respectively). TAD estimated from [99mTc]Tc-MAA-SPECT/CT was greater than that from 90Y imaging (7.7% increased) (mean:11.9Gy, 95% limits of agreement (LoA):-85.6Gy, 109.5Gy), and NTAD was lower (2.1% decreased) (mean:-8.2Gy, LoA:-72.4Gy, 56.0Gy). For the functional workflow, 42 patients were included. The PCC for TAD and NTAD was 0.88 and 0.74 respectively. The relative overestimation of [99mTc]Tc-MAA-SPECT/CT TAD compared to 90Y imaging (24.7% increased), (mean:48.3Gy LoA:-81.7Gy, 178.4Gy) and underestimation of NTAD (27.0% decreased) (mean:-27.0Gy, LoA:-91.3Gy, 37.3Gy) was greater for this workflow. ***Conclusion:*** A strong correlation between absorbed dose metrics from pre and post-procedural imaging was identified. An anatomical segmentation workflow exhibited closer agreement than a functional segmentation workflow.

OP-862

Interim AnalysisAssessment of Hypoxia Before Radioembolization Treatment With ^{18}F-FMISO PET (ARTE-MISO Trial):

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Aim/Introduction: Transarterial radioembolization (TARE) stands out as a prominent therapeutic option for primary and secondary liver tumors. Its primary mechanism of action involves radiation-induced injury. Hypoxia within the tumor microenvironment has been posited as one of the underlying mechanisms contributing to radiation resistance.In this pilot study, our objective was to analyze and quantify the extent of hypoxia within liver tumors and evaluate its impact on treatment response to TARE. ***Materials and Methods:*** Patients who received transarterial radioembolization (TARE) for liver tumors were included prospectively from August 2023, with planned completion in August 2024. This abstract presents the interim analysis of the study(ClinicalTrials.gov Identifier: NCT06027021), aimed at analyzing the effect of tumor hypoxia measured by ^{18}F-FMISO PET on the response to TARE. Within 4 weeks prior to TARE, all patients underwent ^{18}F-FMISO PET imaging. Maximum standardized uptake value (SUVmax) and mean standardized uptake value (SUVmean) of all VOIs were recorded for analysis. Tumor-to-muscle ratio (TMR) and tumor-to-blood pool ratio (TBpR) were calculated. Response to treatment was assessed radiologically and metabolically. ***Results:*** Total of 30 lesions from 11 patients (mean age: 57.8 ± 11.4, 8 males and 5 females) were included in the interim analysis. Following transarterial radioembolization (TARE), partial response (PR) was observed in 18 lesions (60%), complete response (CR) in 8 (27%), stable disease (SD) in 3 (10%), and progressive disease (PD) in

1 (3%) lesion.The median values of ^{18}F-FMISO SUVmax (p=0.2) and tumor-to-blood pool ratio (TBpR) (p=0.3) for responder and non-responder lesions did not show significant differences. However, the median tumor-to-muscle ratio (TMR) values differed significantly (median: 2.65, range: 0.5-5.1 vs. median: 3.15, range: 2.5-3.4, p=0.03) between the two groups.Cut-off values were calculated as follows: 3.0 for ^{18}F-FMISO SUVmax (sensitivity: 80%, specificity: 75%, AUC: 0.71, p=0.18), 1.62 for TMR (sensitivity: 77%, specificity: 100%, AUC: 0.89, p=0.01), and 1.79 for TBpR (sensitivity: 88%, specificity: 75%, AUC: 0.80, p=0.06) for predicting response to treatment. Based on the cut-off value for TMR, the treatment response rate was 100% for non-hypoxic tumors and 60% for hypoxic ones (p=0.02). ***Conclusion:*** The results of this analysis suggest that the evaluation of tumor hypoxia with ^{18}F-FMISO before treatment in patients undergoing TARE may have a potential role in predicting treatment response. Upon completion of the study, dose threshold values required to achieve response in hypoxic tumors will also be calculated with analysis of a larger number of lesions.

OP-863

Hepatobiliary Scintigraphy and Holmium-166 Radioembolization with Personalized Dosimetry for Hepatocellular Carcinoma: Feasibility of a One-day Evaluation including Simulation and Functional Assessment, and Functional Follow-up

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Aim/Introduction: Personalized dosimetry increases the efficacy and safety of TARE (TransArterial RadioEmbolization). But recent publications tend to confirm that in an HCC (HepatoCellular Carcinoma) context, functional information is also crucial. First, our aim was to demonstrate the feasibility of a HBS (HepatoBiliary Scintigraphy) done just after a 166Ho (Holmium-166) scout simulation, correcting for the scatter. Then, we compared it with the follow-up by HBS. ***Materials and Methods:*** 21 patients suffering from HCC simulated with 166Ho-PLLA (Poly-L-Lactic Acid) « scout dose » were included, for a total of 24 simulations, leading to 24 baseline HBS (the week preceding the scout dose) and 24 post-scout HBS (just after the scout dose, the same day). Among those 21 patients, 15 were treated with 166Ho-PLLA, leading to 15 follow-up HBS (3 months after treatment). The HBS were conducted on our SPECT/CT system following well-documented acquisition parameters. Whole liver clearance calculation was done in our own software developed to automatize the post-processing and maximize the reproducibility. Local liver clearances were assessed combining anatomical information, functional information, and dosimetry, in current software's. To compare the 24 whole liver clearances before and after scout, a Student paired t-test was done (data being normally distributed). Then, whole liver clearances and non-treated liver clearances (based on a 60 Gy isodose curve segmentation) at the different time points were compared, including coefficients of determination calculation. ***Results:*** The t-test showed non-significant differences between the whole liver clearances before and just after the injection of the scout dose, with a p-value of 0.65. Distributions seem similar, but with a poor correlation (R2 = 0.6). Focusing on whole liver clearances comparison, baseline versus 3 months after TARE, we see less similar distributions with a mean decrease, and still a bad correlation (R2 = 0.66). It's quite the same when comparing post-scout and 3 months after TARE follow-up (R2 = 0.69). The correlations between the non-treated liver clearances, baseline versus post-scout, baseline versus 3 months after TARE follow-up, and post-scout versus 3 months after TARE follow-up, seem better (R2 = 0.71, R2 = 0.75, and R2 = 0.76 respectively). ***Conclusion:*** These results indicate that a HBS just after the injection of the scout dose is feasible and seems more accurate regarding the non-treated liver clearance than regarding the whole liver clearance. Compared to the baseline HBS, both allow good prediction of the non-treated (future remnant) liver clearance 3 months after TARE.

OP-864

Dosimetric-guided therapeutic efficacy of ^{177}Lu-tin colloid radio-synovectomy in patients with inflammatory knee joints conditions

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Aim/Introduction: Radiosynovectomy (RSV) uses the radionuclide loaded colloidal particles such as 177Lu-tin-colloid which are rapidly phagocytized by macrophages in the inflamed synovial membrane that leads to the reduction in the synovial inflammation. Our prior experience with 177Lu-tin colloid treatment in inflammatory arthritis patients showed promise, yet was restricted to intra-articular injection of empirical activity in a small cohort. Thus, present study is aimed to assess the therapeutic efficacy with dosimetrically estimated 177Lu-tin-colloid RSV in patients with chronic inflammatory knee joint conditions. ***Materials and Methods:*** Dosimetry of 177Lu-tin-colloid was adapted by absorbed dose profile given by Torres M. et al. Considering the S-Values (Gy/MBq*h) for 250 cm2 synovium area, 0.02 cm thickness of synovial lining cells, and assuming the complete radionuclide decays in the knee joint, the 90Y-dose equivalent therapeutic activity of 177Lu-tin colloid was estimated by varying the prescribed absorbed dose with severity of disease and administered intra-articularly to the inflamed knee joint. Blood pool bone scan and clinical parameters e.g. mobility score (0-3), pain score (0-10), analgesic score (0-6), tenderness score (0-3) and joint swelling score (0-3) were performed at baseline, 6, 12 and 24 month from RSV. The patients with > 50% decrease in the cumulative scores of clinical parameters from baseline and a return of blood pool activity to background (thigh) level were considered as responders to therapy. ***Results:*** A total of 62 knee joints in 58 patients with various inflammatory joints conditions like rheumatoid arthritis (24 joints), pigmented villonodular synovitis (12 joints), Hemophillic arthritis (9 joints), lipoma arborescens (5 joints), non-specific chronic synovitis (7 joints), spondyloarthritis (4 joints), psoriatic arthritis (1 joint), underwent intra-articular injection of dosimetrically estimated activity 1750-2220 MBq of 177Lu-tin-colloid to inflamed knee joint. Of 62 inflammatory knee joints, 48 joints (~77%) were considered as responder and 14 (~23%) as non-responders at 6-months. Of 48 joints, remission were seen in 41 joints (~85%), while 7 (~15%) had recurrences at 1 year duration. Further, long term follow-up at 2-years, 35 (~73%) had complete remission and 13 (~27%) had recurrence. There was significant reduction in blood pool activity as well as change in cumulative score of clinical parameters at 6, 12 and 24 months when compared with baseline ($p<0.05$). No lymphedema, infection, radio-necrosis, or any other serious adverse effects were observed in any patient. ***Conclusion:*** Dosimetrically-guided 177Lu-tin colloid RSV is useful treatment modality for long-term remission in patients of chronic inflammatory joints.

OP-865

The correlation between tumor dosimetry and clinical parameters with therapy response and overall survival in patients with hepatocellular carcinoma, who underwent transarterial radioembolization treatment

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Aim/Introduction: The aim is to determine the correlation between tumor dosimetry and clinical parameters with therapy response(TR) and overall survival(OS) in hepatocellular carcinoma(HCC) patients,who received transarterial radioembolization(TARE) treatment. ***Materials and Methods:*** The patients diagnosed with HCC were included in the study,who underwent TARE treatment with glass microspheres.BCLC stages, Child-Pugh, MELD and ALBI scores were obtained from the documentation of pre/post-treatment clinical,laboratory and radiological findings.Baseline SUVmax values were calculated from F^{18}-FDG PET/CT images.The TR was assessed according to mRECIST and PERCIST criteria based on MRI and/or F^{18}-FDG PET/CT scans obtained at 3-6 months.The patients were divided into four groups:complete response (CR),partial response(PR),stable disease(SD),progressive disease(PD).Multicompartment dosimetry data were calculated from hepatic artery perfusion SPECT/CT images.The relationship between clinical and dosimetry data with OS was ascertained by Kaplan Meier and Cox regression analyses. The threshold perfused tumor doses(PTD) for the prediction of 'CR' and'CR or PR'were determined by ROC analysis. ***Results:*** 71 patients were included into the study(Table-1).During the follow-up; CR was observed in 17 patients, PR in 25 patients ,SD in 10 patients and PD in 19 patients.OS was estimated as 19 months(11.74-26.26, %95 CI).While there was a significant correlation between the TR and OS,the highest OS was observed in the CR group(median:51 months) and the lowest OS in the PD group(median:9 months) (p=0.004)(Table-2). In the ROC analysis,the threshold PTD required for 'CR or PR' was calculated as 180 Gy (sensitivity %76, specificity %55; AUC: 0.677, p: 0.012).and the threshold PTD required for 'CR' was calculated as 232 Gy (sensitivity:%77, specificity: %60 AUC: 0.721, p:0.006).There was a statistically significant increase in OS in patients, who received a PTD above 180 Gy (36 vs 10 months, p<0.001)(Table-3).Likewise,the patients received a PTD above 232 Gy had statistically higher OS(36 vs 15 months, p=0.025). According to Cox regression multivariate analysis, PTD over 180 Gy (HR:3.2) was found to be the most significant indicator in predicting OS. ALBI degree (HR:3) and SUVmax value (HR:1.15) are other statistically significant parameters in predicting OS(Table-4). ***Conclusion:*** In this study,it has been determined that the 'CR or PR' may be predicted with a PTD above 180 Gy and 'CR' may be predicted with a PTD above 232 Gy.Furthermore,a statistically significant relationship between PTD and OS has been found. Although ALBI scores and baseline SUVmax values are important parameters for predicting OR and TR,the PTD has been identified as the most important determinant for achieving effective TR and higher OS.

OP-866

Interplay Between Radiomics Features of pre- and post-procedural SPECT and PET Imaging for the Prediction of Response to Selective Internal Radiation Therapy (SIRT) for Hepatocellular Carcinoma (HCC): Preliminary Analysis

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Aim/Introduction: SIRT efficacy is mainly related to a dose-response threshold; however, tumoral heterogeneity can potentially affect treatment response. This heterogeneity is only partially reflected by pre-SIRT structural imaging. Further insights might be provided by pre-/post-procedural Nuclear Medicine imaging with SPECT/CT and PET/CT respectively. We aimed to investigate the early predictive value of radiomic features extracted from pre- and post-procedural SPECT/CT and PET/CT. ***Materials and Methods:*** Retrospective data were collected on consecutive patients with liver-dominant HCC undergoing SIRT-treatment at the University of Turin (Oct 2014-Sept 2023) with a clinical follow-up ≥1 year. Target-lesions were segmented on pre/post-procedural SPECT/PET after coregistration with conventional imaging using Simplicit90YTM. Radiomic features were extracted with PyRadiomics, using a 95% resegmentation range for noise removal, a fixed bin-count (n=25) and native isotropic voxels (spacing=4). The prognostic value (overall survival-OS and progression-free survival-PFS) of radiomic features was tested using ROC curve and Kaplan-Meier analysis with log-rank test (threshold based on Youden-index). ***Results:*** 46 HCC patients were included (median follow-up of 18 months [IQR 10-39]). 91% (42/46) of patients had cirrhosis, 37% (17/46) neoplastic portal-vein trombosis. Child-Pugh classification as follows: A5 in 72% (33/46), A6 in 22% (10/46) and B7 in 6% (3/46). Bilirubin levels were > 1.1 mg/dl in 41% (19/46) patients. Pre- and post-procedural SPECT/CT and PET/CT images were available in 44 and 27 patients respectively. PET-derived Gray Level Dependence Matrix (GLDM) Large Dependence Low Gray Level Emphasis (LDLGLE) as measure of textural heterogeneity showed a correlation with target-lesion progression during follow-up (AUC 0.80), significantly predicting PFS (median PFS 10 months vs not reached, p=0.006). SPECT-derived LDLGLE reached an AUC of 0.68, with a significant impact on PFS distribution (median PFS 15 months vs not-reached, p=0.031). Finally, when considering whole-liver progression, SPECT-derived Gray Level Size Zone (GLSZM) Large Area High Gray Level Emphasis feature showed an AUC of 0.74, possibly related to the initial disease burden. PET textural heterogeneity metric LDLGLE also predicted OS (ROC AUC 0.82; median OS 11 months vs not reached, p=0.005). No SPECT features were able to predict OS (AUC<0.7 in all cases). ***Conclusion:*** Preliminary evidence in HCC patients undergoing SIRT treatment supports a potential role of SPECT and PET radiomic features in predicting treatment response and PFS, while only PET-derived features were able to predict OS. The next steps towards the development of a combined predictive/prognostic model will require the integration of clinical, dosimetric and pre-treatment CT/MR radiomic data.

OP-867

A novel approach to radioembolization dosimetry treatment planning using a hybrid [^{99m}Tc]Tc-MAA contrast enhanced SPECT/CT

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Aim/Introduction: Dosimetry treatment planning is integral to the radioembolization work-up. Current guidelines recommend volumes be segmented on baseline anatomical images (e.g. contrast-enhanced CT) and registered to the separately acquired SPECT/CT. However, this conventional method is limited by registration errors and potential interval progression. The aim of this study was to compare hybrid contrast enhanced SPECT/CT-based treatment planning with the conventional method. ***Materials and Methods:*** Hybrid contrast enhanced SPECT/CT was performed in 24 patients with hepatocellular carcinoma (HCC). Treatment planning followed both the conventional and updated workflow, where delineation was performed directly on the contrast enhanced SPECT/CT. Dosimetric and morphological differences between workflows were quantified using Simplicit90Y and MIM software, and evaluated by Bland-Altman analysis. ***Results:*** Direct delineation on contrast-enhanced SPECT/CT yielded higher tumour doses (10.5% increase; 95% limits of agreement [LoA]: -70.2 Gy, 130.5 Gy) and lower normal tissue doses (13.2% decrease; 95% LoA: -66.4Gy, 109.6Gy). Tumour (p=0.01) and normal tissue doses (p=0.02) differed significantly between workflows. Tumour volume increase between baseline CT and contrast enhanced SPECT/CT was 8.2% (95% LoA: -58.6 mL, 81.6mL). Morphological differences between segmentations created via the conventional and updated workflow (indicators of registration errors and interval progression) revealed the relative impact of these effects was greater for tumour volumes (mean DICE 0.6, mean Hausdorff distance 24.2mm) than whole liver volumes (mean DICE 0.8, mean Hausdorff distance 31.2mm). ***Conclusion:*** Hybrid contrast enhanced SPECT/CT based treatment planning improves target definition and dosimetry estimates.

OP-868

ALBI score affects Overall Survival (OS) in patients with hepatocellular carcinoma (HCC) treated with selective internal radiation therapy (SIRT)

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Aim/Introduction: Optimising treatment application and selection is crucial in patients potentially eligible to SIRT. We aimed to evaluate the prognostic impact of baseline clinical features and treatment procedure, including liver function measured with albumin-bilirubin (ALBI) formula and dosing methods in HCC patients treated with SIRT. ***Materials and Methods:*** The study includes 82 consecutive patients with liver-dominant HCC treated with SIRT (90Y glass microspheres, TheraSphereTM) between October 2014 and September 2023. 25 patients were treated with standard dosimetry, while for remaining patients multi-compartment dosimetry was performed using Simplicit90YTM software. Impact of baseline patients characteristics including presence of portal vein thrombosis (PVT), Child Pugh score (CP), ALBI score, bilirubin levels, tumor size and prior loco-regional liver directed or systemic treatments was assessed through multivariable Cox proportional hazard model.Clinical outcome was evaluated in terms of objective response rate (ORR) and OS. Relationships between either tumor absorbed-dose (TAD) or normal tissue absorbed-dose (NTAD) and clinical outcomes was evaluated. ***Results:*** Median follow-up after treatment was 40.0 months (15.2-67.9); 69 patients (84%) presented cirrhosis, while 35 (43%) had neoplastic PVT. 47 patients (60.3%) had bilirubin levels up to 1.1 mg/dl and 31 (39.7%) over 1.11 mg/dl. 28 patients (44.4%) had an ALBI grade 1, while 35 (55.6%) an ALBI grade 2. Median TAD and NTAD were 471.9 Gy (365.3-632.6) and 27.4 Gy (13.0-45.4), respectively.At univariable analysis, only baseline ALBI score was found to be independent prognostic factor for OS after SIRT (p=0.001, respectively); furthermore, at Cox proportional hazards analysis, HR for death of ALBI 2 vs ALBI 1 was 10.54 (95% CI, 1.42-78.19, p=0.021), while, despite not significant, HR in patients with bilirubin levels over 1.1 mg/dl was 2.47 (0.69-8.89, p=0.166). Conversely, no significant association were found between OS and cirrhosis, tumor size and PVT. Difference in ORR between standard vs multi-compartment dosimetry did not reach significancy, however the use of standard dosimetry was associated to a lack of objective response (SD+PD) with a rate three times higher with respect to multi-compartment dosimetry: stratification into TAD subgroups (from < 200 Gy to ≥ 300 Gy) showed a linear association between ORR and higher TAD (p=0.022). ***Conclusion:*** ALBI score demonstrated to impact OS in HCC patients treated with SIRT thus going beyond a simple prediction of treatment-related toxicity. The present results are relevant for the selection of HCC patients for SIRT in a real-world clinical setting.

1807

Wednesday, October 23, 2024, 09:45 - 11:15
Hall Y10-Y12

Featured Session: Bone & Joint Committee: 50 Shades of MSK Cancer

OP-869

50 Shades of MSK Cancer

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OP-870

Assessment of 2-$^{[18F]}$FDG-PET/CT metrics in treatment-naive patients with bone and soft tissue sarcomas.

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Aim/Introduction: 2-$^{[18F]}$FDG-PET/CT (FDG-PET) has been used for determining the oncological stage, therapy response, and prognosis in patients with Bone Sarcoma (BS) and Soft Tissue Sarcoma (STS). The aim of our study is to evaluate the semiquantitative and volumetric parameters of FDG-PET in treatment-naive patients with BS and STS and analyze their distribution according to histological grading groups. ***Materials and Methods:*** We retrospectively included 66 patients (mean age 40 ± 20). Among them, thirty-two patients were diagnosed with Bone Sarcoma (BS) and thirty-four with Soft Tissue Sarcoma (STS). FDG-PET imaging was performed for initial staging in all patients. Classical semi-quantitative parameters such as SUVmax, SUVmean, TBR (Tumor SUVmax/Liver SUVmean), Metabolic Tumor Volume (MTV), and Total Lesion Glycolysis (TLG) in the primary tumor were obtained from FDG-PET scans. These FDG-PET parameters were analyzed across histopathological classification

groups. The grading of BS and STS was established based on histotype and by FNCLCC classification, categorized as follows: Grade I-low (G1), Grade II-intermediate (G2), and Grade 3-high (G3). ***Results:*** Patients with high-grade (G3) BS and STS statistically exhibited higher SUVmax, SUVmean, and TBRs. For SUVmax, a median of 6.98 (IQR: 4.31-14.62) was observed compared to a median of 4.41 [IQR: 2.70 - 8.98] in the G1-G2 group. The values for SUVmean and TBRs are summarized in Table 1. In the STS group, higher SUVmax values were noted in G3 with a median: 8.77 (IQR: 5.12-17.73) compared to G1-G2 with a median of 3.33 (IQR: 2.45-6.17; p<0.005). However, no significant differences were observed in the FDG-PET parameters among the histological BS subgroups. Patients with G1-G2 BS had significantly higher values in the FDG-PET parameters (SUVmax, SUVmean, and TBRs) when compared to G1-G2 STS. No significant differences were found among groups in terms of volumetric parameters (MTV and TLG). ***Conclusion:*** Our findings indicate that patients with high-grade (G3) BS and STS demonstrated significantly higher SUVmax, SUVmean, and TBRs compared to lower-grade tumors. Particularly in the STS group, elevated SUVmax values correlated with higher histological grades, suggesting a potential role of FDG-PET in prognostic assessment. These findings underscore the potential of FDG-PET as a valuable tool for assessing tumor characteristics and guiding treatment strategies in patients with BS and STS, particularly in the context of histological grading, but larger cohorts are warranted to validate these findings.

OP-871

To evaluate F^{18} FDG PET/CT based parameters in prediction of histopathological response to neoadjuvant chemotherapy in patients with Osteosarcoma

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Aim/Introduction: To evaluate F^{18} FDG PET-CT based parameters in prediction of Histopathological Response to Neoadjuvant Chemotherapy in Patients with Osteosarcoma. ***Materials and Methods:*** 30 patients diagnosed with osteosarcoma who underwent FDG PET-CT scan at baseline and post neoadjuvant chemotherapy (NACT), followed by surgery (between 2011 - 2016) were assessed. The SUVmax , metabolic tumor volume (MTV) and total lesion glycolysis (TLG)of the primary lesion was recorded at baseline and post NACT along with post/pre NACT ratios. MTV was calculated with threshold of 45% SUVmax; MTV(45%)and by summing the volume of voxels with SUV higher than SUV 2; MTV(2). TLG(45%) and TLG(2) was calculated. Histopathological reports post-surgery were obtained, necrosis fractions and response was catalogued. Histopathological necrosis fractions (HNF) were correlated with post NACT parameters and post/pre NACT ratios. Receiver operating characteristic (ROC) curve analysis was done to determine cut off, sensitivity and specificity for post/pre NACT ratios which could predict good histopathological response from poor response. Post/pre NACT ratios were compared to find out better predictor of histopathological response. ***Results:*** 16 patients were good histopathological responders and 14 were poor histopathological responders. Post NACT SUVmax , MTV (2) , TLG(2) , post/pre NACT ratios of SUVmax, MTV (2), and TLG (2) showed difference between good and poor responders. Among post/pre NACT ratios, all parameters except MTV (45%) showed correlation with HNF. TLG (2) showed strong, MTV (2) ratio showed moderate and SUVmax ratio showed weak correlation. On post NACT PET- CT scan, absolute values of SUVmax and MTV (45 %) did not show correlation with HNF and MTV (2), TLG (2) and TLG (45 %) showed weak correlation. ROC curve analysis and comparing AUCs (area under curve), revealed MTV (2) ratio and TLG (2) ratio to be equally good predictors of histopathological response. MTV(2) ratio is a better predictor of histopathological response than SUVmax ratio. The sensitivity and specificity for predicting a good response was 92.8 % and 75 % using a MTV (2) ratio cut off of 0.17 and using a TLG (2) ratio cut off of 0.10. ***Conclusion:*** In our osteosarcoma population, the change in ^{18}F-FDG PET-CT based parameters post NACT were useful in predicting tumor response. The change in combined metabolic/volumetric parameters like MTV and TLG (measured at threshold of SUV 2) post NACT were better predictors of Histopathological response than change in the metabolic parameter, SUVmax post NACT.

OP-872

Radiomics-based Machine learning method for prediction of metastatic disease in soft tissue sarcoma

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Aim/Introduction: Soft-tissue sarcomas(STS) are rare tumors with unpredictable clinical behavior. Distant metastasis(DM) occurs in about 25-30% of patients and ponders poor prognosis. A comprehensive approach, including surgery and chemoradiotherapy, is common and can improve survival rates provided complete excision of disease is possible. Thus, the preoperative assessment for metastatic disease is vital for prognosis and for formulating treatment strategy. However, available imaging including functional positron-emission tomography(PET)-CT imaging carries limited accuracy leading to unnecessary interventions. Thus, this study was carried out to model a non-invasive method to predict the likelihood of DM to assist in more tailored interventions only in cases with reasonably high pre-test likelihood. ***Materials and Methods:*** Patients with STS who underwent ^{18}F-FDG PET-CECT imaging were included in the study. Experienced Nuclear Medicine physicians manually delineated the regions of interest and high-dimensional radiomic features(RF) were extracted using LIFEx (v7.2). Univariate analysis was applied to each RF as well as metabolic parameters (SUVmax, MTV and TLG), using area under curve(AUC) of receiver operator curve(ROC) and p-value computed by Mann-Whitney-U test. p-value<0.05 was considered significant. Clinical ± imageological follow-up was taken as the gold standard. RF with an AUC>0.6 were further refined with least absolute shrinkage and operator(LASSO) algorithm. A support vector machine(SVM)-based MLM was developed using Rv.4.1.3, with 75% of data for training and 25% for validation. Model's performance was assessed using ROC curves and compared with metabolic parameters. ***Results:*** The study included 41 STS patients (30 males, median age-41, range: 2 months-74 years). Among these, 23 patients had metastatic disease on follow-up. A total of 134 RF were extracted from each ^{18}F FDG PET-CT image. Subsequently, Univariate analysis was performed which revealed 17 RF were statistically significant predictors of outcome. In multivariate analysis, the best SVM-LASSO model consisted of 9 RF (Table-1). The SVM-MLM achieved a sensitivity and specificity of 83.33% & 75% respectively with AUC of 0.917 compared to 78.3% & 50% for MTV at a cut-off of 92.5cm3 and 82.6% & 55.6% for TLG at a cut-off of 533 with an AUC of 0.688 and 0.703 respectively. Thus, SVM-MLM demonstrated superior performance compared to metabolic parameters with an overall accuracy of 80%. ***Conclusion:*** SVM-MLM can provide an efficient tool to predict the risk of metastases in STSs. This technique has

potential to assist in choosing the appropriate treatment for STSs and potentially improve patient survival.

OP-873

A registration pipeline for digitized histopathology and multimodality imaging in sarcoma

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Aim/Introduction: Despite growing interest, preoperative response monitoring in sarcomas during neoadjuvant therapy has not yet resulted in standardized response assessment and subsequent treatment personalisation. This is caused due to lack of understanding on relations between imaging features and tumour biology, complicated by considerable tumour heterogeneity in sarcomas. Here we develop and evaluate a methodological pipeline to spatially register digitized histological information with preoperative [18F]FDG-PET, CT, T1-, diffusion weighted-, and dynamic contrast enhanced MRI. ***Materials and Methods:*** We propose workflows for 6 different research settings; registration of bone sarcomas in retrospective (WF1), and in prospective settings without (WF2) or with fixating tumours in 3D-printed tumour moulds during pathological processing (WF3), and corresponding settings in soft-tissue sarcomas (STS); WF4, WF5 and WF6, respectively. For each workflow 2 patients were included forming a development cohort to test registration accuracy with Dice coefficients. Histology slides were digitized and annotated for viable and responsive tumour tissue. Slides were stitched and registered to preoperative images. Associations between imaging features and tissue types were assessed, quantitatively modelled and clustered in an unsupervised manner with hierarchal stochastic neighbour embedding (HSNE) to gain insight in tumour biology. Another 8 sarcomas were included to validate most accurate retrospective and prospective candidate workflows. ***Results:*** The developed methods showed good registration accuracy in WF1-3, WF5 and WF6 with average Dice coefficients being 0.86, 0.84, 0.89, 0.91, 0.93, respectively. Retrospective registration in STS (WF4) was considered not to be feasible due to tissue deformation. Several clusters of different tissue types could be identified with HSNE, showing added value of combining information from multiple imaging modalities. In predictive modelling, mean accuracies and areas under the curves for response were 0.73(±0.06) and 0.80(±0.07), respectively. [18F]FDG-PET was available in 10 patients and was the modality with highest importance for response classification in 60%. Interestingly, in 4 STS with histological response to radiotherapy, non-necrotic response, consisting of fibrosis, hyalinization, or cell maturation, showed higher SUV than viable tumour. In the 2 of these 4 patients that showed treatment-induced necrosis, necrosis showed lower average SUVs (1.0 in both) than viable tumour (4.3 and 4.4 in a liposarcoma and maligne nerve sheath tumour, respectively). ***Conclusion:*** Results suggest retrospective registration of bone sarcomas is feasible and use of 3D-printed moulds adds precision in both bone- and STS. The proposed pipeline allows to establish the relation between imaging and tumour biology and development of quantitative models explaining observed tumour heterogeneity.

OP-874

Development of a Deep Learning Model for Automated Measurement of Skeletal Muscle Mass in [18F]F-FDG PET/CT Scans

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Aim/Introduction: In recent years, the reduction in muscle mass (sarcopenia) has garnered attention as a poor prognostic factor in various malignancies and resistance to treatments such as surgery, chemotherapy, and radiation therapy. Accurately measuring individual skeletal muscle mass is becoming increasingly important in the realization of personalized medicine. Thus, this study aimed to develop a deep learning model to automatically measure the muscle mass of anti-gravity muscles using whole-body CT scans from [18F]F-FDG PET/CT. ***Materials and Methods:*** This study included 209 individuals (148 males, 61 females) who underwent [18F]F-FDG PET/CT scans for cancer screening between January 2017 and April 2022 at Preemptive Medicine and Lifestyle Related Disease Research Center, Kyoto University Hospital. Muscle regions in the CT data of four PET/CT scans were manually labeled using the open-source software (3D Slicer), creating the training data. The open-source 3D segmentation model (nnUNET1) was trained with these data and then used to perform inference on the anti-gravity muscle areas in the remaining 205 CT data. The overlap (Dice coefficient) between the labeled regions and the inferred regions was calculated for the four training datasets. The Spearman correlation coefficient was calculated for skeletal muscle mass measurements between nnUNET and the bioelectrical impedance analysis device (InBody) for 209 subjects. ***Results:*** The average Dice coefficient was 0.973 ± 0.0085 (range 0.961-0.979). A board-certified nuclear medicine and radiology specialist extracted CT data randomly from 30 of the 205 participants after inference and confirmed that nnUNET could accurately infer anti-gravity muscle regions. The correlation coefficient between skeletal muscle mass measurements by nnUNET and InBody was 0.963. ***Conclusion:*** The study demonstrated that our 3D segmentation deep learning model could reasonably measure skeletal muscle mass from whole-body CT images in PET/CT scans. PET/CT is expected to become an increasingly important tool for personalized medicine, as it can acquire not only tumor accumulation values (SUVmax) from PET images, but also non-tumor parameters such as muscle mass that reflect individual patient characteristics from CT images.

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OP-875

PSMA expression and PSMA PET/CT imaging in advanced soft tissue sarcomas; potential for PSMA-targeted radioligand treatment? Interim results

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Aim/Introduction: Although initially associated with prostate cancer, it is now known that PSMA expression is also present in

several other tumours, including soft tissue sarcomas. This study aimed to assess PSMA-tracer uptake on PSMA PET/CT imaging in advanced soft tissue sarcomas, to determine the feasibility of a large-scale trial investigating PSMA-targeted radioligand therapy in this patient population. ***Materials and Methods:*** This prospective single-centre feasibility trial, registered as NCT05522257 [1], included patients with advanced soft tissue sarcoma with measurable disease (lesion diameter > 1cm), WHO performance status 0-2 and either no systemic therapy in the previous 8 weeks or progressive disease on previous systemic therapy. First, immunohistochemical PSMA expression levels were determined on previously obtained biopsy material. In case of high PSMA expression [2], a [18F]-JK-PSMA-7 PSMA PET/CT was made with a fixed dose of 359 MBq [3]. Evident PSMA-tracer uptake was defined as SUVmax > 8. The progression criterium was set at evident tumoural PSMA-uptake in at least 6 out of 15 PET/CT scans. ***Results:*** To date, 24 patients with metastatic soft tissue sarcoma have been included. High PSMA expression was found in 11 patients (46%): 4/10 leiomyosarcomas, 2/5 liposarcomas, 3/4 undifferentiated sarcomas, 1/4 fibrosarcomas and 1/1 malignant peripheral nerve sheath tumour (MPNST). Five of these patients agreed to a [18F]-JK-PSMA-7 PET/CT scan: one patient (MPNST) had evident PSMA-uptake in multiple metastases (SUVmax = 16.7), three patients (leiomyosarcoma, liposarcoma and undifferentiated sarcoma) had moderate PSMA-uptake with SUVmax between 6-8, and one patient (leiomyosarcoma) had no PSMA-uptake above the background. ***Conclusion:*** Interim results from this still recruiting trial showed that almost half of metastatic soft tissue sarcomas had high PSMA expression, which was higher than expected based on previously published literature. Metastatic PSMA-tracer uptake was seen in 4 out of 5 patients, however, in 1 patient the SUVmax exceeded 8. More data are needed to draw conclusions about the implications for potential PSMA-targeted radioligand therapy in soft tissue sarcoma patients. Further results from this feasibility study will follow. ***References:*** [1] https://classic.clinicaltrials.gov/ct2/show/NCT05522257, [2] https://doi.org/10.18632%2Foncotarget.13994, [3] https://doi.org/10.1186%2Fs13550-019-0540-7

OP-876

Ad-hoc analysis of [18F]FAPI-74 imaging in patients with sarcoma within an ongoing prospective basket-trial

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Aim/Introduction: Radiolabeled fibroblast activation protein (FAP) ligands, a novel class of tracers for PET/CT imaging, have demonstrated very promising results in various oncological, as well as in some benign, diseases with long-term potential to supplant the current pan-cancer agent [18F]FDG in some cancer types. In particular, sarcoma has been shown to overexpress fibroblast activation protein (FAP) on abundant cancer-associated fibroblasts within its surrounding microenvironment. Hence, we conducted an ad-hoc study from our ongoing prospective, basket-study with an intra-individual comparison of [18F]FAPI-74 and [18F]FDG, to investigate the diagnostic performance of FAP imaging in sarcoma. ***Materials and Methods:*** The cohort of this ad-hoc study included currently 6 biopsy-proven sarcoma patients with a median age of 57 (range 33 - 64) who underwent both [18F]FDG PET/CT with contrast-enhancement and [18F]FAPI-74 PET with low-dose CT for primary staging (n = 1) and therapy response control (n = 3) or re-staging due to suspected relapse (n = 2). We assessed the tracer uptake with metabolic parameters such as SUVmax and SUVmean. The tumor-to-background ratio (TBR) was derived by dividing the SUVmax of tumor lesions by the SUVmax of adipose tissue, skeletal muscle, and blood pool. Furthermore, we evaluated the metabolic tumor burden and its implications for the prognosis. ***Results:*** Overall, 10 lesions were detected in 6 patients including primary (n = 5) and distant organ metastases (n=5). Although the direct comparison of metabolic PET parameters in terms of SUV reveals a similar intensity of tracer uptake, the favorable background uptake leads to a superior TBR and better lesion delineation with FAPI imaging ***Conclusion:*** This ad-hoc investigation represents, to our best knowledge, the first, prospective, intra-individual investigation comparing [18F]FAPI-74 with [18F]FDG imaging in sarcoma with interesting results regarding prognostic implications of metabolic and volumetric analyses.

OP-877

Response assessment to chemotherapy in multiple myeloma by[68]Ga-Pentixafor PET/CT: A comparative evaluation with[18]F-FDG PET/CT and IMWG based clinical response

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Aim/Introduction: Multiple myeloma (MM) is a complex oncological disorder known to overexpress CXCR4 receptors. These receptors are viewed as potential disease targets for theranostic applications in MM. In the present study, we investigated the diagnostic utility of 68Ga-Pentixafor PET/CT for initial disease evaluation and response assessment to chemotherapy on follow-up imaging. The results were compared with 18F-FDG PET/CT and IMWG based clinical response. ***Materials and Methods:*** Thirty newly diagnosed MM patients were recruited prospectively and their clinical details were recorded. All the patients underwent 68Ga-Pentixafor and 18F-FDG PET/CT at baseline and 6-mo post standard treatment regime. IMPETUS criterion was used for 18F-FDG PET/CT data and for 68Ga-Pentixafor PET/CT based response assessment on follow-up, EORTC guidelines were used. Patients were classified into different response categories according to IMWG response criteria. The clinical response was correlated with PET/CT based response. Cohen's kappa (K) was used to quantify the level of agreement. ***Results:*** Thirty (16 male: 14 female) treatment naive MM patients were enrolled having median age=55 years (range=34-81 years). Baseline 68Ga-Pentixafor PET/CT was positive in 29/30 patients (96.7%) and 18F-FDG PET/CT was positive in 24/30 patients (80.0%). 68Ga-Pentixafor PET/CT had significantly higher ($p<0.01$) mean SUVmax value than 18F-FDG PET/CT (12.3±11.9 vs. 4.5±2.9). As compared to 18F-FDG PET/CT, a significantly higher decrease in 68Ga-Pentixafor PET/CT mean SUVmax value in CR, VGPR and PR and increase in SUVmax in PD clinical response categories was noted. On evaluation of response in these patients, as per the IMWG criteria, 11 patients (36.7%) showed sCR, 6 CR (20.0%), 10 VGPR (33.3%), 2 PR (6.7%) and 1 PD (3.3%). Response assessment on 18F-FDG PET/CT demonstrated 17/24 (70.8%) having CR, 5/24 (20.8%) PR, 1/24 (4.2%) SD and 1/24 (4.2%) PD. Whereas, 68Ga-Pentixafor PET/CT based response classified 8/29 (27.6%) as CR, 18/29 (62.1%) PR, 1/29 (3.4%) SD and 2/29 (6.9%) PD. 68Ga-

Pentixafor PET/CT based response assessment showed higher agreement with IMWG response criteria (K= 0.43, p=0.001) vs. that of 18F-FDG PET/CT (K=0.27, p=0.04). ***Conclusion:*** 68Ga-Pentixafor PET/CT provided higher (by factor of 3.0) baseline mean SUVmax than 18F-FDG PET/CT and thus presented better image contrast and lesions' characterization. 68Ga-Pentixafor PET/CT was able to evaluate response in consonance with IMWG clinical response in a higher number of patients as compared to 18F-FDG PET/CT. The study findings demonstrated that the tracer uptake tied up with CXCR4 disease activity is a sensitive PET based biomarker for response evaluation to chemotherapy in MM.

1808

Wednesday, October 23, 2024, 09:45 - 11:15
Hall G2

TROP Session: Cardiovascular Committee: Myocardio Perfusion and Coronary Plaque: The PET Area

OP-878

A Phase I study of [18F]SYN2, a new PET perfusion tracer in healthy subjects

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Aim/Introduction: The phase I clinical, a first-in-man, study aimed to assess safety profile, radiation dosimetry, and biodistribution of a new potential cardiac positron emission tomography (PET) perfusion tracer [18F]SYN2 (18F-labelled acridinium derivative) in healthy subjects. ***Materials and Methods:*** [18F]SYN2 intravenous administration with PET imaging was performed in healthy volunteers and sequential whole-body imaging was performed for 4 hours. Blood and urine samples were collected for up to 240 min. Safety follow-up visits took place at 2, 5 and 14 days after the administration. ***Results:*** 10 subjects (8 females and 2 males) completed all study procedures. The mean age was 38.1 ± 8.8 years, and the mean body mass index was 22.7 ± 3.0 kg/m2. The mean administered dose of radioactivity was 253 MBq (range: 240 - 258 MBq). There were no drug-related adverse events, and the tracer was well tolerated in all subjects. The mean whole-body effective radiation dose for [18F]SYN2 was 0.0195 mSv/MBq. The tracer was very rapidly taken up by myocardial wall and cleared up from plasma leading to good image quality already after minutes of tracer injection. The accumulation of [18F]SYN2 to left ventricle was 2.2-2.4 %ID/organ. ***Conclusion:*** Based on tracer safety profile, radiation dosimetry, and biodistribution [18F]SYN2 appears a promising agent for clinical PET myocardial perfusion imaging and further clinical studies are warranted.

OP-879

First experiences with ^{18}F-Flurpiridaz in clinical practice

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Aim/Introduction: 18F-flurpiridaz is a mitochondrial complex 1 tracer for cardiac perfusion imaging using positron emission tomography (PET). A second phase III trial has recently been published, in which 18F-flurpiridaz PET demonstrated a significantly higher sensitivity and noninferior specificity for detection of coronary artery disease (≥50% stenosis) in comparison with 99mTc-labeled single photon emission computed tomography (SPECT)1. When compared to readily available myocardial PET tracers (e.g. 82Rb and 13N-ammonia), 18F-flurpiridaz has multiple advantages, which has sparked interest for clinical practice1. Aim of this study was to assess the feasibility of 18F-flurpiridaz in real-world clinical practice. ***Materials and Methods:*** All patients referred for cardiac perfusion imaging between December 2022 and April 2024, and planned for 18F-flurpiridaz PET/CT were included. Patients underwent 18F-flurpiridaz PET scan, in accordance with the protocol of the second phase III trial1. 18F-flurpiridaz was provided on named-patient use basis. Prespecified 18F-flurpiridaz doses were 110 MBq for rest imaging and 240 MBq for stress imaging, with a 60-minute time interval between rest and stress imaging. All stress imaging was done using pharmacological stress with either adenosine (140 µg/kg/min, 6-minute continues infusion) or regadenoson (400 µg, slow administration). All dynamic and static images were analyzed in a dedicated software package for cardiac PET analysis (4DM, INVIA), in which motion correction and residual activity correction is implemented. Dynamic PET data at rest and pharmacological stress were integrated into a two-tissue-compartment model to effectuate myocardial blood flow quantification. Myocardial blood flow and myocardial flow reserve were used in the interpretation of the images. ***Results:*** A total of 100 patients with suspected coronary artery disease were scanned, of which 58 were male and 42 were female. The mean age was 65.5 years (range 34.6-84.9 years). In 46 patients findings were suspected of ischemia, both limited (<10% ischemia burden; 12 patients) and extensive (≥10% ischemia burden; 34 patients). A total of 26 patients went for coronary angiography (CAG) as a result of the abnormal findings on 18F-flurpiridaz PET. 19 out of 26 patients had confirmed obstructive coronary artery stenosis (>50%), whilst 7 did not. In 3 out of 7 negative CAG findings, patients were deemed to have microvascular disease by the treating cardiologist. ***Conclusion:*** This is the first real-world cohort of 100 patients demonstrating the clinical feasibility of 18F-flurpiridaz for routine clinical practice. ***References:*** 1Maddahi J,et al. Flurpiridaz F^{18} PET Myocardial Perfusion Imaging in Patients With Suspected Coronary Artery Disease. J Am Coll Cardiol. 2023;Oct,17;82(16):1598-1610.

OP-880

Association between reduced cerebral blood flow andmyocardial blood flowin patients with heart failure

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Aim/Introduction: Heart failure (HF) is associated with an increased risk of cognitive impairment (CI), leading to a poor prognosis for patients, but the mechanisms underlying these alterations are unclear. The aim of this study was to investigate cerebral blood flow (CBF) alterations in patients with HF and their relationship with CI and myocardial blood flow (MBF). ***Materials and Methods:*** 33 HF patients caused by ischemic heart disease and 20 healthy volunteers underwent brain MR, 13N-NH3·H2O cardiac PET/MR scans and MMSE cognitive tests. MR sequences included T1WI for brain structure and arterial spin labelling (ASL)

sequence for brain perfusion. Quantitative MBF was calculated from dynamic 13N-NH3·H2O PET data. Two sample t-tests were performed between the patient and control data at voxel level and at ROI level (brain ROIs defined in the AAL brain atlas). A p-value < 0.05 after FDR multiple test correction was considered statistically significant. Correlations between CBF, cognitive score and MBF were accessed with generalized linear model and used age and sex as covariates. ***Results:*** Compared to the healthy control, the HF patients demonstrated reduced CBF in the thalamus, frontal, calcarine, cerebellum, hippocampus, parahippocampus, fusiform, temporal, cingulate post, and precuneus regions. Relative strong perfusion decrease was observed in the hippocampus and parahippocampus region. Similar perfusion differences are reflected by the comparison of brain area mean CBF. Decreased brain perfusion appears in both side of the hippocampus, calcarine, cuneus, lingual, precuneus, thalamus and the left temporal region. CBF in the right olfactory, paracentral lobule and rectus correlate with the MMSE score (slope -2.25, p=0.01; slope=-2.45, p=0.03; slope=-2.04, p=0.03). Correlation analysis also indicated significant correlation between the MBF of the left circumflex artery territory and the regional CBF in the left angular, precuneus, post cingulum, middle temporal gyrus, right precuneus, thalamus, middle frontal orbital gyrus. The MBF of the right coronary artery territory correlated significantly with the regional CBF in the left middle temporal gyrus, angular, post cingulum, right middle frontal orbital gyrus, precuneus, and post cingulum. ***Conclusion:*** HF patients exhibit widespread CBF decrease in multiple brain regions, and a correlation with CI, suggesting that chronic cerebral hypoperfusion due to reduced MBF may be an important cause of the CI in patients.

OP-881

Sex Differences in the Brain-Heart Axis in the Setting of Acute Mental Stress

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Aim/Introduction: The steady progress achieved in the management of cardiovascular diseases (CVD) has less benefited women than men, suggesting sex-specific mechanisms in CVD. The role of mental stress in CVD is increasingly acknowledged, with an established correlation between fluor-18-fluorodeoxyglucose ([18F]FDG) uptake in the amygdala, a surrogate for stress-related neural activity (SNA), and adverse cardiovascular events, likely involving the hypothalamus-pituitary-adrenal (HPA) axis and the sympathetic nervous system (SNS). The aim of this prospective study was to investigate the existence of sex differences in 1) the amygdala and myocardial responses, as well as 2) the HPA and SNS responses to acute mental stress. ***Materials and Methods:*** Healthy volunteers (50% women), aged 50-75 years, were prospectively recruited at the University Hospital Zurich and investigated with positron emission tomography/magnetic resonance (PET/MR), using two radiotracers: [18F]-FDG to explore the amygdala metabolism, and [13N]ammonia ([13N]NH3) to explore the amygdala and myocardial perfusion. Acute mental stress was triggered using two mental stress tests: the Trier Social Stress Test (TSST) while undergoing [18F]FDG PET/MR, and the Montreal Imaging Stress Task (MIST) while being explored with [13N]NH3 PET/MR. The primary endpoint consisted of sex differences in SNA, defined as the ratio between [18F]FDG uptake (as mean standard uptake value, SUVmean) in the amygdala and a reference region, i.e., the cerebellum. Secondary endpoints included sex differences in i) amygdala perfusion (using [13N]NH3), ii) myocardial blood flow (MBF) and flow reserve (MFR), iii) salivary cortisol response to stress (a surrogate for HPA axis activation), and iv) the heart rate response (HRR) to stress (a surrogate for SNS activation). ***Results:*** Sixty-four healthy volunteers (32 women), aged 59.8±5.8, were included. Following the TSST, SNA was significantly higher in women than in men (SNA=0.7530 in women vs. 0.7173 in men, p<0.001). Amygdala perfusion showed a significant decrease during the stress part of the MIST in females (ΔAmygdalaperfusion=-0.0181 [-0.0267; -0.0094], p<0.001) and a trend toward a decrease in men (ΔAmygdalaperfusion=-0.0086 [-0.0177; 0.0005], p=0.064). MBF at rest was significantly higher in women than men (p=0.019), however, the MFR did not significantly differ between sexes (p=0.537). Conversely, the cortisol response to stress was significantly increased in men (p=0.034) but not in women (p= 0.465), while the HRR was greater in women than men (p= 0.049). ***Conclusion:*** Amygdala response to acute mental stress is more pronounced in women than men and triggers predominantly the SNS in the former and the HPA axis in the latter.

OP-882

The perfusion response to adenosine in the brain, liver, spleen, kidneys, skeletal muscles, and pancreas as measured using total-body PET

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Aim/Introduction: Adenosine is routinely used as a pharmacological stressor in myocardial perfusion imaging. However, its effects on other organs have been less well-studied. The aim of this study was to investigate the effect of adenosine on body organs using [15O]H2O and total-body PET. ***Materials and Methods:*** Patients (n=25) underwent total-body [15O]H2O PET perfusion imaging with and without adenosine stress (140 µg/kg/min). Two patients were excluded because of technical problems in the analysis. K1-derived absolute perfusion values were measured using a single-tissue-compartment model. Segmentation of the organs was done using the CT-based total segmentation method. The brain was segmented using a dedicated brain model for the averaged brain. The input function was derived from the descending aorta. Bonferroni corrected p-values from paired comparisons are reported. ***Results:*** In addition to myocardial perfusion, the mean perfusion in the studied organs was mildly increased only in the liver (at rest median 0.42 [25th-75th percentiles 0.32-0.55] mL/g/min, during stress 0.58 [0.32-0.86] mL/g/min; stress/rest ratio 1.34 [0.97-1.87], p-value for rest vs. stress 0.052). In contrast, perfusion decreased in the brain white matter (rest 0.38 [0.36-0.47] mL/g/min, stress 0.33 [0.28-0.37] mL/g/min, stress/rest ratio 0.77 [0.75-0.93], p<0.0001) and grey matter (rest

0.46 [0.41-0.51] mL/g/min, stress 0.37 [0.32-0.41] mL/g/min, stress/rest ratio 0.77 [0.70-0.90], p<0.00001), spleen (rest 1.25 [0.96-1.39] mL/g/min, stress 0.27 [0.23-0.37] mL/g/min, stress/rest ratio 0.26 [0.20-0.34], p<0.00001) and kidneys (rest 0.95 [0.82-1.06] mL/g/min, stress 0.67 [0.50-0.81] mL/g/min, stress/rest ratio 0.66 [0.49-0.91], p<0.001). In skeletal muscles and pancreas, the differences in perfusion were not statistically significant. ***Conclusion:*** The perfusion response to adenosine appears to be organ-specific. In the heart and liver, perfusion is increased, but in the brain, spleen, and kidneys, it is reduced. At the same time, no significant difference was detected in skeletal muscle and pancreas.

OP-883

Effect of Age and Sex on LV Stress-MBF and Cardiac Output Reserve Using ^{15}O-water PET

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Aim/Introduction: Global left ventricular (LV) myocardial blood flow measured with 15O-water PET myocardial perfusion imaging (MPI) during adenosine-induced hyperemia (stress-MBF) has high prognostic value for future cardiac adverse events. Additionally, adenosine increases heart rate and cardiac output (CO) by a neuronal effect, secondary to peripheral vasodilation. Little is known about the association of stress-MBF and hemodynamic responses towards age and sex. We therefore aimed to determine the impact of age and sex on cardiac and peripheral vascular adenosine responses in a large cohort. ***Materials and Methods:*** We retrospectively identified clinical patients referred to rest/adenosine stress 15O-water PET MPI due to suspected coronary artery disease (CAD) at a single center. Patients with known heart failure or CAD, major adverse cardiac events (MACE) or significant perfusion defects (defined as stress defects with a size ≥5% of the LV, MBF ≤2.3 mL/min/g within the defect and a relative flow reserve of <0.69) were excluded. Stress-MBF and CO reserve were measured using aQuant Research (Medtrace). The association of LV stress-MBF and CO reserve towards age and sex was evaluated using linear regression (ANCOVA). ***Results:*** A total of 783 patients with suspected CAD were identified and MACE were recorded during a median follow-up of 3.6 years. 326 patients (60% women) remained after exclusion criteria were applied, median age 66 years (interquartile range: 59-73, range 21-87). For LV stress-MBF vs age, linear regression of stress-MBF resulted in the equations: y (mL/min/g)=4.17-0.019*Age for men (P=0.002) and y=5.77-0.032*Age for women (P<0.0001). Both slope and intercept differed between sexes (P<0.0001). For age groups of 20-49, 50-69 and ≥70 years, men had LV stress-MBF of 3.25, 3.11, and 2.58 mL/min/g and women of 4.42, 3.89, and 3.29 mL/min/g respectively. For CO percentage increase versus age, the equations were %=160-0.62*Age for men and %=175-0.80*Age for women (both P<0.0001). Intercept was higher for women (P=0.003), but slopes were similar (P>0.05). Using these equations, the CO reserve was abolished at age 95 for both sexes. ***Conclusion:*** Ageing blunted both cardiac and systemic effects of adenosine among low-risk subjects with chest pain and normal PET MPI. Women had higher stress-MBF than men even at older age, but female stress-MBF declined faster with increasing age. Age also decreased CO reserve, but at similar rates for both sexes.

OP-884

The relative prognostic value of coronary plaque burden and myocardial perfusion according to the length of follow-up

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Aim/Introduction: Non-invasive anatomical and functional imaging modalities enable risk stratification in chronic coronary artery disease (CAD), but there is limited knowledge about the relative prognostic impact of anatomical and functional information according to the length of follow-up. We evaluated the prognostic value of quantitatively measured coronary atherosclerotic plaque burden and stress myocardial blood flow (MBF) at short, intermediate, and long-term follow-up. ***Materials and Methods:*** A pooled cohort of 1385 patients (median age 63 years, 54% male) from two academic medical centers underwent coronary computed tomography angiography (CCTA) and [15O] H2O positron emission tomography (PET) myocardial perfusion imaging for suspected chronic CAD. Coronary plaque burden was measured as percent atheroma volume (PAV). Lowest regional stress MBF (ml/g/min) was measured as an average of two adjacent segments. The endpoint was a composite of all-cause mortality, myocardial infarction, and unstable angina pectoris. Multivariable Cox regression models were constructed for short, intermediate, and long-term, with truncation of follow-up at 3, 6, and 9 years, respectively. Hazard ratios (HR) were adjusted for significant clinical predictors of outcome (age, sex, hypertension, diabetes). ***Results:*** Until 3, 6, and 9 years of follow-up, 72 (5%), 131 (9%), and 167 (12%) patients experienced the composite endpoint, respectively. There was a moderate inverse correlation between PAV and lowest regional stress MBF (ρ=-0.44; p<0.001). After adjusting for clinical variables, PAV was a predictor of outcome in 3, 6, and 9-year follow-up (at 9 year: HR=1.04 (95%CI 1.03-1.05) per 1% increase, p<0.001). Similarly, lowest regional stress MBF was an adjusted predictor of outcome in 3, 6, and 9-year follow-up (at 9 year: HR=1.03 (1.01-1.05) per 0.1 ml/g/min decrease, p<0.001). When PAV and lowest regional stress MBF were incorporated into same multivariable models, both were independent predictors of outcome at 3-year follow-up (PAV: HR=1.04 (1.02-1.06), p<0.001; MBF: HR=1.04 (1.00-1.07), p=0.026) and at 6-year follow-up (PAV: HR=1.03 (1.02-1.05), p<0.001; MBF: HR=1.03 (1.00-1.05), p=0.024). In contrast, at 9-year follow-up, only PAV was an independent predictor of outcome whereas regional stress MBF was not (PAV: HR=1.03 (1.02-1.05), p<0.001; MBF: HR=1.01 (1.00-1.03), p=0.138). However, regional stress MBF became statistically significant (HR 1.03 (1.01-1.05), p=0.015) after exclusion of 281 (20%) patients undergoing early (6-month) myocardial revascularization. ***Conclusion:*** Both coronary plaque burden and myocardial perfusion are associated with adverse clinical outcome. The relative prognostic impact of myocardial perfusion may decrease during long-term follow-up, but myocardial revascularization appears as a potential confounder.

OP-885

Quantification of Plaque Burden over Stenosis Severity Improves the Detection of Myocardial Ischemia by Coronary Computed Tomography Angiography

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Aim/Introduction: In symptomatic patients undergoing coronary computed tomography angiography (CCTA) for suspected coronary artery disease (CAD) we assessed, if plaque burden and morphology, as determined by Artificial Intelligence-guided Quantitative Computed Tomography (AI-QCT), in addition to luminal narrowing and clinical risk factors offered incremental value for the identification of myocardial ischemia, as defined by hybrid CCTA/15O-water PET. ***Materials and Methods:*** This study evaluated patients who underwent CCTA for suspected CAD together with 15O-water PET myocardial perfusion imaging in case of ≥50% visual stenosis. CCTA scans were subsequently analysed using AI-QCT with percent total (TPB), calcified (CPB), noncalcified plaque burden (NCPB) and maximum diameter stenosis. Logistic regression was used to determine variables related to ischemia and test two multivariable models for prediction of ischemia; Model 1: clinical + stenosis ≥50% and Model 2: clinical + stenosis ≥50% + plaque burden. The Models´ performance were compared with area under the receiver operating characteristic curves (AUC). Test characteristics for ischemia was compared for (a) stenosis ≥50% and (b) intermediate stenosis+ plaque burden. For the latter, patients were classified non-ischemic for stenosis <30% and ischemic for stenosis >70%. Patients with 30-70% stenosis were classified ischemic if the plaque burden exceeded a binary optimal threshold to predict ischemia according to the method of Youden and non-ischemic if plaque burden was below. ***Results:*** 2145 patients were analysed by AI-QCT. TPB and NCPB had equal discriminative ability for ischemia on top of clinical variables and ≥50% stenosis (AUC 0.91 for both, ns) whereas CPB was inferior (AUC 0.89, p<0.0001 in comparison with TPB model) and TPB was chosen for subsequent analysis. TPB on top of clinical variables and ≥50% stenosis improved the prediction of ischemia (Model 1 AUC=0.87 and Model 2 AUC=0.91, p<0.001). Sensitivity, specificity, positive and negative predictive values and AUC for ischemia of stenosis ≥50% were (a): 75%, 88%, 57%, 94% and 0.81. The optimal TPB threshold to predict ischemia in intermediate stenosis was ≥12.2%. The test characteristics of intermediate stenosis +TPB 12.2% (p-value vs. (a)) were (b): 76% (p=0.008), 91% (<0.001), 64% (<0.001), 95% (<0.001), 0.84 (p=0.048). ***Conclusion:*** The addition of total plaque burden and non-calcified plaque burden by AI-QCT to clinical variables and ≥50% stenosis improved the detection of myocardial ischemia. Furthermore, applying a total plaque burden threshold of 12.2% in patients with intermediate stenosis improved the diagnostic accuracy as compared to the traditional ≥50% stenosis approach.

OP-886

The association between coronary plaque burden and coronary plaque inflammation, as assessed by ^{68}Ga-DOTATATE PET/CT in primary prevention

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Aim/Introduction: 68Ga-DOTATATE is a positron emission tomography (PET) radiotracer with a high affinity for the somatostatin receptor subtype 2 (SSTR2), commonly expressed on activated macrophages (M1). 68Ga-DOTATATE therefore holds promise as a specific marker for atherosclerotic lesion inflammation. In this study, we evaluated the association between coronary artery disease (CAD) as assessed by coronary computed tomography angiography (CCTA) and 68Ga-DOTATATE PET/CT uptake as a surrogate marker for coronary plaque inflammation. ***Materials and Methods:*** We performed 68Ga-DOTATATE PET/CT in volunteers aged >50 years, who recently (within 78 weeks of screening) underwent CCTA. Forty participants with no history of cardiovascular disease or revascularization were included with either no or minimal (CAD-RADS 0-1) or extensive CAD (CAD-RADS 4) in a 1:1 ratio matched by age and sex. Image analyses were performed by a blinded observer. A target-to-background ratio (TBRmax) was determined based on the standardized uptake value (SUVmax) in the coronary arteries, and SUVmean within the blood pool of the superior vena cava. Multivariable linear models were used to evaluate the relation between CAD presence and TBRmax on a per patient (linear regression) and a per-vessel level (mixed effects linear regression). ***Results:*** The study included 40 primary prevention participants, 34 male, with a mean age of 64.75 ± 5.86. Mean low density lipoprotein (LDL) cholesterol was 2.66 ± 0.99, median high sensitivity C-reactive protein (hsCRP) was 0.80 [0.60, 1.92], and 16 (40%) participants were on statin therapy. The median TBRmax was 2.06 [1.59, 3.08]. In the multivariable analysis, extensive CAD resulted in a 0.881 higher TBRmax (95% CI: 0.062, 1.700; p=0.042), whereas the use of statin resulted in a numerically lower TBRmax (-0.862, 95% CI: -1.705, -0.019; p=0.053) on a per patient level. On a per-vessel level, the mixed linear effects model confirmed a higher TBRmax in extensive CAD and a lower TBRmax in statin use. ***Conclusion:*** Our findings demonstrate a positive association between plaque burden and 68Ga-DOTATATE uptake within coronary arteries in a primary prevention population. These findings underscore the potential of 68Ga-DOTATATE, as a specific marker for coronary inflammation.

1809

Wednesday, October 23, 2024, 09:45 - 11:15
Hall F

e-Poster Presentations Session 14: Oncology & Theranostics Committee: Prostate and Local Therapy

EPS-274

Safety and Outcome of Retreatment with [^{177}Lu]Lu-PSMA-I&T Radioligand Therapy (PRLT) in Metastatic Castration Resistant Prostate Cancer

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Aim/Introduction: Abundant evidence exists that 177Lu-PRLT prolongs survival in mCRPC patients with only minor side effects. The approved treatment regimen is based on a fixed activity of 7.4 GBq, injected 6-8 weeks apart for up to 6 cycles. The purpose of this study was to assess the safety and outcome of re-challenge [177Lu]Lu-PSMA-I&T in patients who progressed after response

to initial treatment. ***Materials and Methods:*** We retrospectively included 18 patients who underwent re-challenge with [177Lu]Lu-PSMA-I&T. All patients presented with i) disease control after intial treatment ii) [68Ga]Ga-PSMA-11 PET/CT confirming the presence of PSMA-positive metastases iii) ECOG-performance status 0-1. Adverse events were graded according to CTACE v5.0. Response was assessed by PSA classified according to Prostate Cancer Working Group 3 recommendation. For patients who underwent restaging with [68Ga]Ga-PSMA-11 PET/CT, imaging response was categorized according to adapted PERCIST v1.0. In patients with discordant [68Ga]Ga-PSMA-11 PET/CT and PSA, other available imaging modalities were evaluated to confirm disease status. Overall survival (OS) was calculated from the first cycle of initial PRLT and re-challenge PRLT, respectively, until last patient contact or death. ***Results:*** Patients were initially treated with a median of 5 cycles (range 4-7; median cumulative activity 38,4 GBq) and were re-challenged after a median of 9 months (range 3-13). Each patient received a median of 4 (range 2-7) re-challenge cycles (median cumulative activity 26,1 GBq). During both treatment periods, none of the patients experienced life-threatening G4 adverse events. Grade 3 adverse events included one only case of renal failure. In 8/18 patients long-term toxicities were G3 anemia (n=3) and G4 renal insufficiency (n=2). PSA-response was seen in 56% (n=10/18) patients. In 12/18 patients re-staged by imaging, 7 (58%) patients showed disease control, one mixed response, and 4 progression. After a median follow-up time of 25 months (range 14-44) 10 patients died, 7 were still alive and 1 were lost at follow-up. The median OS calculated was 29 months (95%CI 14,3 - 43,7 months) for the first treatment and 11 months (95%CI 8,1 - 13,8 months) for first re-challenge course. ***Conclusion:*** More than half of patients continue to respond to re-challenge PRLT. Our analysis suggests that re-treatment may prolong survival in selected patients, with an acceptable safety profile.

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Implementation of 177Lu-PSMA-617 Dosimetry Based on 360° CZT Whole-Body SPECT/CT and Collapsed Cone Superposition: A Comparison with Organ S-values and Local Deposition Method

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Aim/Introduction: Today, dosimetry in patient undergoing 177Lu-PSMA-617 therapy for metastatic castration resistant prostate cancer (mCRPC) is complex and non-standardized. SIMPLE-DOSE is an automated patient-specific whole-body dosimetry software implementing collapsed cone superposition (CCS). We aimed to compare dosimetry values using SIMPLE-DOSE to dosimetry values using organ S-values (OSV) implemented in MIRDcalc [1] and local deposition method (LDM). ***Materials and Methods:*** 10 patients with mCRPC who received first infusion of 7.4 GBq of 177Lu-PSMA-617, underwent at day 3 ± 2 days whole-body SPECT/CT on VERITON-CT (Spectrum Dynamics, Israel). SIMPLE-DOSE implements a deep-learning-based organ segmentation nnU-Net [2] and CCS to compute the absorbed dose taking into account tissue densities [3]. Activity concentration in Bq/mL and masses for seven organs were derived from SIMPLE-DOSE's segmentation process to serve as an input in the OSV approach (MIRDcalc). For the LDM approach, SPECT/CT was converted to dose-rate maps with an energy deposition coefficient of 147 keV/Bq. Local density was provided by the CT. ***Results:*** Median (InterQuartile Range (IQR)) dose rate in mGy.h-1 for kidneys, liver, spleen, salivary glands, pancreas, lungs and bone marrow were respectively 7.4 (3.45), 1.08 (0.63), 0.92 (0.89), 4.5 (4.07), 1.01 (1.53), 0.8 (0.48), 0.32 (1.2). The organ-wise comparison with MIRDcalc showed a median (IQR) difference of 2.41% (1.4%), 2.85% (3.4%), 3.96% (4.2%), 4.88% (10.5%), 10.9% (3.2%), 21% (12.61%), 32% (10.7%) respectively. The voxel-wise comparison with LDM showed a median (IQR) symmetric mean absolute percentage deviation (sMAPD) of 31.2% (8.77%). Respectively 46%, 25% and 12.5% of voxels within the body had differences greater than or equal to 5%, 10%, 20%. The computation time for the whole process with SIMPLE-DOSE was between 2.5 and 3.5 minutes. ***Conclusion:*** Compared with MIRDcalc and LDM, dose rate calculations using CCS resulted in significant differences in dosimetry, especially when considering specific organs. Further comparisons with Monte Carlo simulations and correlations with organ toxicity are currently underway. SIMPLE-DOSE, an automatic, fast, and user-friendly dosimetry software, is available for testing at Oncometer3D.com. ***References:*** [1] Kesner AL, Carter LM, Ramos JCO, et al. MIRD Pamphlet No. 28, Part 1: MIRDcalc-A Software Tool for Medical Internal Radiation Dosimetry. J Nucl Med. 2023;64(7):1117-1124. [2] Isensee F, Jaeger PF, Kohl SAA, Petersen J, Maier-Hein KH. nnU-Net: a self-configuring method for deep learning-based biomedical image segmentation. Nat Methods. 2021;18(2):203-211. [3] Sanchez-Garcia M, Gardin I, Lebtahi R, Dieudonné A. Implementation and validation of collapsed cone superposition for radiopharmaceutical dosimetry of photon emitters. Phys Med Biol. 2015;60(20):7861-7876.

EPS-276

Theranostic Application of ^{68}Ga/^{177}Lu-LNC1011: A Novel Long-Circulating PSMA Probe for Metastatic Castration-Resistant Prostate Cancer

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Aim/Introduction: Utilizing albumin binders to enhance tumor uptake is a strategy to improve the therapeutic efficacy of PSMA-targeted treatments. However, maintaining diagnostic capabilities while ensuring low bone marrow toxicity is challenging. LNC1011 (D-Dan-Phe-PSMA) is a novel long-circulating PSMA probe based on a weak albumin-binding dansyl group. Preliminary animal studies have shown its potential to balance diagnostic and therapeutic efficacy. This study aims to conduct preliminary human distribution and dynamic imaging research of [68Ga]Ga-LNC1011 and [177Lu]Lu-LNC1011 in mCRPC patients, exploring uptake characteristics in tumors and organs, and to investigate its diagnostic and therapeutic efficacy as a theranostic probe. ***Materials and Methods:*** This study initially enrolled six mCRPC patients for dynamic PET/CT imaging using [68Ga]Ga-LNC1011 at time points of 10, 20, 30, 40, 60, 90, 110, and 150 minutes post-administration of [68Ga]Ga-LNC1011. Additionally, 3 patients underwent 1 and 2-hour [68Ga]Ga-PSMA-11 imaging within one week for comparison. In the therapeutic aspect, the study included 12 mCRPC patients who underwent SPECT imaging at multiple time points after the administration of [177Lu]Lu-LNC1011 at 2h, 4h, 24h, 48h, 72h, 120h, and 168h. The 12 patients were divided into three groups, receiving doses of 1.85 GBq , 2.78 GBq , and 3.7 GBq of [177Lu]Lu-LNC1011, respectively, for two treatment cycles. The therapeutic efficacy assessment post-treatment was based on the Response Evaluation Criteria In PSMA-Imaging

(RECIP 1.0) for molecular imaging efficacy evaluation. ***Results:*** PET images at multiple time points showed notably high early uptake in the cardiac blood pool at 10 min, with evident tumor uptake observed at the same time. Compared to [68Ga]Ga-PSMA-11, which detected 35 lesions in three patients, [68Ga]Ga-LNC1011 detected an equivalent number of lesions. High tumor uptake was observed in the time-activity curves, with SUVmax values showing a continuous increasing trend. Kidney uptake was highest among other organs, with a gradual increasing trend. SPECT imaging at multiple time points for [177Lu]Lu-LNC1011 showed significant tumor uptake at 168 hours. After two treatment cycles, two patients reached progressive disease (PD), while eight patients achieved stable disease (SD), and two patients attained partial response (PR) based on RECIP 1.0 criteria. ***Conclusion:*** [68Ga]Ga-LNC1011 demonstrated non-inferior diagnostic efficacy compared to [68Ga]Ga-PSMA-11, with early tumor uptake observed. Combined with [177Lu]Lu-LNC1011 SPECT, prolonged retention of the imaging agent in the tumor was suggested. Additionally, [177Lu]Lu-LNC1011 exhibited promising therapeutic efficacy after two cycles of treatment. Therefore, LNC1011 serves as a promising theranostic probe.

EPS-277

Characterize the Effective Half-Life for Instant Single Time Point Dosimetry using Machine Learning

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Aim/Introduction: Single time point (STP) image-based dosimetry presents a more convenient approach for clinical practice in radiopharmaceutical therapy (RPT) compared to conventional multiple time point (MTP) image-based dosimetry. Despite significant advancements, STP methods still pose challenges in routine clinical settings due to the need for strict and late timing in data acquisition. A new concept of instant single time point (iSTP) dosimetry is introduced in this preliminary study, achieved by predicting the effective half-life (Teff) of organs using machine learning (ML) applied on pre-therapy (PET and clinical) data. ***Materials and Methods:*** An ML model was developed to predict Teff based on patient characteristics derived from pre-therapy PET scans and clinical values. The time-integrated activities were then calculated from the predicted Teff and the STP measurements to estimate the absorbed dose. For the proof of concept, we focused on the left and right kidneys, liver, and spleen. Retrospective data from two centers using different PSMA-targeting radiopharmaceutical were included. Patients from the first center underwent [177Lu]Lu-PSMA I&T RPT (n=22 patients, 42 cycles) following pre-therapy [68Ga]Ga-PSMA-11 PET imaging. Patients from the second center received [177Lu]Lu-PSMA-617 (n=12 patients, only first cycle) following pre-therapy $^{[18F]}$F-PSMA-1007 PET imaging. The results using the iSTP method were compared to the MTP and the previously proposed Hänscheid methods. ***Results:*** The ML model, utilizing pre-cycle PET/CT data from both centers, achieved mean errors (ME) below 2% for [177Lu]Lu-PSMA I&T and 17% for [177Lu]Lu-PSMA-617, across both kidneys, liver, and spleen. Our iSTP method showed satisfactory results at 2 h, 20 h, 43 h, and 69 h time points, significantly outperforming the Hänscheid method at 2 h ($p<0.001$), where dosimetry is not feasible. Statistical analysis indicated that at 2 h and 20 h, our method performed better or was comparable to Hänscheid's best STP results. When using only initial PET/CT data from before the first cycle to predict Teff for subsequent cycles, [177Lu]Lu-PSMA I&T dosimetry demonstrated that, despite some variations, most cycles showed no significant differences across scenarios. Although the model using the second center data was less accurate compared to the first center, these results with PSMA-617 demonstrate the generalisability of our method. ***Conclusion:*** The preliminary results on two different PSMA RPT tracers confirmed the potential of iSTP in achieving accurate image-based dosimetry shortly and flexibly after the patient received its RPT. This proposed method may expedite the application of dosimetry in broader contexts, such as outpatient treatment.

EPS-278

Actinium-225 PSMA-617 therapy in metastatic castration resistant prostate cancer - Single center retrospective study

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Aim/Introduction: Prostate-specific membrane antigen (PSMA) radioligand therapy (RLT) is a novel treatment modality for metastatic castration-resistant prostate cancer (mCRPC). Actinium-225 (^{225}Ac), an alpha-emitter, has higher efficacy than beta-emitters and hence superior therapeutic option for mCRPC. This study aimed to evaluate the survival and safety of ^{225}Ac-PSMA-617 RLT in heavily pretreated mCRPC patients. ***Materials and Methods:*** This single center retrospective study included 15 mCRPC patients who had progressive disease with standard line of therapies, including Lutetium-177 (^{177}Lu) PSMA-617 RLT and were eventually treated with at least ≥1 cycle of ^{225}Ac-PSMA-617 RLT. Overall survival (OS), progression free survival (PFS), prostate specific antigen (PSA) response and treatment related adverse effects using common terminology criteria for adverse events (CTCAE) v5.0 grading system were assessed. ***Results:*** Among the 15 heavily pretreated mCRPC patients (mean age: 63.3 years, range: 52-78), median cumulative dose of 7.4 MBq (IQR 3.73-10.3) of ^{225}Ac-PSMA-617 RLT was administered intravenously over 36 cycles (median two cycles). All 15 patients had skeletal metastases, whereas lymph node and visceral metastases were seen in 12 and 4 (liver - 2 and lungs - 2) patients respectively. Pretreatment included androgen deprivation therapy (n=15), androgen receptor pathway inhibitors (Abiraterone: 9; Enzalutamide: 8), taxane based chemotherapies (Docetaxel: 15; Cabazitaxel: 3) and ^{177}Lu-PSMA RLT (n=8). Median follow-up duration was 9·0 months (IQR 2·0-40.0). Median baseline PSA was 158 ng/mL (IQR 7.67-1590). The median PFS and median OS were 20.9 months (95% CI 3.5-49.0) and 9.0 months (95% CI 2.7-15.2) respectively. 5/15 patients (33%) demonstrated PSA fall of >50%. Along the course of ^{225}Ac-PSMA-617 RLT, PSA fall >50%, from 1st to 4th cycles, was noted in 33%, 27%, 6.7% and 0 patients respectively. ^{177}Lu PSMA-617 naive patients had higher median OS than those pretreated with ^{177}Lu-PSMA-617 (19.7 vs 7.5 months). However, only borderline statistical significance was observed (p=0.063). In terms of adverse effects,

grade 1/2 xerostomia (10/15 patients, 67%) and fatigue (7/15 patients, 47%) were two most common adverse events in post-therapy period. Only four patients had grade 3 adverse events (xerostomia requiring nasogastric tube feeds in 1; anemia in 1; thrombocytopenia in 1; and nephrotoxicity requiring dialysis in 1). ***Conclusion:*** ^{225}Ac-PSMA-617 RLT is an efficacious therapeutic agent for mCRPC patients in whom standard lines of approved agents are exhausted. Xerostomia is the most common side-effect, however grade ≥3 adverse events are less encountered. So, overall ^{225}Ac-PSMA-617 RLT appears to be safe and well-tolerated in mCRPC patients.

EPS-279

PSMA radioligand therapy does not select for PSMA-negative tumor cells

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Aim/Introduction: PSMA radioligand therapy (RLT) has become an established palliative therapy for metastatic castration-resistant prostate cancer (mCRPC). However, virtually all tumors recur after treatment. This study investigated if RLT selects for tumor cells that no longer express PSMA. ***Materials and Methods:*** Radiation doses to PSMA positive and negative cells in cell clusters of varying sizes were calculated with MIRDcell. In addition, we searched an institutional database of 379 consecutive mCRPC patients for patients who achieved an exceptional response to PSMA RLT with Lu-177-PSMA I&T, defined as a decline of PSA by at least 90%. PSMA expression of metastases as assessed by SUVmax was compared between the PET scan before RLT and the PET scan at the time of relapse. ***Results:*** Simulations of densely packed clusters of prostate cancer cells showed that the self-dose (i.e., the radiation that PSMA-expressing cells receive from the radioligand that they have accumulated) is only 2.5% of the total dose (self-dose and cross-dose from neighboring cells) for spherical clusters as small as 1.0 mm. Differences between self- and cross-dose were smaller when PSMA-expressing cells were not densely packed, but under many scenarios, cross-dose remained dominant. This suggested that PSMA-negative cells in a metastasis that shows radioligand uptake on PET may not have a survival advantage. This hypothesis was confirmed by an analysis of 29 patients with an exceptional response to RLT. In 69 PSMA-positive lesions that showed a marked decrease in uptake/disappearance after therapy followed by an increase in uptake/relapse, there was no significant decrease in PSMA expression at the time of relapse compared to baseline (SUVmax 22.07±14.12 vs. 19.55±13.45, P=0.81; or SUVmax 22.58±12.15 vs. 17.70±11.57, P=0.76). ***Conclusion:*** In contrast to other targeted cancer therapies such as CAR-T cells or protein kinase inhibitors, PSMA RLT does not appear to select for cancer cells that lack target expression. Thus, retreatment with PSMA RLT at the time of relapse can often be a valid treatment option.

EPS-280

Quantitative ^{18}F-DCFPyL(PSMA) SUV_{max} Cutoff Values May Distinguish Prostate Cancer from Benign Tissue

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Aim/Introduction: Quantitative 18F-PSMA PET/CT may be useful distinguishing prostate cancer from benign activity with PET parameter cutoff values correlated to histopathologic diagnosis. ***Materials and Methods:*** This is a retrospective multi-institutional analysis of men who underwent 18F-DCFPyL (PSMA) imaging and subsequent histopathologic diagnosis. Participants underwent a PET/CT, two hours post-injection of 6 mCi (222 MBq) 18F-DCFPyL and subsequent tissue sampling a median of 28 days later (min-max: 1-172 days). Regions of interest (ROIs) were drawn to anatomically match tissue location. Quantified parameters included standardized uptake value (SUV)max/mean, total lesion uptake (TLU) and lesion volume. Liver and spleen ROIs served as reference for normalization ratios. PET positivity for lesions was visually assessed as uptake distinct from background. Univariate associations were evaluated via generalized linear mixed models and the Benjamini-Hochberg procedure was used to adjust for multiple testing. Cutoff values were determined by maximizing the Youden index. ***Results:*** In this preliminary subset assessment, 85 men, (median age of 67) from the National Cancer Institute were evaluated (median PSA: 4.37 ng/mL [min: 0.02, max: 464]). Thirty-four had metastatic disease, 14 had localized disease/treatment-naïve, and 37 had biochemical recurrence after primary treatment. Prior to imaging, 18 had a history of prostatectomy, 25 had radiation treatment and 15 had both prostatectomy and radiation therapy, with 17 men on androgen therapy within 6 months before or during the PSMA scan. One hundred and sixty-five histopathologic specimens (malignant [n=96]; benign [n=69]) were available for PET comparison (in-gland [n=40]; extra-prostatic [n=125]). For all lesions, there were strong associations between quantitative PET measurement and probability of malignancy: SUVmax/mean, tumor:liver , tumor:spleen, PET positivity, TLU, TLU:spleen, and TLU:liver (p-value < 0.001). Proposed optimal cutoffs included 4.14 for SUVmax (sensitivity 0.761, specificity 0.917),1.28 for tumor:spleen (sensitivity 0.667, specificity 0.917), and 0.664 for tumor:liver, (sensitivity 0.696, specificity 0.944). For the subset of in-gland lesions, imaging factors with the strongest relationship to malignancy included SUVmax/mean, tumor:liver, tumor:spleen and PET positivity (p-value <0.001). Grade Group 5 was highly associated with PET positivity, SUVmax/mean, tumor:liver, and tumor: spleen (p=value<0.001). Proposed prostate lesion cutoffs include: 3.95 for SUVmax (sensitivity 0.875, specificity 0.910), 1.19 for tumor:spleen (sensitivity 0.750, specificity 0.955), and 0.686 for tumor:liver (sensitivity 0.750, specificity 0.909). ***Conclusion:*** Quantitative 18F-PSMA imaging may improve ability to discriminate between benign and malignant lesions, especially when indeterminate. Further analysis is ongoing to validate the suggested cutoffs in this preliminary, hypothesis-generating study.

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To evaluate the detection rate of local and whole-body recurrence by integrated ^{18}F-PSMA PET/MR assessment of prostate cancer patients treated with prostatectomy with very low biochemical recurrence (< 0.5 ng/ml). Therapeutic implications.

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Aim/Introduction: To analyse the efficacy of integrated assessment of ^{18}F-PSMA.1007 PET/MRI on the early detection of local recurrence (LR) for prostate cancer patients with PSA levels <0.5 ng/ml after radical prostatectomy. To assess the location of recurrence so that therapy may be tailored to patient. ***Materials and Methods:*** Prospective study including 35 patients with prostate cancer (PCa), who were referred for a ^{18}F-PSMA.1007A PET/MR after prostatectomy with a very initial PSA value increase. Simultaneous acquisition in a PET/MRI hybrid equipment (SIGNA-GE), 1 hour after administration of 370±10%MBq of ^{18}F-PSMA.1007: Prostate selective imaging (20min): Multiparametric PET+MRI (MRImp): DIXON,T1,T2,diffusion, post-Gadolinium sequence. Whole body image (30min): PET+MRI: DIXON,T1,T2,diffusion,STIR sequences. A Nuclear Physician and a Radiologist jointly reviewed the studies: In order to assess LR, the "Prostate Imaging for Recurrence Reporting" system was used on MRI, as well as the Likert scale on the PET prostate imaging. The remaining lesions were classified as N1 and M1a. ***Results:*** PET/MRI was negative in 10 patients (28.6%) and positive in 25 (71.4%). RL was detected in 15 patients (42.9%): in 2 (5.7%) MRI was superior; in 3 (8.6%) PET was superior; integrated PET/MRI showed improved results in 5 patients (14.3%) for the detection of LR. Location of recurrences: LR in 11 patients (44.0%); N1 in 10 (40.0%); LR+N1(8.0%) in 2; LR+N1+M1a in 2 (8.0%). In 20 patients (80%) the PET/MRI findings allowed radioguided radiotherapy implementation (11 on LR, and 9 on N1), whereas hormonal treatment was decided in 5 patients (20%) due to multimetastases/spread disease. ***Conclusion:*** ^{18}F-PSMA.1007 PET/MRI increased by 14.3% the detection rate of LR in patients with PCa after prostatectomy and with PSA levels <0.5ng/ml, with a high detection rate of N1+M1a (71.4%), thus allowing radioguided radiotherapy in 80% of patients. ***References:*** JR Garcia, A Compte, M Buxeda, et al. Impacto de la tecnología híbrida PET/RM con ^{18}F-Colina en la estrategia terapéutica de los pacientes con cáncer de próstata tratados con prostatectomía que presentan elevación del antígeno prostático específico inferior a 1 ng/ml. Rev Esp Med Nucl Imagen Mol: 2021: 40: 197-203.Jorge Abreu-Gomez, MD, Adriano Basso Dias, MD, Sangeet Ghai, MDPI-RR: The Prostate Imaging for Recurrence Reporting System for MRI Assessment of Local Prostate Cancer Recurrence After Radiation Therapy or Radical Prostatectomy. A Review. AJR:220, June 2023. AL Gutierrez, JA Vallejo, JR Garcia, et al. Guía del procedimiento de la PET/TC con ^{18}F-DCFPyL. Rev Esp Med Nucl Imagen Mol: 2023: 42: 203-208.

EPS-282

Exploring the use of PRIMARY Score in favourable intermediate risk Prostate Cancer: analysis about the correlation with pathological upstaging after radical prostatectomy

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Aim/Introduction: The aim of our retrospective, single center study is to establish a correlation between PRIMARY score calculated on ^{18}F-PSMA-1007 PET/CT scan performed for staging favourable intermediate risk prostate cancer (PCa) and pathological evaluation after radical prostatectomy. ***Materials and Methods:*** We retrospectively enrolled 54 patients diagnosed with favourable intermediate risk PCa (Gleason Score 3+4; ISUP Grade 2) after biopsy procedure, who underwent ^{18}F-PSMA-1007 PET/CT to stage the disease and were referred to surgery as primary treatment at our institution. PSMA PET were revised by two experienced readers and PRIMARY score was calculated. Data about pathological assessment were collected and statistically combined with PSMA-PET results. ***Results:*** Patients were stratified into two groups based on PRIMARY Score results. Of 54 patients enrolled, 28 (51,9%) were classified as Group 1: PRIMARY Score 1,2 or 3, median PSA 6,2 ng/ml; 26 (48,1%) were classified as Group 2: PRIMARY Score 4 or 5, median PSA 9,3 ng/ml. After pathological evaluation of the prostate surgical specimen 15 patients (27,8%) were upstaged to unfavourable intermediate risk. Among them, 4 patients (14,3%) belonged to Group 1 and 11 patients (42,3%) to Group 2. Despite the limitations derived from a small population, PRIMARY Score 4,5 was significantly correlated with pathological upstaging after surgery through Chi-Square Test (Chi-Square Value=5,179; p=0,0229). ***Conclusion:*** Our results are harmonious with the current literature on this subject, confirming the importance of a correct interpretation of intra-prostatic PSMA uptake and furtherly validating the accuracy of PRIMARY Score. There's more to be discovered about PSMA PET and its role as a game changer in the management of prostate cancer both in surgical and in active surveillance approaches, therefore our analysis is worth to be deepened in larger prospective trials. ***References:*** Emmett L, Papa N, Buteau J, Ho B, Liu V, Roberts M, Thompson J, Moon D, Sheehan-Dare G, Alghazo O, Agrawal S, Murphy D, Stricker P, Hope TA, Hofman MS. The PRIMARY Score: Using Intraprostatic 68Ga-PSMA PET/CT Patterns to Optimize Prostate Cancer Diagnosis. J Nucl Med. 2022 Nov;63(11):1644-1650. doi: 10.2967/jnumed.121.263448. Epub 2022 Mar 17. PMID: 35301240; PMCID: PMC9635676.

EPS-283

^{212}Pb SPECT/CT Clinical Imaging for Routine Biodistribution and Dosimetry of Targeted Alpha Therapy

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Aim/Introduction: Aim/Introduction 212Pb-based Targeted Alpha Therapy (212Pb-TAT) shows great promise. We have developed a SPECT/CT acquisition protocol for routine biodistribution and dosimetry imaging in patients with metastatic castration resistant prostate cancer (mCRPC) following the administration of a novel PSMA-targeted-therapy, [212Pb] Pb-ADVC001. ***Materials and Methods:*** SPECT/CT dosimetry imaging series have been acquired at 90 minutes, 4, 20 and 24-28 hours post injection (p.i.) of 60 MBq [212Pb] Pb-ADVC001 in

four patients. Confirmatory treatment localisation imaging has been acquired at 90 minutes for the subsequent 3 cycles in each patient. The images were acquired on a gamma camera using HE collimators, 30 minutes per bed position (30s/projection, 120 projections over 360 degrees) for 2 bed positions to include the salivary glands and kidneys. To maximise efficiency, 6 energy windows were used for two triple-energy window acquisitions (78 keV ± 20% with 20% scatter [31% abundance] and 239 keV ± 10% with 10% scatter [43% abundance]. Equal weighting was applied to each scatter window during scatter and attenuation corrected reconstruction. Each photo peak was reconstructed separately, and the resultant images summed. ***Results:*** [212Pb] Pb-ADVC001 SPECT CT imaging was feasible in all patients. 212Pb progeny have high energy emissions (208Tl 2.6 MeV 35%) which cause significant scatter from the patient and the lead collimator leading to a reconstruction artefact along the collimator orbit path. This artefact dominates the count statistics of the transaxial images which was reduced with filtering and is trimmed for creation of MIP images. A Gaussian 12 filter was applied for visual localisation, and unfiltered reconstructions were used for dosimetry analysis. [212Pb] Pb-ADVC001 uptake showed concordance with location of PSMA-expressing disease on $^{[18F]}$DCFPyL or [68Ga]Ga-PSMA-11 PET imaging. Uptake in tumour lesions at 90 min p.i. was seen in all patients, and tumour retention was observed over 24h, while uptake in kidneys decreased significantly after 5h p.i.. Notably, [212Pb] Pb-ADVC001 uptake in the salivary glands was low and comparable to background level. Normal organ absorbed dose estimates were derived from the serial acquisitions. ***Conclusion:*** 212Pb SPECT/CT imaging allows confirmation of TAT biodistribution and permits TAT dose estimates, assuming no progeny redistribution.

EPS-284

Characteristics, tolerance and effectiveness of patients aged more or less than 75 years treated with [177Lu]Lu-PSMA-617 as part of France's early access program

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Aim/Introduction: [177Lu]Lu-PSMA-617 (Lu-PSMA) is a new treatment for metastatic castration-resistant prostate cancer (mCRPC) expressing PSMA, available in France since December 2021 as part of France's early access program in patients who previously received at least one line of taxane chemotherapy and one new generation hormonal therapy. Its safety profile in the elderly is not known. This retrospective analysis compares the characteristics, safety and efficacy of Lu-PSMA in all patients aged >75 years old (yo) treated in France as part of early access program compared to patients ≤75yo. ***Materials and Methods:*** From 01.12.2021 to 31.01.2024, 1696 patients were included. The recommended administration schedule was 6 intravenous injections of Lu-PSMA (7.4 GBq) every 6 weeks. Patients characteristics and safety data were collected during the 6 follow-up visits. ***Results:*** 645 patients >75yo (39.7%) and 981 patients ≤75yo (60.3%) were included. Patients ≤75yo and patients >75yo had the following characteristics: ECOG score [0-1] 84.1% vs 89.2% (p<0.001); Median PSA 64.5 ng/ml vs 52.6 ng/ml (p=0.23); metastases by site: bone 92.9% vs 93.9% (p=0.42); lymph nodes 57.8% vs 61.5% (p=0.14); hepatic 9.8% vs 8.9% (p=0.54); number of systemic treatment lines ≥ 3 77.5% vs 78.4%; pain management by opioids 21.6% vs 31.3% (p<0.001) respectively. Over a period of effectiveness defined by a first cycle of treatment between 01.12.2021 and 30.04.2023, 790 underwent clinical, biological and radiological evaluations, of whom 294 patients >75yo (37.2%). Median follow-up time period was around 7 months. The median time to imaging PFS was not statistically different 6.93mo [5.78 - 7.66] for patients ≤75yo vs 7.98mo [6.11 - 8.21] for pt>75yo. 82.9% of patients >75yo and 80.8% of patients ≤75yo had a controlled PSA level (decrease or stabilization). 82.9% of patients>75yo and 80.8% of patients ≤75yo had a controlled PSA level (decrease or stabilization). Over this same period, 85 patients ≤75yo and 68 patients>75yo had dose adaptation (p=0.039). There was no significant difference between the 2 populations regarding reasons for discontinuing treatment, progression of the disease, or serious adverse events related or not to the treatment and death. ***Conclusion:*** Analysis of the French National data of patients treated with Lu-PSMA for mCRPC shows few differences for patients >75yo compared to patients ≤75 yo concerning patients characteristics and safety. Also, no differences in terms of radiological and biological response was observed. These data suggest that age alone should not preclude the use of Lu-PSMA in patients >75yo.

EPS-285

Can We Predict the Response to Lu177-PSMA Therapy and Progression-Free Survival Using Ga68-PSMA and F^{18}-FDG PET/CT Parameters in Prostate Cancer?

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Aim/Introduction: The aim of our study is to investigate clinical, pathological, Ga68-PSMA and F^{18}-FDG PET/CT parameters that can predict Lutetium177-Prostate-Specific Membrane Antigen(Lu177-PSMA) treatment response and progression-free survival(PFS) in patients with prostate cancer prior to therapy. ***Materials and Methods:*** 38 patients with metastatic castration-resistant prostate cancer who received Lu177-PSMA therapy were included in our study. Demographic characteristics and pathology-laboratory findings[total Prostate Specific Antigen(PSA), pre-treatment and 2nd month total PSA difference(ΔPSA)] were recorded. The parameters of Ga68-PSMA and F^{18}-FDG PET/CT[Maximum standardized uptake value(FSUVmax), mean SUV(FSUVmean), metabolic tumor volume(MTV), and total lesion glycolysis(TLG) for F^{18}-FDG PET/CT; maximum SUV(PSUVmax), mean SUV(PSUVmean), PSMA-Tumor Volume(PSMA-TV), and Total Lesion-PSMA(TL-PSMA) for Ga68-PSMA PET/CT) of the lesion with the highest PSMA expression on pre-treatment Ga68-PSMA PET/CT examination were recorded. PFS was defined as the interval between the date of the first treatment dose and the date of the second consecutive increase in total PSA. Logistic regression analysis was conducted to identify factors predicting the response to Lu177-PSMA therapy, and Kaplan-Meier analysis was performed to determine factors affecting progression-free survival. ***Results:*** The clinical-pathological characteristics of the 38 patients are presented in Table 1. Treatment response was observed in 26(68%) of the 38 patients. The mean progression-free survival time observed was 7

months(range: 3-15 months). A statistically significant relationship was found between treatment response and the ratio of bone PSUVmax to liver PSUVmax(p=0.024) and the ratio of bone PSUVmax to parotid PSUVmax(p=0.018). In the univariate analysis conducted to determine factors predicting treatment response, the bone FSUVmax/PSUVmax ratio(p=0.047,ORR: 0.03, C.I. 0.001-0.950), bone FSUVmean/PSUVmean ratio(p=0.042,ORR: 0.029, C.I. 0.001-0.881), and pre-treatment LDH level(p=0.029,ORR: 0.989, C.I. 0.980-0.999) were found to be significant. However, they were not significant in the multivariate analysis. The impact of bone PSMA-TV(p=0.008), bone FSUVmax/PSUVmax ratio(p=0.004), bone FSUVmean/PSUVmean ratio(p=0.005), bone MTV(p=0.022), TLG(p=0.024), and ΔPSA value(p=0.013) on PFS was found to be significant. In the ROC analysis, the cut-off value for bone PSMA-TV was determined to be 3.03 ml(sensitivity: 80%, specificity: 73%), indicating that patients with PSMA-TV <3.03 ml had longer PFS(≥7 months). ***Conclusion:*** In prostate cancer, it has been found that low bone PSMA-TV, low bone FSUVmax, FSUVmean, MTV, TLG parameters before Lu-177 PSMA therapy and high ΔPSA value after the 1st dose are associated with longer PFS. Consequently, we would like to emphasize the importance of evaluating both the tumor volume of lesions in Ga68-PSMA PET/CT and F^{18}-FDG PET/CT parameters in predicting prognosis before Lu177-PSMA therapy.

EPS-286

The correlation between PSMA PET/CT uptake and [^{177}Lu]Lu-PSMA-I&T absorbed dose in Metastatic Castration-Resistant Prostate Cancer Patients.

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Aim/Introduction: Patients with metastatic castration-resistant prostate cancer (mCRPC) might be excluded from PSMA-targeted radioligand therapy due to anticipated limited therapeutic efficacy if their tumours show less than 1.5 times the uptake in their liver on PSMA PET/CT.[1] The mean absorbed dose (MAD) in tumour lesions and normal tissues is likely associated with therapeutic efficacy and toxicity, respectively.[2] A strong correlation between PSMA PET uptake and [177Lu]Lu-PSMA absorbed dose potentially enhances patient selection as treatment outcomes and toxicity are more predictable. Our objective was to correlate the SUVmean value on PSMA PET to the MAD of tumours after the first cycle of [177Lu]Lu-PSMA-I&T therapy, stratifying for different radiotracers. ***Materials and Methods:*** mCRPC patients who underwent [177Lu]Lu-PSMA-I&T therapy from October 2020 till January 2023 were retrospectively included. Patients who had not undergone an EARL-accredited PSMA PET/CT scan within 2 months prior to treatment were excluded. PSMA PET/CT scans were performed using [18F]F-PSMA-JK-7, [18F]F-PSMA-1007 or [68Ga]Ga-PSMA-11. All patients received 7.4 GBq [177Lu]Lu-PSMA I&T and underwent SPECT/CT scans at 24 and 168 hours post-administration. In target lesions, a volume of interest (sphere of 20 mm diameter) was delineated around the voxel exhibiting the highest SUV or uptake for PET and SPECT, respectively. MADs were assessed using a mono-exponential fit. Correlations between SUVmean and MAD in tumours were analysed for bone, lymph node and other lesions. Additionally, we investigated differences among the different PSMA PET radiotracers. ***Results:*** 46 mCRPC patients with a total of 132 target lesions were included. For bone lesions, a moderate correlation was observed between SUVmean and MAD (N=66, r=0.54, p<0.01). Among the radiotracers, [18F]F-PSMA-JK-7 exhibited the strongest correlation (N=37, r=0.872, p<0.01), surpassing [18F]F-PSMA-1007 (N=12, r=0.12, p=0.75) and [68Ga]Ga-PSMA-11 (N=22, r=0.39, p<0.08). Lymph node lesions exhibited a moderate correlation (N=42, r=0.562, p<0.01). [68Ga]Ga-PSMA-11 demonstrated the strongest correlation (N=13, r=0.718, p=0.01) in comparison to [18F]F-PSMA-JK-7 (N=22, r=0.614, p<0.01) and [18F]F-PSMA-1007 (N=7, r=0.2, p=0.8). For other lesions, the overall correlation was strong (N=21, r=0.753, p<0.01). [18F]F-PSMA-JK-7 exhibited a very strong correlation (N=9, r=0.967, p<0.01) while [68Ga]Ga-PSMA-11 showed a moderate/strong correlation (N=11, r=0.71, p<0.02). ***Conclusion:*** While there was an overall moderate correlation seen for all tumour lesions, [18F]F-PSMA-JK-7 generally demonstrated stronger correlations across bone and other non-lymph node lesions. These findings suggest that if PSMA PET-guided prediction models for radiation dose or treatment outcomes are developed, radiotracer selection is crucial. ***References:*** [1]Hofman et al. Lancet Oncol (2018) [2]Wang et al. Clin Nucl Med (2019)

EPS-287

Quantitative Evaluation of PET/CT and SPECT/CT-based Dosimetry following Yttrium-90 Radioembolization

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Aim/Introduction: Following 90Y-radioembolization (90Y-RE), 90Y-PET/CT and 90Y-SPECT/CT imaging provide the means to calculate the voxelized absorbed dose distribution. Given the widespread use of the two imaging modalities and lack of well-established standardized dosimetry protocols for 90Y-RE, there is a clinical need to systematically investigate the performance of voxel-based dosimetry between them. The aim of this work is to quantitatively analyze and compare 90Y-PET/CT and 90Y-SPECT/CT-based dosimetry following 90Y-RE. ***Materials and Methods:*** 90Y-PET/CT and 90Y-SPECT/CT imaging was acquired for 35 patients following 90Y-RE with glass-microspheres for the treatment of unresectable hepatocellular carcinoma (as part of a prospective clinical trial, RAPY90D, NCT03896646). Dosimetry was performed using the local deposition method with known activity and the mean dose (Dmean) was calculated for perfused liver volumes (PV), tumors (T), and perfused normal livers (NL). Additionally, the absorbed dose to x% of the volume (Dx, x ∈ [5%, 10%, ∈, 95%]) and the volume receiving y Gy (Vy, y ∈ [10 Gy, 20 Gy, ∈, 200 Gy]) were calculated for T and NL, respectively. Dose metrics were compared using linear regression, Bland-Altman analysis, and statistical testing. ***Results:*** Both 90Y-SPECT/CT and 90Y-PET/CT-based tumor Dmean were strongly correlated (R2≥0.90) with Dx, excluding metrics on the extrema. Intra-modality comparisons of various Dx and Vy metrics yielded statistically significant differences (ANOVA, p<0.001) for both 90Y-PET/CT and 90Y-SPECT/CT. Based on statistical testing, only Dx metrics separated by greater than 20-30% coverage, and only Vy metrics separated by greater than 40-70 Gy, reported significant differences. For PV, there was a strong correlation (R2≥0.99) between Dmean derived separately from 90Y-PET/CT and 90Y-SPECT/CT imaging. The strength of the correlation was slightly reduced for T and NL with R2=0.91 and R2=0.95, respectively. For PV, the mean bias ± standard error (SE) and 95% limits of agreement (LOA) between Dmean from the two modalities was effectively zero with -0.8±0.4% (±2.5%). For T and NL, the mean bias ± SE (±LOA) was -14.5±3.7% (±24.1%) and 9.4±4.7% (±27.4%), respectively. ***Conclusion:*** The strong correlation between Dmean and Dx suggests information from multiple dose metrics (e.g., D70 and Dmean) is largely redundant when establishing dose-response relationships in 90Y-RE. Dmean

is highly correlated between 90Y-PET/CT and 90Y-SPECT/CT-based dosimetry, for all liver VOIs. Relative to 90Y-SPECT/CT, 90Y-PET/CT, on average, yielded larger Dmean to tumors (14%) and smaller Dmean to perfused normal livers (9%). Absorbed dose differences for perfused liver volumes between 90Y-SPECT/CT and 90Y-PET/CT were negligible.

EPS-288

Holmium-166 transarterial radioembolization in unresectable, early-stage hepatocellular carcinoma; a prospective, single-arm, open label, multicenter phase II study: HOMIE-166 Study Protocol

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Aim/Introduction: Holmium-166 transarterial radioembolization (Ho-166 TARE) is a promising modality for the treatment of hepatocellular carcinoma (HCC), given the unique characteristics of holmium, allowing careful patient selection and personalized dosimetry treatment planning. Further clinical evidence is needed to evaluate the safety and efficacy of Ho-166 TARE in the treatment of early-stage HCC. The primary objective is to evaluate the efficacy of Ho-166 TARE in HCC patients with limited tumor burden, well preserved liver function and performance status, and ineligible for liver transplantation and/or liver resection. The secondary objectives are to analyse response rates, time to event outcomes, safety-toxicity, liver function, biodistribution/dosimetry and quality of life. Additionally, magnetic resonance (MR)-based dosimetry will be assessed as an exploratory objective. ***Materials and Methods:*** This is a prospective, single-arm, open-label, multicenter study with Ho-166 TARE. Patients with unresectable HCC with a single nodule ≤ 8 cm or up to three nodules with a diameter of ≤ 5 cm (each) will be recruited. Patients eligible for liver transplantation can still be included in the setting of bridge to transplant. It is expected a sample size of 65 evaluable patients to be recruited. The primary efficacy endpoint is defined as confirmed objective response rate (ORR) by localized mRECIST assessed by blinded independent central review. The secondary endpoints are best ORR based on localized mRECIST, best and confirmed ORR based on mRECIST, Duration of Response (DoR) ≥ 6 months based on localized mRECIST and mRECIST, time to progression, progression-free survival (PFS), hepatic PFS, liver transplantation rate, liver resection rate, overall survival, adverse events and MR-based dosimetry. Additionally, magnetic resonance (MR)-based dosimetry endpoints will be analysed. This study will also provide further evidence on the dose-response relationship of Ho-166 TARE in early HCC. Patients will be followed up regularly until 24 months post treatment with Ho-166 microspheres. After that, patients will be followed for survival follow-up every 6 months until death or 60 months, whichever comes first. ***Conclusion:*** Personalised dosimetry treatment planning in TARE holds the promise of future improvement of treatment efficacy and safety. The unique imaging properties of Ho-166 microspheres will support such developments. This study will confirm the safety and efficacy of Ho-166 TARE in this patient population.

EPS-289

The impact of non-target lesions on dosimetry calculations in Y-90 microsphere liver radioembolization

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Aim/Introduction: There are some studies based on mean whole healthy liver parenchymal absorbed dose (WHLPD) values to determine the maximum safe dose for patients in Y-90 microsphere transarterial radioembolization (TARE) treatment (1). Although non-target space occupied liver lesions (outside the perfused area) do not affect the doses absorbed by perfused targeted healthy parenchyma, subtracting them from liver parenchyma volume during dosimetry calculations would impact the dose received by healthy parenchyma of the whole liver since they might have a considerable volume. In this study, the impact of subtracting non-target lesions (NTL) from the liver volume on the average dose received by whole healthy liver parenchyma was investigated in dosimetry calculations. ***Materials and Methods:*** Twenty-five patients who underwent Y-90 TARE between July 2018 and March 2024 were studied. Post-treatment regional imaging was performed with PET/MRI within 24 hours. Multi-compartment dosimetry was performed using Simplicit90Ytm software on the post-treatment PET/MRI images by delineating volumes of interests (VOIs) for the whole liver, perfused area, targeted tumor, and healthy parenchyma of the perfused area. Additionally, VOIs for NTL were delineated for each patient and subtracted from the whole liver parenchyma followed by a second dosimetry calculation. ***Results:*** The mean administered Y-90 activity was 2.4 ± 1.6 GBq. The mean volumes of the whole liver, target tumor, and NTL were 1923.4 ± 726.2 cm^3, 311.7 ± 485.3 cm^3 and 120.6 ± 152.8 cm^3, respectively. When NTL were subtracted, the mean healthy parenchymal volume of the whole liver was 1491.1 ± 298.5 cm^3, compared to 1611.7 ± 381.4 cm^3 without subtraction. The mean WHLPD value was significantly higher when the subtraction of NTL is performed (34.0 ± 15.7 Gy versus 31.9 ± 15.2 Gy; $p < 0.01$), giving an increase value between 0.5% and 39.9%. ***Conclusion:*** Incorporating NTL in dosimetry of Y-90 TARE leads to a more accurate volume calculation and dose estimation to the whole healthy liver parenchyma. We found that this approach results statistically significant increase of mean dose comparing to NTL non-subtracted calculation. Therefore, taking NTL into account to the dosimetry aids to a better determination of the maximum safe dose for the patients undergoing Y-90 TARE, especially in those with high NTL volumes. ***References:*** 1. Chiesa C, et al. Radioembolization of hepatocarcinoma with 90Y glass microspheres: Treatment optimization using the dose-toxicity relationship. European Journal of Nuclear Medicine and Molecular Imaging. 2020;47:3018-32.

EPS-290

Efficacy And Safety of Repeated TARE Treatments with Extended Shelf Life Y90 Glass Microspheres in Colorectal Cancers : A Single-Center Experience

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Aim/Introduction: When planning TARE treatment for liver malignancies, multiple treatment sessions may be required due to the presence of large tumoral lesions, heterogeneity in the distribution of glass microspheres, and specially bilobar disease. In this study, we aimed to evaluate the efficacy of treatments with quantitative parameters of pre/post-treatment $^{[18F]}$F-FDG PET/CT imaging and assess the safety and side effect profile in patients with metastatic colorectal cancer (mCRC) who underwent repeated sessions of TARE with Extended shelf life (ExSL) 90Y glass-microspheres. ***Materials and Methods:*** A total of 62 TARE sessions involving 37 patients were included, with a minimum of 2 and a maximum of 6 sessions per patient. Multicompartmental dosimetry was performed using Simplicity90YTM software. "Baseline" and "follow-up" MTV and TLG values were calculated by pre-post treatment $^{[18F]}$F-FDG PET/CT imaging. Absorbed dose values for unit MTV/TLG were calculated as (Gray/MTV) x100 and (Gray/TLG)x100, respectively. The metabolic tumor response was categorized as follows: "Complete Response-CR", "Partial Response-PR", "Stable Disease-StD", "Progressive Disease-PD", "Disease Control Rate-DCR" and "Objective Response Rate-ORR". Time from diagnosis to death, time from the first treatment session to death (overall survival-OS) and progression-free survival (PFS) were determined. Adverse events were recorded using the CTCAE v5.0 criteria. ***Results:*** For 62 treatments, CR was observed in 8 cases, PR in 25 cases, StD in 22 cases, and PD in 7 cases. The DCR (CR+PR+StD) was 88.7% and the ORR (CR+PR) was 53.2%, with median OS of 12.7 months and median PFS of 9.3 months. The median number of microspheres reaching the liver was found to be statistically higher in CR and PR cases compared to StH and PD cases (p=0.021). When the patients were classified as treatment-responders and non-responders, a statistically significant increase in the time from diagnosis to death was observed in the treatment-responders group (p=0.034, HR=1.977, 95% CI: 1.055-3.707). When the patients who received two sessions of TARE treatment were classified as treatment responders and non-responders, OS was higher in the responders group (p=0.025, HR=0.35, 95% CI: 0.14-0.874). In the dose-toxicity profile analyses, one patient developed REILD, and another patient developed RECHT. The clinical manifestations in these two patients occurred after the third TARE sessions. ***Conclusion:*** Our single-center study has demonstrated, for the first time, evidence of the therapeutic effectiveness and contribution to OS of repeated treatments and safety in terms of the dose-toxicity profile of ExSL 90Y glass-microspheres in mCRC patients who received multiple sessions.

EPS-291

Efficacy and tolerance results of high-dose radiation segmentectomy with resin microspheres.

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Aim/Introduction: Radiation segmentectomy (RS) is a supraselective liver radioembolization procedure, aimed at small lesions, confined to one or two liver segments, with radical therapeutic intent. Standardized dosimetric guidelines are based on results from cohorts treated with glass microspheres. The aim of the present study is to demonstrate the feasibility of performing supraselective procedures with resin microspheres, using ablative doses and to describe both therapeutic results, in terms of radiological response, and adverse effects. ***Materials and Methods:*** Retrospective, descriptive study, which included lesions treated with RS through administration of resin microspheres and use of ablative doses, in the period between April 2021 and September 2023. Response monitoring was carried out by CT scan one and three months after the procedure, using mRECIST criteria, classifying the type of response as complete, partial and progression.By reviewing the clinical history, the adverse effects related to the procedure and the most relevant dosimetric data were collected, such as the theoretical tumor absorbed dose and final absorbed dose, calculated using voxel-based dosimetry software, D50 and D70, extracted from the dose/volume histogram, angiosome tumor volume and number of segments included. ***Results:*** 30 hepatocellular carcinoma lesions (HCC) were included with a mean tumor size of 34,33mm and mean angiosome volume of 340,04cc. 83,33% of the procedures included a single segment and 16,67% included two liver segments. The calculated mean target dose was 377,78Gy (median 400Gy). The mean final calculated absorbed dose on 90Y-PET/CT image was 429,53Gy, with D50 and D70 values of 401,9 and 303,3Gy respectively. 73,33% of the lesions showed complete radiological response, 20% partial response and 6,66% progression. As adverse effects, only one patient was recorded with liver abscesses secondary to the procedure, resolved by antibiotic therapy. ***Conclusion:*** RS with high-dose resin microspheres is a safe and well-tolerated procedure in patients with small HCC, achieving a complete response of up to 73,33%.

EPS-292

Radiation protection during liver surgery shortly after SIRT: Interactive visualization of radiation on the liver surface for individualized planning.

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Aim/Introduction: Liver surgery shortly after radioembolization (SIRT) with 90Y microspheres may be indicated. However, the surgical personnel has to be spared from excessive radiation exposure. Since 90Y predominantly emits beta radiation with about a cm range, the particle distribution inside the liver

and especially the distance of 90Y from its surface determines radiation exposure of the personnel touching the liver surface. Instead of using a blanket waiting time for the decay of 90Y before surgery, an individual visualization of radiation on the liver surface (spatial and temporal) is proposed. This may allow for earlier surgery and may even guide the surgery itself (hand placement, radiation shielding sheets and gloves). The clinical potential of this approach was assessed by experienced transplantation surgeons. ***Materials and Methods:*** Patients underwent simultaneous 90Y-PET/MRI imaging of the liver after SIRT. PET emission data were acquired for twenty minutes in one bed position, standard liver MRI sequences were acquired concurrently. The reconstructed PET images were convolved with a dose-point-kernel to obtain the dose distribution. The open-source software framework Voreen (1) was adapted and used for the visualization of the distribution of radiation on the liver surface, together with MR-derived liver anatomy and adjacent anatomical structures such as vessels that may serve as anatomical landmarks during surgery. Two experienced transplant surgeons were acquainted with the visualization method (3 patients with unifocal, oligofocal and disseminated tumor) and given a questionnaire asking for their assessment of its clinical applicability. ***Results:*** An interactive visualization that satisfies the specifications set out at the start of the project was successfully realized within the Voreen framework. A user can explore the rendered data in 3D, he can explore the decay over time and he can set radiation threshold levels on the liver surface. The transplant surgeons assessed that the method can be applicable and of worth in the clinical setting. ***Conclusion:*** Individual visualization of radiation on the liver surface may be a suitable method to safeguard safe and early surgery, e.g. liver transplantation, after SIRT. This warrants further refinement, validation and practical implementation of the method. Careful consideration has to be given to the fact that the liver changes shape when manipulated during surgery in contrast to static imaging used for this first proof of concept. ***References:*** (1) Drees D, Leistikow S, Jiang X, Linsen L. Voreen - An Open-source Framework for Interactive Visualization and Processing of Large Volume Data (2022). arXiv:2207.12746.

EPS-293

Does the number of microspheres impact the treatment efficacy in ^{90}Y Transarterial Radioembolization?

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Aim/Introduction: In 90Y trans arterial radioembolization (TARE) considerable variability exists in clinical outcomes, prompting investigations into factors influencing treatment response. Among these factors, the number of spheres administered has garnered significant interest. Aim of this study is to determine the impact of the number of particles on the treatment efficacy. ***Materials and Methods:*** A total of 23 patients with 31 HCC lesions treated with TARE was considered in this single-institution retrospective study.The modified Response Evaluation Criteria in Solid Tumors (mRecist) was used to evaluate the tumor response on contrast enhanced CT performed at 3 months after radioembolization. Post-TARE 90Y-PET/CT was used to calculate the mean absorbed tumor dose (TD) with the voxel dosimetry approach and the Equivalent Uniform Dose (EUD) to take into account the dose distribution heterogeneity. For each patient, tumor particle density (particles/mL) and tumor-to-normal ratio (TN) were determined on 90Y-PET/CT. The 90Y resin microspheres vial contains approximately 44.48X106 particles and only an aliquot is necessary to obtained the calculated activity to be injected, therefore the number of particles delivered to the tumor was calculated as: (44.48x106 x Delivered Activity within the Tumor Region[GBq])/(3[GBq]at the time of calibration on calibration day x 2-treatment time (hours after calibration)/64.1). The tumor particle density was obtained by dividing this value for the tumor volume. The TN was calculated as the ratio between the activity within the tumor and normal liver volume of interests. To assess the impact of TD, EUD, tumor particle density and TN on tumor response, a multivariate analysis was performed. ***Results:*** Tumor volumes ranged from 6.48 to 732 mL (median 72.83 mL). On the basis of Barcelona Clinical Liver Cancer (BCLC) classification, 5 patients were BCLC A, 13 BCLC B, 5 BCLC C; 24 of 31 target lesions (77%) exhibited partial/complete response. Mean TD and EUD were 322±179 Gy and 199.96±87.71 Gy respectively. Evaluation of the 90Y-PET/CT provided a mean particle density of 65885±33901 particles/mL and a mean TN of 1.84±0.93. Multivariate analysis showed that local tumor response was significantly predicted by EUD (p=0.03), mean particle density (p=0.02), TN (p =0.007), but not by TD (p =0.15). ***Conclusion:*** An accurate choice of the number of resin spheres can significantly impact treatment planning and patient outcomes, offering a tailored approach to radioembolization therapy.

1901

Wednesday, October 23, 2024, 11:25 - 11:45
Hall 1

Closing Ceremony

OP-891

Closing Ceremony

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EP-01

e-Poster Area

A: Preclinical Studies -> A1 Medical Preclinical -> A11 In Vitro Studies

EP-0001

[^{3}H]PiB was not a useful radio ligand for the biding assay using magnetically isolated myelin

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Aim/Introduction: in vivo imaging of myelin sheaths is significant for the clinical diagnosis of multiple sclerosis (MS). PET tracer visualizing myelin plays crucial role for this purpose. Seeking the compounds with high affinity to myelin is a first step to develop myelin imaging tracers and displacement binding assay using a radioactive ligand is typical technique to assess the affinity of compounds. PiB is a well known amyloid tracer and binds to white matter, where myelin is most abundant. In this

regard, PiB has been considered to bind basic myelin protein. We decided to use 3H-labeled PiB as a radio ligand of binding assay to the myelin which was isolated by magnetic beads. ***Materials and Methods:*** Myelin fractions from mouse brain (6-week-male, whole brain except cerebellum) were prepared using a commercially available tissue dissociation kits and myelin isolation beads according to the manufacturer's protocol. The molar activity and radiochemical purity of [3H]PiB used in the experiments were 2.96 TBq/mmol and 99%, respectively. MeDAS was synthesized in accordance with reference 1. Isolated myelin fractions were placed on the slide glass and dried. The myelin fractions were incubated with MeDAS (10 μM), a fluorescent compound with high affinity for myelin, to confirm the presence of myelin. In vitro binding assay of [3H]PiB (1 nM) was performed against the isolated myelin fractions. Non-specific binding was defined in the presence of unlabeled PiB (1 μM). ***Results:*** MeDAS-positive structures were observed on the myelin fractions. The result indicated the isolated myelin would be usable for displacement binding assay. In vitro binding assay of [3H]PiB indicated that significant specific binding was not detected on the myelin fractions although [3H]PiB preserved high specific binding for the synthetic Aβ40 fibrils. ***Conclusion:*** We prepared magnetically isolated myelin fractions for the displacement binding assay. Fluorescent MeDAS stain was observed but specific binding of [3H]PiB was not detected on the myelin fractions. As a result, we did not use [3H]PiB as a radio ligand for the biding assay. ***References:*** 1. Wu C. et al, J. Med. Chem. 2008 51, 6682.

EP-0002

In Vitro Study on DNA Damage Induction by Targeted Radionuclide and External Radiotherapy compared to DNA Damage Simulation using GEANT4 DNA

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Aim/Introduction: Targeted radionuclide therapy (TRNT) has recently emerged as a highly effective treatment option for cancer patients with metastatic disease who do not respond to conventional therapies. Targeted Alpha Therapy (TαT) is the most effective TRNT, as α-particles induce complex DNA damage (DD) and are less prone to resistance development. Nevertheless, little is known about DD induction and repair after TRNT. Furthermore, successful treatment requires accurate, model-based estimation of the administered dose. Therefore, these processes are studied with α-emitters (225Ac, 227Th, 223Ra) and a β--emitter (177Lu) along with external photon radiation for reference. GEANT4-DNA will be used for the model comparison with radiobiological data. ***Materials and Methods:*** The prostate cancer cell lines PC3 (PSMA-), LNCaP and C4-2 (PSMA+) were incubated with either free, non-complexed radionuclides or with targeted, radiolabeled PSMA-ligands for 1 or 4 hours at the following activity ranges: 1-100 kBq (α-emitters) and 100-5000 kBq (β--emitter). External radiation doses of 0.5-2.5 Gy were applied to additional samples. DNA double-strand breaks were visualized via immunofluorescent staining of γH2AX and data analyzed for DD dependency on radionuclide and dose. The membrane-bound and internalized fraction of the total activity was quantified in a complementary cell assay. ***Results:*** Analysis of mean γH2AX foci/nucleus revealed a two orders of magnitude higher potency of α-emitters than β--emitters in DD induction. 223Ra caused higher DD than 227Th due to the increased frequency of emitted α-particles. While the signal intensity of the foci increased linearly with dose in all treatments, the area showed a greater expansion for α-emitters than for photons and β--emitters. In addition, radionuclides specifically administered in targeted radiopharmaceuticals did not induce significantly higher DD. This could be related to the non-specific binding of non-complexed radionuclides to the cell membrane, which account for up to 30 % of the total activity. ***Conclusion:*** The results emphasize the differences between the therapies based on α- and β--emitters. They provide a solid base for estimating the therapeutically effective dose and enable a better comprehension of DD induction. In particular, the differences in DD induction of non-complexed versus targeted radionuclides were studied. In future, Monte Carlo modelling of DD is essential to validate the experimental data and to clarify the effects of radionuclide distribution. Therefore, a GEANT4-DNA simulation based on a single-cell model to mimic the DD and γH2AX foci will be performed.

EP-0003

Investigation of Photodynamic Therapy Promoted by Cherenkov Light Activated Photosensitizers - New Aspects and Revelations

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Aim/Introduction: Photodynamic therapy (PDT) is based on the activation of photosensitizers (PSs) by light. The disadvantage of this method is the low penetration depth of the light. Therefore, it was investigated whether radionuclide-induced Cherenkov light (CL) could also induce this effect, allowing therapy deep within the body. ***Materials and Methods:*** The CL sources are the nuclear medicine relevant radionuclide Re-188 (1.5 GBq) and the 15 MV photons from a linear accelerator, which were used to irradiate FaDu, B16 and 4T1 tumor cells for 24 hours or a few minutes, respectively. The CL generated by Re-188 was detected using a CCD camera and a microtiter plate reader. Psoralen or trioxsalen dissolved in DMSO was used as PS. The phototoxic effect was evaluated by colony formation assays and compared with control samples not exposed to CL. The effect of the PSs was verified by DNA gel electrophoresis on plasmid DNA. Other ongoing studies are investigating the effect of the PSs on plasmid DNA activated by CL generated by the linear accelerator setup. ***Results:*** The CL produced by Re-188 and its shielding were confirmed using a CCD camera and the CL spectrum was recorded using a microtiter plate reader, showing the expected peak in UVA wavelengths. An absorbance measurement shows that daylight does not induce a psoralen/trioxsalen reaction. There is reduced cell viability for CL-irradiated cells compared to controls for both PSs, although this is statistically significant due to large fluctuations of the cell experiments. This challenge is addressed with upcoming plasmid DNA experiments. Gel electrophoresis showed an enhanced effect of trioxsalen compared to psoralen. ***Conclusion:*** The expected therapeutic effect of CL-activated PSs in radionuclide therapy could only be demonstrated on a non-significant basis in cells. The plasmid DNA data should shed light on this.

EP-0004

In vitro studio of affinity of 18F-NaF vs 99mTc-DPD for amyloidosis cardiac imaging

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Aim/Introduction: Cardiac amyloidosis (CA) consists of a group of diseases characterized by a deposition of insoluble and misfolded proteins in the myocardium. Technetium labelled bone seeker phosphonate such as DPD,PYP and HMP are recognized as highly accurate for the non-invasive diagnosis of transthyretin (ATTR) cardiac amyloidosis. 18F-fluoride ($^{[18F]}$NaF) is a radionuclide approved for bone metabolism studies in Positron Emission Tomography (PET), that raise our interest as a potential ATTR diagnosis tool. $^{[18F]}$NaF benefits from the improved spatial resolution of PET imaging, offering superior imaging characteristics and quantification capabilities. These features could potentially lead to better diagnostic performance, especially in the early stages of the disease. To date, few data are available about the actual affinity of $^{[18F]}$NaF for fibrils. The aim of this study was to evaluate, as an essential preliminary step for planning a future clinical study, the in vitro affinity of $^{[18F]}$NaF for synthetic fibrils, in comparison with [99mTc]Tc-DPD. ***Materials and Methods:*** Amyloid fibrils were generated dissolving 10 mg of insulin in an aqueous solution of HCl (pH 2.0) and incubating the solution at 55°C to induce fibril formation. Ten vials were prepared, each with 120 uL of fibril preparation. In five vials, increasing amounts of $^{[18F]}$NaF (50, 100, 200, 500, 1000 kBq) were added and brought to a volume of 2 mL with saline solution. In other five vials, increasing amounts of [99mTc]Tc-DPD (50, 100, 200, 500, 1000 kBq) were added and brought to a volume of 2 mL with saline solution. As per protocol for bone acquisition, the $^{[18F]}$NaF vials were incubated for 60 min, while the [99mTc]Tc-DPD vials were incubated up to 180 min. Labelling yield was subsequently evaluated using ITLC-SG and acetonitrile and water (9:1) as mobile phase for $^{[18F]}$NaF, and TLC silica gel and acetone and methanol (1:1) for [99mTc]Tc-DPD. ***Results:*** The binding kinetics of both [99mTc]Tc-DPD and $^{[18F]}$NaF followed a specific-type pattern even if at different concentration, characterized by a sigmoidal shape suggestive of a BET isotherm model. Notably, at the same concentration $^{[18F]}$NaF exhibited a higher affinity than [99mTc]Tc-DPD. ***Conclusion:*** Our findings suggest that $^{[18F]}$NaF may possess superior binding ability for amyloid fibrils compared to [99mTc]Tc-DPD. Potentially it could provide to be a more effective tracer for cardiac amyloidosis imaging. Further in vitro and clinical investigations are needed to validate the diagnostic utility of $^{[18F]}$NaF in comparison to [99mTc]Tc-DPD and to elucidate its role in clinical practice.

EP-0005

Harnessing Pentafluorophenyl Esters for the Site-Selective Bioconjugation of a HER2-Targeted Radioimmunoconjugate

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Aim/Introduction: Site-selective bioconjugations facilitate the creation of well-defined radioimmunoconjugates. However, none of the extant strategies for site-selective bioconjugation are as procedurally or logistically simple as stochastic methods, creating a barrier to clinical translation. Bhat et al. demonstrated that amine-reactive fluorophenolic esters preferentially react with the Lys-188 (K188) residues in the constant region of the kappa light chain of mAbs [1]. We previously reported an approach to site-selective bioconjugation based K188 residue modifications with pentafluorophenyl ester (PFP)-bearing azides and the subsequent attachment of cargoes via the strain-promoted azide-alkyne cycloaddition [2]. However, this method still requires two steps. Herein, we describe our efforts to streamline this process into one reaction. We have synthesized a PFP-bearing variant of desferrioxamine (DFO) to modify the K188 residues of pertuzumab. Then, the site-selectively modified immunoconjugate was labeled with the positron-emitting radiometal zirconium-89 (t1/2 ~3.3 d) to produce the radioimmunoconjugate, [89Zr]Zr-DFOPFP-pertuzumab, which exhibited excellent in vitro behavior. ***Materials and Methods:*** Fe-N-succinyl-DFO-PFP was prepared and characterized via mass spectrometry and UV-Vis spectroscopy [3]. Following the removal of iron, site-selective bioconjugation was achieved by incubating N-succinyl-DFO-PFP (10 eq.) with pertuzumab (19 h, 4 °C). The resulting immunoconjugate — DFOPFP-pertuzumab — was purified via size-exclusion chromatography, analyzed via LC-MS analysis, and radiolabeled to produce [89Zr]Zr-DFOPFP-pertuzumab. Stability measurements were taken every 24 h via radio-instant thin layer chromatography (5 days), and immunoreactivity was determined using HER2-coated magnetic beads. Additionally, a HER2-expressing SK-OV-3 tumor was grown in vivo, cryogenically frozen, cut, and subjected to immunofluorescence staining with DFOPFP-pertuzumab and goat anti-human IgG Alexa-488. ***Results:*** Mass spectrometry confirmed the synthesis of N-succinyl-DFO (m/z ~661.4), and UV-Vis spectroscopy revealed the formation of metalated Fe-N-succinyl-DFO-PFP (absorbance ~430 nm). Following bioconjugation, SDS-PAGE demonstrated selective labeling of the light chain on the mAb. In addition, LC-MS experiments confirmed selectivity towards the light chain and revealed a degree-of-labeling of ~1.0 DFO/mAb. [89Zr]Zr-DFOPFP-pertuzumab was produced in >97% radiochemical yield, remained >96% and 86% stable over 5 days in PBS and human serum, respectively, and boasted an immunoreactive fraction of >0.85. Immunofluorescence staining revealed high binding to HER2-expressing SK-OV-3 tumor tissue. ***Conclusion:*** In this investigation, we have improved upon our previously validated site-selective bioconjugation strategy based on pentafluorophenyl esters to create a HER2-targeted radioimmunoconjugate with excellent in vitro properties. Our next steps involve evaluating the in vivo performance [89Zr]Zr-DFOPFP-pertuzumab in a murine model of breast cancer. ***References:*** Bhat. US2012/0201809A1. 2014.Sarrett. Bioconjug Chem. 2022.Verel. J Nucl Med. 2003.

EP-0006

Assessment of (S)-LW223 binding affinity to TSPO in rs6971 genotyped human brain tissue

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Aim/Introduction: The 18kDa Translocator protein (TSPO) is a molecular imaging target for the investigation of inflammation across many sites throughout the body. Over the past several decades, multiple radiotracers have been developed but the majority are limited by considerable interindividual binding variability in humans caused by genetic polymorphism (rs6971). We have developed a novel TSPO ligand, $^{[18F]}$LW223, which is the first fluorinated TSPO radiotracer with binding in human tissue independent of the rs6971 polymorphism [1] and has now entered

clinical translation. Both [18F]LW223 and [11C]PK11195 possess chiral amide side-chains with R-configuration. [11C](R)-PK11195 is known to be insensitive to the rs6971 genetic polymorphism and has higher affinity to TSPO than [11C](S)-PK11195. We hypothesise that, as is the case with PK11195, (S)-LW223 will have a lower affinity to TSPO than its R-enantiomer, but will also be insensitive to the rs6971 genetic polymorphism. ***Materials and Methods:*** Eighteen genotyped and frozen human frontal cortex samples were obtained from the UK Brain Bank Network, representing n=6 high affinity binders (HAB), n=6 mixed affinity binders (MAB) and n=6 low affinity binders (LAB). A homogenised brain tissue solution was prepared for each sample and the binding affinity of (S)-LW223 was then assessed using a [3H]PK11195 competition binding assay as previously described [1]. Specific binding was calculated relative to a full blocking control. Both one-site and two-site fitting for specific binding was assessed, with one-site being the preferred option for all datasets. Individual one-site specific binding was used to calculate the Ki across each genotype and the overall population, and average one-site specific binding across each genotype was used to calculate the LAB:HAB ratio. ***Results:*** Across all samples, the average (S)-LW223 affinity (Ki) was 4.5± 0.7 nM (mean± SEM). This binding affinity to TSPO is 7.5 lower than that of (R)-LW223 which has been previously reported (0.6 nM) [1]. There was no difference in (S)-LW223 affinity between HAB vs. LAB (p= 0.53, unpaired t test). The average LAB:HAB ratio was 1.5. ***Conclusion:*** The TSPO binding affinity of (S)-LW223 is lower than that of (R)-LW223. Like (R)-LW223, (S)-LW223 is not sensitive to the rs6971 genetic polymorphism suggesting that structure, and not chirality, of the side chain is important for polymorphism insensitivity. Overall, (R)-LW223 remains the superior enantiomer for TSPO binding. ***References:*** 1. MacAskill MG, et al. Quantification of Macrophage-Driven Inflammation During Myocardial Infarction with 18 F-LW223, a Novel TSPO Radiotracer with Binding Independent of the rs6971 Human Polymorphism. J.Nucl.Med.2021;62:536-44.

EP-0007

Selection of Living Kidney Donors with measured Glomerular Filtration Rate using 99mTc-DTPA compared to creatinine estimated equations

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Aim/Introduction: Accurate assessment of kidney function in living kidney donors is crucial prior to surgery. The aim of this study was to demonstrate the value of measured Glomerular Filtration Rate using 99mTc-DTPA (mGFRDTPA) in living kidney donors compared to creatinine estimated equations, Modification of Diet in Renal Disease (MDRD, eGFRMDRD) and Chronic Kidney Disease Epidemiology Collaboration (CKD-Epi, eGFRCKD-Epi) for a best selection of potential kidney candidates. ***Materials and Methods:*** mGFRDTPA were performed in kidney donors candidates after intravenous injection of 37 MBq 99mTc-DTPA, followed by two blood samples at 2h and 4h post-injection according to BNMS Guidelines. Creatinine was measured in all candidates and the estimated creatinine eGFR calculated by MDRD and CKD Epi equations. mGFRDTPA was compared to the eGFRMDRD and eGFRCKD-Epi and the donors selected for the protocol transplantation according to their mGFRDTPA when superior or equal to 80ml/min/1.73m2 ***Results:*** 342 kidney donors (194 women 56,7%,148 men 43,3% mean age 50,06±11,80). The mGFRDTPA was 90,13±20,3 ml/min/1.73m2, eGFRMDRD 89,96±23,5 ml/min/1.73m2, eGFRCKD-Epi 93,97±18,11 ml/min/1.73m2. The mean creatinine was at 8,5±1,9, BMI at 26,10 Kg/m2 A total of 235 patients (68,7%) achieved a mGFRDTPA ≥ 80ml/min/1.73m2, selected into the transplant protocol. mGFRDTPA rejected 107 donors (31,3%) mDFGDTPA and eGFRMDRD were concordant in 68,42% of the population and discordant in 31,57%, with 69 donors rejected by eGFRMDRD but selected with DTPA. mDFGDTPA and eGFRCKD-Epi were concordant in 71,63% of the population and discordant in 28,36%, 34 donors rejected by eGFRCKD-Epi and selected with DTPA. CKD-EPI is better than MDRD to assess renal function in selecting kidney living donors as recommended by the nephrology societies, but mGFRDTPA is still recommended for such important impact clinical decisions, when facing doubt in assessing renal function such as aged donors or suspicious estimated GFR ***Conclusion:*** Measured GFR in assessing renal function mGFRDTPA is a gold standard method in the selection of potential kidney donors candidates compared to eGFR equations with an impact on the transplant decision, but mGFRDTPA requires indications adapted to this population. ***References:*** 1- Fleming JS, Zivanovic MA, Blake GM, Burniston M, Cosgriff PS. Guidelines for the measurement of glomerular filtration rate using plasma sampling: Nucl Med Commun. août 2004;25(8):75969.2- Burniston DM. Clinical Guideline for the measurement of glomerular filtration rate (GFR) using plasma sampling. Rep BNMS 2018. 2018;23.

EP-0008

Comparing tumor cell intrinsic mechanisms governing response/resistance to^{177}Lu- and^{212}Pb-PSMA therapy

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Aim/Introduction: 177Lu-PSMA has revolutionized prostate cancer (PC) treatment, but a substantial fraction of patients does not respond to radioligand therapy (RLT). Using in vitro models, we comparatively investigate tumor cell intrinsic mechanisms governing responses to 177Lu-PSMA617 and the emerging alpha-emitter 212Pb-PSMA. ***Materials and Methods:*** Using different PSMA-expressing PC cell models (PSMA-high, PSMA-low, PSMA-high and p53 loss), we determined the half-lethal activities for 177Lu- and 212Pb-PSMA (clonogenic assay). We analyzed DNA damage induction and repair kinetics (γH2A.X), cell cycle distribution (PI FACS), and the molecular changes in response to 177Lu- and 212Pb-PSMA therapy (RNA-seq) at low (half-lethal) and high activities over time. ***Results:*** RLT efficacy expectedly depended on PSMA-levels and p53 status, with PSMA-high cells responding better than PSMA-low cells, and p53-intact cells responding better than p53-KO cells. Low and high activities of 177Lu-PSMA resulted in rapidly repaired DNA damage, similar to external beam radiotherapy, but without cell cycle arrest - suggesting an opportunity for combination therapies that exploit 177Lu-induced DNA damage concurrent with RLT administration. In contrast, 212Pb-PSMA induced more sustained DNA damage that was accompanied by the activation of multiple signaling pathways including DNA damage response signaling with activation of non-homologous end joining as DNA repair pathway, p53 signaling, telomere and oxidative stress induced senescence, cell cycle checkpoints, and immunoregulation. Thereby, signatures related to DNA damage repair, cell cycle arrest and senescence were enriched early after treatment (24 h), and DNA damage repair, senescence and cell death signalling predominated after 48 h. Late responses (day 6) included activation of pathways related to DNA damage repair, DNA

fragmentation, antigen processing, and Toll-like receptor activation. ***Conclusion:*** The current study comparing the responses of PC cells to 177Lu- and 212Pb-PSMA sheds light on the complexity of tumor cell intrinsic mechanisms influencing the efficacy of RLT and suggests distinct modes of action for the two radioligands, with potential implications for combination therapies. In vivo validation of these results is warranted and ongoing.

EP-0009

Evaluation of radiation sensitivity by monitoring DNA double-strand breaks and cell cycle in prostate cancer cell lines

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Aim/Introduction: Recently, various radiopharmaceuticals and radiotherapy have been developed. The anti-cancer effect of external beam radiation varies depending on the radiation exposure dose, and although much basic research has been conducted on this, much research is still needed to identify biological changes according to the distribution of absorbed dose in the body. In this study, we aim to evaluate radio-sensitivity by measuring the effect of absorbed dose distribution, observing DNA double-strand breaks and monitoring cell cycle changes in prostate cancer cell lines expressing high levels of PSMA. ***Materials and Methods:*** LNCaP, C4-2, and VCaP were used as PSMA positive cells, and PC3 was used as PSMA negative cells. Real-time quantitative reverse transcription PCR (qRT-PCR) and Western blotting was performed to determine androgen receptor (AR) and PSMA expression. Cell lines were exposed to 137Cs irradiator. Dose dependence of DNA damage was monitored through immunofluorescence staining of γH2AX and 53BP1 as double-strand break markers. Cell cycle changes by radiation (3, 6, 9 Gy), flow cytometry was performed after Propidium iodide (PI) staining. ***Results:*** Levels of gene expression of AR and PSMA in LNCaP, C4-2, and VCaP were significantly higher in both qRT-PCR and immunoblots compared to PC-3 cells. When they exposed to 2 Gy irradiation, the number of 53BP1 and rH2AX foci were reduced by half at 2 to 4 hours. When cells were exposed to 6 Gy, the number of 53BP1 and rH2AX foci decreased after 48 h in PSMA-positive cell lines, but the number of 53BP1 and rH2AX foci increased over time in PC-3. G2/M cell cycle arrest in PC-3 showed a time-dependent increase up to 48 hours after exposure to 6 Gy and 9 Gy doses, whereas no significant increase was seen in PC-3 exposed to 3 Gy. G2/M cell cycle arrest was 3- to 6-fold lower in PSMA-positive LNCaP and C4-2 compared to PC-3. Additionally, differences in treatment effectiveness appear in the absorbed dose distribution within the tumor ***Conclusion:*** These results suggest that cells expressing PSMA and AR are more resistant to radiation compared to control cells. This study is expected to provide important information when comparing differences in treatment effects according to absorbed dose distribution in future treatment using radiopharmaceuticals labeled with alpha- and beta-emitting radioisotopes.

EP-0010

Spheroids as Promising Models to Investigate Peptide-Based Targeted Radionuclide Therapy

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Aim/Introduction: Targeted radionuclide therapy (TRT) is recognized as a valuable option for selective irradiation of metastases using Lutetium-177 (177Lu) ligands. However, its efficacy varies greatly depending on the size of irradiated lesions, a parameter that cannot be studied on 2D monolayer cells models. Therefore, the objective of this work was therefore to assess the dynamic and efficacy of TRT in singles cells versus larger multicellular constructs for 177Lu-TRT peptide ligands. The neurotensin receptor-1 (NTS1) was selected as a target. ***Materials and Methods:*** HT-29, Colorectal Adenocarcinoma cells that overexpressing NTS1, were grown as monolayer cells, in Roswell Park Memorial Institute (RPMI)1640 Medium supplemented with 10% fetal bovine serum, and as spheroids, in spheroids medium consists of Dulbecco's Modified Eagle Medium F12 (DMEM F12) medium (with Glutamine, without Antibiotic nor serum), with 0,4% Methylcellulose and supplemented with B-27 (50X), N-2 (100X), hEGF (10µg/ml) (human Epidermal Growth Factor) and hBFGF (25µg/ml) (Fibroblast Growth Factor-Basic human). For monolayer cells (2D), 5000 cells were seeded the day before the experiment. Whereas for spheroids (3D), 5000 cells were used to generate spheroids 3 days before the experiment. Next, [177Lu]Lu-JMV6659, a radiolabelled NTS1-agonist previously developed by our consortium1, was applied at increasing concentrations. Both 2D and 3D cells were exposed to radioactivity for 4h. Uptake and therapeutic efficacy (viability) were monitored. Next, monolayers and spheroids were characterized in terms of size, $^{[18F]}$-FDG uptake, and HIF1α expression. ***Results:*** [177Lu]Lu-JMV6659 showed an uptake of 25111 ± 4231 Bq in monolayer cells vs 13808 ± 2772 Bq in spheroids at 20MBq/mL. Consequently, the therapeutic efficacy was better in monolayer cells (IC50 = 6.4 MBq/mL vs > 100MBq/mL for spheroids). Spheroids were much larger than the monolayer cells. $^{[18F]}$-FDG uptake was 1.03% added dose (AD)/µg of protein for spheroids vs. 0.079 % AD/µg of protein for monolayer cells. There was no difference in HIF1α expression between the two models, as determined by western blotting. ***Conclusion:*** Spheroids stands as a versatile and promising platform for studying the radiobiology and pharmacodynamic of peptide-based TRT in single cells and multicellular constructs. ***References:*** 1: Silicon-Containing Neurotensin Analogues as Radiopharmaceuticals for NTS1-Positive Tumors Imaging. Fanelli R, Chastel A, Previti S, Hindié E, Vimont D, Zanotti-Fregonara P, Fernandez P, Garrigue P, Lamare F, Schollhammer R, Balasse L, Guillet B, Rémond E, Morgat C, Cavelier F. Bioconjug Chem. 2020 Oct 21;31(10):2339-2349.

EP-0011

Exploring ^{135}La-DOTA-hEGF as a Promising Candidate for Targeted Radionuclide Therapy in Glioblastoma

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Aim/Introduction: Glioblastoma is the most common and aggressive form of brain cancer. The current treatment is inefficient and eventually leads to death in all cases. Thus, the demand for novel therapeutic approaches for glioblastoma patients is paramount. The epidermal growth factor receptor (EGFR) is overexpressed in approximately 55% of glioblastoma patients and possesses a promising target for targeted radionuclide therapy. Here, we produced lanthanum-135, a favorable Auger electron emitter, and radiolabeled human epidermal growth factor (hEGF) with lanthanum-135 to furnish 135La-DOTA-hEGF. We subsequently investigated the in vitro potential of 135La-DOTA-hEGF in glioblastoma cells. ***Materials and Methods:*** Lanthanum-135 was produced by irradiation of pressed enriched [135Ba]BaCO3 and Al (1:2, w/w) targets with a 16.5 MeV GE PETtrace cyclotron and purified by a simple procedure, as previously described [1]. DOTA was non-specifically conjugated to available amines on hEGF via an activated NHS-ester. DOTA-hEGF (11-22 nmol, 0.6 DOTA per hEGF) was radiolabeled with lanthanum-135 (up to 2.0 GBq) for 1.5 h at 95 oC at pH 5.5 in NH4OAc buffer. Cellular kinetics and subcellular distribution were assessed utilizing the EGFR-expressing glioblastoma cell line LN229. ***Results:*** At EOB, 1.62 ± 0.18 GBq lanthanum-135 was produced per target after 4 hours of irradiation in an effective molar activity of 79.6 ± 25.3 MBq/nmol measured via DOTA titration. 135La-DOTA-hEGF was radiosynthesized in activities up to 1.1 GBq in non-decay corrected RCYs of approximately 50-55% and apparent molar activities around 40-45 MBq/nmol. 135La-DOTA-hEGF demonstrated EGFR-specific uptake in LN229 cells with 9.9 ± 1.16 %, 13.3 ± 2.2 %, and 17.0 ± 4.1 % internalization after 1, 2 and 4 hours of incubation, respectively, and high cellular retention at 69 ± 5.8 % after 24 hours of incubation. ***Conclusion:*** We report development and synthesis of 135La-DOTA-hEGF in moderate RCY at good activity levels and molar activities. Further, we report EGFR-specific cellular uptake and retention. The 135La-DOTA-hEGF reported herein is suitable for preclinical in vitro and in vivo efficacy studies, paving the way for further studies into its suitability as a candidate for targeted radionuclide therapy for glioblstoma. ***References:*** [1] K. S. Pedersen, et al., Applied Radiation and Isotopes, 2023, 192, 110612.

EP-0012

TSPO ligands regulate HK activity by affecting TSPO dimer formation and TSPO-VDAC1 binding

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Aim/Introduction: Binding of hexokinase II (HKII), which is highly expressed in tumor cells, to mitochondrial voltage-gated anion channel 1 (VDAC1) increases the activity of HKII, resulting increased FDG uptake. Translocation protein-18 kDa (TSPO), which functions in a dimeric form, exists in the mitochondrial outer membrane and is known to bind to the VDAC1 protein. However, the effect of the binding of TSPO and VDAC1 on HKII activity is not clearly understood. The purpose of this study was to investigate whether inhibition of binding between TSPO dimers and VDAC1 could regulate FDG uptake by affecting the activity of HKII. ***Materials and Methods:*** 293FT (Human embryonic kidney), MCF7 and MDA-MB-231(human breast cancer) cell lines were used. PK11195 known as a TSPO antagonist used to inhibit TSPO-VDAC1 interaction. SDS-PAGE and native-PAGE were performed to identify the monomeric and multimeric expression of TSPO, VDAC1 and HKII. Co-Immunoprecipitation (Co-IP), Bimolecular Fluorescence Complementation (BiFC) and fluorescence resonance energy transfer (FRET) imaging were performed to observe protein-protein interactions. The hexokinase activity was measured with hexokinase assay kit (Abcam). ***Results:*** Multimeric expression of TSPO, VDAC1, and HKII was observed in normal cells, 293FT, and breast cancer cell lines (MCF7 and MDA-MB-231). No significant differences were observed in the multimeric expression of TSPO and VDAC1 when treated with PK11195. Through BiFC-FRET (Venus-mCerulean) fluorescence signals and Co-IP, a decrease in the interaction between TSPO dimer and VDAC1 and an increase in VDAC1-HKII binding were observed after PK11195 treatment, and the interaction of TSPO-VDAC1-HKII was confirmed. When PK11195 was treated in transfected breast cancer cells, we observed a decrease in FRET signal in cells co-expressing TSPO dimer-VDAC1 dimer. Additionally, in breast cancer cells treated with PK11195, a 1.5-fold increase in the amount of HKII bound to VDAC1 was observed in mitochondrial fraction isolation, and an increase was also observed in Co-IP. This is consistent with the 1.36-fold increase in measured hexokinase activity in breast cancer cells treated with PK11195. ***Conclusion:*** We showed that the interaction of the TPSO-VDAC1-HKII complex can lead to changes in HKII activity. These data suggest that reduction of TSPO dimer-VDAC1 assembly by TSPO ligand increases binding of HKII and VDAC1 and causes activation of HKII, which may also affect FDG uptake.

EP-0013

Development and in vitro characterization of [3H]GMC-058 as radioligand for imaging parkinsonian-related proteinopathies

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Aim/Introduction: PET imaging of α-synuclein (α-syn) pathology in Parkinson's disease (PD) and related movement disorders is a clinical unmet need. Recent studies with newly developed PET tracers [18F]ACI-12589 (1) and [18F]SPAL-T-06 (2) have shown promising results in patients with multiple system atrophy (MSA). However, there is still need for a PET tracer able to image α-syn pathology in PD. The aim of this study was to develop and characterize in vitro a PET radioligand for imaging aggregated α-syn in tissue from different proteinopathies ***Materials and Methods:*** A library of 78 small molecules was developed based on available information

from the public domain. Four optimization cycles were performed with in vitro binding assays using recombinant α-syn fibrils and brain homogenates from Alzheimer´s disease (AD) donors enriched with either tau of A-β pathology. Criteria for selection were Ki for α-syn < 30 nM and Ki for tau and A-β > 200 nM. Three compounds, GMC-073, GMC-098, and GMC-058 fulfilled the pre-defined criteria and were radiolabelled with 3H. Brain tissue from control donors and from patients with different proteinopathies was used for autoradiography (ARG) studies on fresh-frozen tissue sections and paraffine embedded tissue microarrays (TMAs). Emulsion ARG in TMAs was used to study the co-localization of ARG signal with α-syn, p-tau and A-β pathology measured with immunohistochemistry. ***Results:*** The three 3H-labelled compounds were initially evaluated in tissue sections from the cingulate cortex of healthy controls. [3H]GMC-073 (Ki for α-syn: 8 nM) and [3HGMC-098 (Ki for α-syn: 9.7 nM) displayed displaceable binding (likely off-target) in control tissue, whereas [3H]GMC-058 (Ki for α-syn: 22.5 nM) displayed negligible displaceable binding in the cingulate cortex and was considered for further evaluation. ARG studies in TMAs showed specific binding (mean±SEM) of [3H] GMC-058 in synucleinopathies (PD: 520±29 fmol/mg and MSA: 670±79 fmol/mg), as well as in cerebral amyloid angiopathy (CAA: 522±49 fmol/mg), AD (508±62 fmol/mg) and 4R tauopathies (PSP: 703±8 fmol/mg and CBD: 821±155 fmol/mg), in all cases higher than in controls (278±16 fmol/mg). Emulsion ARG showed that the binding of [3H]GMC-058 co-localised with α-syn inclusions in PD and MSA, with dense A-β plaques in CAA and AD, and with p-tau inclusions in PSP and CBD. ***Conclusion:*** [3H]GMC-058 is a novel radioligand displaying moderate in vitro affinity for aggregated α-syn, with an in vitro profile also suitable for imaging tau pathology in 4R tauopathies. ***References:*** 1. Nat Commun 14, 6750 (2023). https://doi.org/10.1038/s41467-023-42305-3; 2. Mov Disord. 2022 Oct;37(10):2159-2161. doi: 10.1002/mds.29186.

EP-0014

Enhanced visualization of metabolic changes in colorectal cancer organoids: a multimodal imaging approach

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Aim/Introduction: In cancer research, tumor organoids serve as the key tools for bridging the gap between in vitro models and clinical applications. Despite their great research potential, challenges remain in visualizing and quantifying metabolic changes. Our study employs a multimodal imaging approach that combines traditional autoradiography with modern co-registration techniques and optical coherence tomography (OCT) to enhance the visualization of FDG uptake in colorectal cancer (CRC) organoids . ***Materials and Methods:*** We developed a novel imaging method that combines autoradiography with OCT to enhance the visualization of clinical radiotracers in tumor organoids while providing 3D morphological information. We applied 5-fluorouracil (5-FU) at concentrations of 1 µM and 2.06 µM, the latter reflecting the IC50 value, to CRC organoids to assess the effects of chemotherapy on FDG uptake. Autoradiography was used to measure FDG uptake before and after drug treatment, providing a quantitative analysis of metabolic changes. To overcome the limitations of traditional 2D autoradiography and gain more detailed insights, we prepared 5 µm-thick frozen sections of the treated organoids,autoradiographically imaged each layer of the section, and constructed 3D models. This technique was then combined with OCT imaging to provide a more comprehensive view of the metabolic activity and structural integrity of the organism. This technique, along with OCT imaging, allowed for a more comprehensive visualization of both the metabolic activity and the structural integrity of the organoids. ***Results:*** Our findings indicate that the multimodal imaging technique provides superior resolution compared to standard PET scans and effectively captures the glycolytic activity of the originating tumor tissues. This suggests that tumor organoids can accurately replicate the metabolic behavior of their respective tumors and serve as predictive models for therapeutic responses. Our findings revealed a significant reduction in FDG uptake following treatment with 5-FU, indicating a decrease in metabolic activity. This reduction was dose-dependent, with more pronounced effects observed at the higher concentration of 2.06 µM, derived from the IC50 value. The combined use of autoradiography and OCT confirmed that the areas with reduced FDG uptake correlated with regions showing structural changes and increased cell death in the organoids. ***Conclusion:*** This method, which combines autoradiography with OCT for visualizing and quantifying FDG uptake in tumor organoids, not only enhances our understanding of the metabolic impact of chemotherapy but also supports the development of more effective cancer treatments by facilitating precise monitoring of therapeutic responses at the cellular level.

EP-02

e-Poster Area

A: Preclinical Studies -> A1 Medical Preclinical -> A12 Preclinical Cardiology and Neurology

EP-0015

Administration of antipsychotic drug induces recovery of the impaired glutamatergic system in Alzheimer's disease

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Aim/Introduction: Patients with Alzheimer's disease (AD) suffer from cognitive dysfunction often accompanied by psychotic symptoms. Therefore, to understand the pathology of AD, it is necessary to understand the relationship between cognitive dysfunction and psychotic symptoms. The glutamatergic system in the central nervous system, known for close links to learning and memory, is of particular interest. However, there exists limited research on the impact of anti-psychotic drugs on the glutamate system. This prompts our current study, where we aim to explore the effects of an antipsychotic drug on the glutamate system in an AD animal model, utilizing functional molecular imaging. ***Materials and Methods:*** We used aripiprazole as an anti-psychotic drug and used transgenic 5xFAD mice as an amyloid pathology-based AD animal model. The female 5xFAD mice were classified into a wild-type, a vehicle control group, and an aripiprazole-treated group (n = 6 for each group) at the age of 5 months. Then, the aripiprazole-treated group was administered aripiprazole intraperitoneally at a dose of 1 mg/kg every day, and the vehicle group was administered only solvents from 5 months to 7 months of age. Then, a novel object recognition test

was performed to evaluate the non-spatial working memory. Glutamate PET images were acquired using a specific radiotracer (i.e., [18F]FPEB) for a metabotropic glutamate receptor 5 (mGlur5) at 8 months of age. Finally, after imaging studies were completed, immunohistochemistry was performed. ***Results:*** In a behavioral test, the vehicle group showed a lower preference for the novel object than the WT group (p = 0.0236). However, the aripiprazole-treated 5xFAD group displayed a significantly increased preference for novel objects compared to the vehicle group (p = 0.0236). In a mGluR5 PET, brain uptakes in the vehicle group were 19-20% lower than that in WT mice (p-value in cortex = 0.0048, striatum = 0.0079, and hippocampus = 0.0012). However, the aripiprazole-treated 5xFAD group displayed 7-8% higher brain uptakes compared with vehicle treated group (p-value in cortex = 0.3028, striatum = 0.3693, and hippocampus = 0.3093) and lower uptakes than that of the WT group (aripiprazole-treated 5xFAD group (p-value in cortex = 0.0941, striatum = 0.1137, and hippocampus = 0.0245). In the immunohistochemistry experiments, aripiprazole administration resulted in inhibiting the down-regulation of mGluR5 in 5xFAD. ***Conclusion:*** From this study, we found that the administration of aripiprazole alleviates memory impairment and induces recovery of glutamatergic system.

EP-0016

New Phantom for Brain Imaging Standardization: first experience with full digital PET/CT

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Aim/Introduction: Characterization of PET scanner is mandatory to evaluate performances and optimize acquisition brain protocols. This can be achieved by using NEMA or anthropomorphic phantoms. The advantage of latter phantom is a better simulation of in-vivo clinical setting. ***Materials and Methods:*** New anthropomorphic brain phantom (StepBrain, Human Shape Technologies s.r.l.) was proposed for standardization among different PET-CT scanners. The phantom includes three different compartments: human grey (cortex, GM; striatum, STR) and white matter (WM) which can be filled with different concentrations of radioactive. The physical model was obtained using a rapid prototyping technique applied to a digital model derived from a dataset of 1.5 T MRI images of a 38-year-old normal volunteer, composed of 3mm thick slices. T1-, PD- and T2-weighted spin-echo images were obtained and segmented into GW, WM, and STR using a multi-parametric technique; compartment cavities separated by walls of 0.75mm thick were made. ***Results:*** STR, WM, GM volumes are of 14.6, 407 and 714ml respectively. Automatic rotating support was designed to ensure homogeneous mixing within each compartment. Healthy FDG PET scan and three Amyloid (AMY) PET scans (negative, doubtful, positive) were simulated by adding ^{18}F-FDG in WM for each of four acquisition (from 4 up to 19 kBq/ml) without changing the radioactive in GM and STR. This allowed the following GM/WM (2.86 for FDG PET scan and 0.77, 0.5, 0.29 for each AMY-PET scan) and STR/GM (1.03) ratios. Acquisitions were performed with full digital PET/CT (Biograph Vision 600, Siemens) in list mode and several parameters were considered including scan time (ST 1-6min), image matrix (IM 440x440 and 256x256), iteration number (ITER 30-120), presence/absence of TOF and PSF, gaussian filter (GF 1-4mm). Analysis was performed considering VOIs (3mm diameter) in WM, GM and STR. Qualitatively best image quality was considering IM 440x440, ST 6min, ITER 120 and GS 2mm, with TOF and PSF correction; ratio GM/WM (mean/SD): 3.3/0.3 for FDG scan; 0.84/0.05, 0.60/0.07 and 0.40/0.04 for AMY scans. Concentration assessment was more accurate without PSF correction, ratio GM/WM (mean/SD): 3.0/0.2 for FDG scan; 0.79/0.06, 0.56/0.06 and 0.032/0.02 for AMY scans. Considering ST <3min) the best assessment was reducing ITER to 60. ***Conclusion:*** Preliminary results show feasibility of this new 3D printed anthropomorphic brain phantom to quantify scanner parameters effect on image quality to optimize acquisition protocol to be used in clinical setting and homogenize acquisition protocols among different scanners for comparative purposes in multicentre studies.

EP-0017

Site-specific antibody labeling for brain PET using sortase-mediated ligation

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Aim/Introduction: Antibodies are attractive radioligands for positron emission tomography (PET) due to their high selectivity and specificity. However, their large size prevents antibodies from penetrating the blood-brain barrier (BBB) and reach targets within the brain. We have therefore developed bispecific antibodies that, next to the target of interest, also bind to the transferrin receptor, which mediates active transport across the BBB. This project aims to site-specifically radiolabel brain-penetrating antibodies through sortase-mediated ligation. This allows for controlled, reproducible and irreversible modifications improving clinical translation and has been evaluated for direct labeling and pretargeting. ***Materials and Methods:*** Bispecific anti-amyloid β (Aβ) antibodies with 1 or 3 sortase recognition motifs were produced in CHO cells. Wildtype (WT) Sortase A (SrtA) and mutated sortase (SrtA 7M) were produced in-house in E. Coli. Antibodies were conjugated to a fluorescent probe (AF680-Gly3) or a trans-cyclooctene (TCO-PEG3-Gly3) with a polyglycine chain using both variants of SrtA. Conjugates were purified with CaptureSelect affinity chromatography and reaction efficiency was monitored using SDS-PAGE. TCO-conjugated antibody was further reacted with a fluorine-18 labeled tetrazine ([18F]-Tz). Affinity was evaluated with ELISA and immunohistochemistry. Brain uptake and Aβ targeting of antibodies radiolabeled with iodine-125 or fluorine-18 was evaluated ex vivo in WT and Aβ expressing AppNL-G-F mice. ***Results:*** Antibodies with 1 or 3 sortase recognition motifs were produced in large quantities. WT SrtA and mutated sortase - SrtA 7M - were produced in-house and the catalytic activity of WT SrtA and SrtA 7M was monitored between 30 min and 24 h. Full conversion was obtained after 1 h and reversibility was observed after 4 h. SrtA 7M showed improved catalytic activity and less reversibility than WT SrtA. No reduction in affinity was observed after the conjugations. Radiolabeled antibodies showed high brain retention in AppNL-G-F compared to WT mice three days after injection and 18F-labeling of the antibodies was achieved by clicking 18F-Tz to TCO-antibody. Co-localization of the modified antibodies with Aβ plaques was confirmed with immunostaining. ***Conclusion:*** Successful site-specific antibody labeling was achieved through sortase-mediated ligation after one hour with SrtA 7M as the preferred sortase. Using antibodies with 1 and 3 sortase recognition motifs, either 1 or 3 tags could be attached without impaired brain uptake or target affinity, allowing

increased and controlled molar activities for radiolabeling. This versatile method can be used for either direct labeling or pretargeted imaging by attaching a pretargeting vector (e.g. TCO) to the antibody.

EP-0018

Effective production of (S)-(2-methylpyrid-5-yl)-6-[(3-fluoro-2-hydroxy)propoxy]quinoline ([18F]SMBT-1) on an iPHASE Flexlab radiochemistry module for in vivo imaging of a rat model with traumatic brain injury

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Aim/Introduction: Reactive astrocytes and activated microglia contribute to progression of neurodegenerative diseases such as Alzheimer's disease and Parkinson's disease1. Reactive astrocytes are known to overexpress monoamine oxidase-B (MAO-B). A novel radiotracer [18F]-(S)-(2-methylpyrid-5-yl)-6-[(3-fluoro-2-hydroxy) propoxy]quinoline ([18F]SMBT-1) effectively targets MAO-B. We report the synthesis, characterisation, subsequent radiolabelling and imaging of a rat model overexpressing MAO-B in response to a traumatic brain injury. ***Conclusion:*** Synthesis of the SMBT-1 precursor for radiolabelling was achieved in good yields, then successfully radiolabelled with 18fluoride in high radiochemical yield to afford the radiotracer [18F]SMBT-1. Imaging of a rat model following unilateral fluid percussion injury showed increased uptake in the affected hippocampus. ***Materials and Methods:*** Following the described literature methods1, we synthesised, then fully characterised the SMBT-1 precursor (2S)-3-((2-(6-methylpyridin-3-yl)quinolin-6-yl)oxy)-2-((tetrahydro-2H-pyran-2-yl)oxy)propyl 4-methylbenzenesulfonate for radiolabeling with 18fluoride ion (18F). Synthesis commenced with ring opening and protection of the chiral epoxide S-glycidyl tosylate, followed by TBS protection of the alcohol and debenzylation in preparation for the Mitsunobu reaction with 2-chloroquinolin-6-ol. Suzuki coupling was performed using the 2-methylpyridine boronic acid, followed by desilylation of the alcohol then reprotection using 3,4-dihydro-2H-pyran. Cold reference standard (S)-SMBT-1 and its enantiomer (R)-SMBT-1 were also prepared. Radiolabelling was performed using the iPHASE FlexLab with 37-74 GBq 18fluoride ion obtained from a 16.5 MeV GE PETtrace cyclotron. Imaging was performed at two weeks following lateral fluid percussion injury in an adult rat model using a nanoScan PET/CT scanner (Mediso, Hungary). Sixty second images were reconstructed with correction for scatter, attenuation and dead-time using the Tera-tomo 3D algorithm. The PET scan was manually co-registered to the Walxholm 80 um MRI atlas with time-activity curves extracted. ***Results:*** Synthetic intermediates were obtained in 52%-78% yields and in >95% purity. 18Fluoride radiolabelling was achieved in 25-30% radiochemical yield (non-decay corrected) and > 99% radiochemical purity by HPLC. Time activity curves were generated and show rapid washout but differential retention (15 mins onwards) particularly in regions known to contain high concentrations of monoaminergic neurons. There is also increased retention in the cortex and hippocampus, sites of reactive astrogliosis post injury. ***Conclusion:*** Synthesis of the SMBT-1 precursor for radiolabelling was achieved in good yields, then successfully radiolabelled with 18fluoride in high radiochemical yield to afford the radiotracer [18F]SMBT-1. Imaging of a rat model following unilateral fluid percussion injury showed increased uptake in the affected hippocampus. ***References:*** 1. Harada, R, Hayakawa, Y, Ezura, M, et al. 18F-SMBT-1: A selective and reversible PET tracer for Monoamine Oxidase-B imaging J.Nuc. Med.2021;62(2):253-8.

EP-0019

^{89}Zr-Immuno-PET as an alternative to radioiodinated bispecific BBB-shuttles targeting alpha-synuclein in a murine seeding model.

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Aim/Introduction: PET imaging could be valuable for evaluating brain delivery and target engagement of biologicals targeting alpha-synuclein, a pathological hallmark of Parkinson's disease. 89Zr-immuno-PET, using the octadentate chelator DFO*, has emerged to visualize therapeutic antibodies that utilize transferrin-mediated transcytosis to cross the BBB.1 Specific uptake of 89Zr- or 124I-labeled anti-alpha-synuclein BBB-shuttles has been demonstrated in a mouse model of extracellular alpha-synuclein fibril deposition.2,3 The 124I-labeled compound showed no specific uptake in a transgenic mouse model expressing intra-neural alpha-synuclein.2 Here, the residualizing PET nuclide 89Zr was explored as an alternative to non-residualizing iodine for imaging intraneural alpha-synuclein. ***Materials and Methods:*** Anti-alpha-synuclein monoclonal antibody HLu-3 was engineered with an 8D3 moiety targeting the murine transferrin receptor 1. HLu-3-scFab8D3 was conjugated with DFO*-NCS and radiolabeled with 89Zr. The radioconjugate was evaluated in an alpha-synuclein seeding model with intraneuronal aggregates, established by intracranial injection of sonicated pre-formed fibrils (4µg/2µL) into both striata of F28tg-mice overexpressing human wild-type alpha-synuclein. Untreated F28tg-mice and C57Bl6wt-mice served as controls. One month post-surgery, 1mg/kg [89Zr] Zr-DFO*-HLu-3-scFab8D3 was injected (4-6MBq/mouse; n=10). Blood sampling and PET imaging up to 168hrs post-injection (p.i.) were performed, followed by biodistribution, autoradiography and immunofluorescence. ***Results:*** The radioconjugate was produced in sufficient radiochemical yields and purity. Blood sampling revealed no significant difference between the three groups. No differences in brain uptake was observed for [89Zr] Zr-HLu-3-scFab8D3 in seeded F28tg-mice compared to F28tg-mice 72hrs and 168hrs p.i., while C57Bl6wt-mice revealed lower brain uptake at 72hrs p.i.. Ex vivo brain uptake 168hrs p.i. confirmed these findings. No significant difference between the cortex and the cerebellum was detected in the PET data. Ex vivo autoradiography revealed a higher uptake in the cortex of all three groups. However, quantification showed a comparable cortex-to-cerebellum ratio, indicating no correlation with alpha-synuclein-specific target engagement. Immunostaining of seeded F28tg-mice revealed sufficient intraneural alpha-synuclein pathology but no corresponding antibody accumulation. ***Conclusion:*** No difference in brain uptake of [89Zr]Zr-DFO*-GM285-scFab8D3 was observed between seeded and control mice. Immunostaining further demonstrated no co-localization of the antibody and alpha-synuclein pathology. While Roshanbin et al. proposed that the residualizing properties of 89Zr could offer a better alternative than radioiodine for visualizing intracellular deposits2,

these results underscore the ongoing challenge of imaging intraneural inclusions. This project received funding from the European Union's Horizon 2020 research and innovation program under the Marie Skłodowska-Curie grant agreement No 813528. ***References:*** 1Wuensche et al., Theranostics 20222Roshanbin et al., Neuropharmacology 20223Wuensche et al., NuclMedBiol 2023

EP-0020

Dynamics of the effects of ketamine on synaptic density: a SV2A PET study in a mouse model of depression

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Aim/Introduction: The prolonged onset of action (2 to 4 weeks) of classical antidepressant drugs is a public health problem. Ketamine (Ket) is now prescribed as a rapid-acting antidepressant, showing effects within hours. However, it's mechanism of action remains unclear and may involve synaptogenesis. We hypothesized that i) the dynamics of Ket' effects on synaptogenesis could be non-invasively monitored using [^{11}C]UCB-J PET imaging, a radioligand targeting SV2A, a marker of synaptic density, and ii) depression may impact this dynamics. ***Materials and Methods:*** To mimic depressive disorders in mice, corticosterone was administered for at least 28 days in water (35µg/mL; CORT model) versus vehicle in naïve controls (VEH). Mice from each group (CORT and VEH) were then injected with either a single dose of Ket (10mg/kg, i.p) or 3 injections 48h apart, corresponding to the clinical scheme regimen in patients. Brain [^{11}C]UCB-J PET imaging (n=5-8 per group) was performed either 24h after the single dose (Ket24h; CORTKet24h), or 1 week (Ket1w; CORTKet1w) or 3 weeks (Ket3w; CORTKet3w) after the last injection of the 3-doses regimen. MicroPET acquisition (dynamic, 90min) was performed under isoflurane anesthesia. Time Activity Curves (TACs) were extracted from selected brain regions delineated from a mouse brain template, and from the left-heart ventricle to determine the image derived input function (IDIF). In additional mice, the proportion of plasma radiometabolites vs time was determined under each condition. Volumes of distribution (VT, Logan plot method and metabolite-corrected IDIFcorr) were determined to estimate the regional brain distribution of [^{11}C]UCB-J. ***Results:*** No mortality was observed in any of the groups. VT was decreased (whole brain; $p < 0,05$) in the CORT group compared to the VEH group. VT didn't change 24h after a single dose of Ket in either the CORT or the VEH groups. One week after the last dose of ketamine, VT was increased in the cortex, thalamus, striatum and cerebellum ($p < 0,05$) of the Ket1w group, but not in the CORTKet1w. Three weeks after the last dose of ketamine, VT was increased in both the Ket3w and the CORTKet3w. At each time-point, VT was lower in CORTKet mice compared with VEH-Ket mice (whole brain, $p < 0,05$). ***Conclusion:*** These results shows that ketamine progressively increases synaptic density in the healthy brain. This effect appears to be slower in the depressed brain. The disease state may thus impact the dynamics of ketamine on synaptogenesis.

EP-0021

Myocardial ^{18}F-FDG uptake quantitatively predicts hypoxic tolerance in calorie restrictive rats via visualizing glucose-fat acid metabolism shifting

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Aim/Introduction: Hypoxia is an important pathogenic factor for ischemic and hypoxic diseases such as ischemic heart diseases (IHDs) and acute high-altitude diseases (AHAD). Calorie restriction (CR) may rapidly improve hypoxia tolerance by myocardial metabolic transformation which has great prospects. However, the lack of non-invasive and reliable quantitative approach to predict the improvement restricts the development and application of it, due to the individual differences and lagging evaluation methods. 18F-FDG PET/CT can continuously visualize and accurately quantifies the glucose metabolism in the myocardium, which is expected to predict the improvement of hypoxia tolerance by detecting metabolic transformations. This study aims to establish and validate an imaging scheme for quantitative predicting the improvement of acute hypoxia tolerance based on metabolic transformation. ***Materials and Methods:*** Male SD rats were randomly divided into different diet and altitude groups. The self-developed low-pressure chamber system was used to simulate the hypoxic environment at an altitude of 7620m (25,000ft). PET/CT was used to quantify myocardial 18F-FDG uptake levels. The myocardial metabolic pattern were analyzed by targeted metabolomics/lipidomics, serological test and WB. Echocardiography, HE staining and TEM was used to assess cardiac function, changes in myocardial fiber and mitochondrial morphology. ***Results:*** Fasting and ketogenic diet pretreatment significantly increased the 24h survival rate of acute hypoxic rats. Metabolomics, lipidomics, serological test and WB showed that the myocardial metabolic pattern was significantly changed. SUV ratio of myocardial 18F-FDG uptake decreased significantly with the fasting and ketogenic diet duration. It was highly correlated with the quantitative results of metabolites detected by metabolomics, and could precisely characterize the metabolic transformation. SUV ratio was significantly correlated with the 24h survival rate of fasting and ketogenic diet rats under hypoxic environment ($P<0.01$, $R2=0.8956, 0.7722$). The regression equations were $y=-18.29x+93.23$ and $y=-15.77x+81.45$. The survival rate of fasting rats could be effectively predicted by the equation, and the bias was less than 7.13%. SUV ratio was also significantly correlated with the levels of blood glucose, blood ketones and free fatty acids. WB, TEM and echocardiography confirmed that fasting can up-regulate autophagy, reduce mitochondrial and myocardial tissue damage caused by acute hypoxia, and protect cardiac function. ***Conclusion:*** Calorie restriction strategies effectively enhance hypoxia tolerance in rats and lead to significant myocardial metabolic transformation. Myocardial 18F-FDG PET/CT imaging can accurately predict the improvement of hypoxia tolerance by quantitatively identifying of myocardial metabolic transformation in fasting and ketogenic diet rats.

EP-0022

Cardiac hybrid metabolic imaging by multi-nuclear positron emission tomography-magnetic resonance imaging (PET/MRI) (^{23}Na/^{1}H) in radiation-induced cardiotoxicity: evaluation of the effect of dapagliflozin

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Aim/Introduction: Sodium-glucose co-transporter 2 (SGLT2) inhibitors decrease glucose and sodium reabsorption in the kidney and improve prognosis in patients with heart failure.

We hypothesized that dapagliflozin might decrease tissue sodium content and glucose metabolism in a murine model of radiation-induced cardiotoxicity. ***Materials and Methods:*** Thirty-seven Sprague Dawley rats were prospectively randomized to dapagliflozin treatment (Dapa, n=19) or Placebo (n=18) 3 months after a 10 Gy cardiac irradiation using a micro-irradiator (X-RAD 225Cx, Precision X-ray Inc.). A Control group (n=5) consisted of non-irradiated animals. The Dapa group received Dapagliflozin for 6 weeks at a dose of 1.5 mg/kg/day. After 6 weeks of treatment, tissue sodium content in the skin, the pectoral muscle, and the heart was non-invasively assessed using 23Na-MRI with a 1H/23Na surface coil, and cardiac glucose metabolism was assessed by dynamic $^{[18F]}$ fluorodeoxyglucose (FDG) PET using a 7-T PET/MRI system (Bruker BioSpin). Left ventricular function was evaluated by echocardiography. Group comparisons were conducted using ANOVA. ***Results:*** After 6 weeks of treatment, systolic left ventricular function was preserved in all groups, as espected (fractional shortening in Dapa: 40±1.8%, Placebo: 42±1.3%, Control: 40.3±1.83%, p=0.7406). Sodium MRI signal was decreased in the muscle in Dapa (630.71±220.88 AU) compared to Placebo (848.56±277.92 AU, p=0.0362), without difference compared to Control (686.57±119.10 AU, p=0.6997). In addition, muscle sodium content was similar in Placebo and Control (848.56±277.92 AU vs. 686.57±119.10 AU, respectively, p=0.2074). In the skin, no significant difference was noted in Dapa (877.89±179.98 AU) vs. Placebo (1102.2±396.81 AU, p=0.0946), and vs. Control (771.5716±85.46 AU, p=0.5742). There was no significant difference in skin sodium content between Placebo and Control (1102.2±396.81 AU vs. 771.5716±85.46 AU, respectively, p=0,0522). In the myocardium, the sodium signal was increased in Placebo (766.8798±372.72 AU) compared to Control (340.83±85.46 AU, p=0.0112) but was non-significantly different in Dapa (530.303±209.94 AU) vs. Control (340.83±85.46 AU, p= 0.30) and vs. Placebo (766.8798±372.72 AU, p=0,0696). Finally, 18F-FDG PET showed a significant decrease in myocardial glucose uptake after dapagliflozin treatment compared to placebo. The 18F-FDG influx rate (Ki) was 0.021±0.01 min-1 in Dapa vs. 0.037±0.02 min-1 in Placebo (p = 0.0219), without significant difference when compared to Control (Ki= 0.039 min-1, p=0.1227). However, the Ki was similar in Placebo and Control (0.037±0.02 min-1 vs. 0.039 min-1 , respectively, p=0,9595). ***Conclusion:*** Cardiac myocardial sodium content was increased after cardiac irradiation, suggesting an increased sodium content. Dapagliflozin treatment resulted in a decrease in both sodium signal and cardiac glucose metabolism.

EP-0023

[^{11}C]PiB Brain Retention is not Affected by Antibody Binding to Amyloid-Beta

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Aim/Introduction: The reduction of amyloid-beta (Aβ) plaques in Alzheimer's disease (AD) patients following treatment with anti-Aβ antibodies like lecanemab is evidenced by a substantially decreased signal in amyloid positron emission tomography (PET) imaging. Yet, this decline in PET signals has not corresponded to a similar notable improvement in cognitive function among AD patients. Several factors could account for this, including the brief duration of treatment and the advanced disease stages of the patients. However, an aspect that remains unexplored, addressed in this study, is whether the interaction of antibodies with amyloid plaques hampers the binding of amyloid-PET ligands. This could create a misleading impression of Aβ clearance from the brain. ***Materials and Methods:*** In the present study, tg-ArcSwe mice (n=22), a mouse model of AD, received three injections of RmAb158, the murine version of lecanemab, or phosphate-buffered saline (PBS) over two weeks. The treatment regimen was designed to maximize RmAb158 binding to Aβ plaques without actual plaque removal. Three days after the last RmAb158 administration, mice were given an intravenous injection of the amyloid-PET radioligand [^{11}C]PiB, followed by isolation of brain tissue at 40 min. Brain sections were immediately prepared and studied by autoradiography. Total Aβ1-40, total Aβ1-42, soluble Aβ aggregate, and microglial protein TREM2 concentrations were determined in brain homogenates. ***Results:*** Autoradiography showed that RmAb158- and PBS-treated mice displayed similar [^{11}C]PiB binding. Moreover, the total Aβ1-40 levels, representing the major Aβ species of plaques in the tg-ArcSwe model, as well as TREM2 levels, were similar in both groups. Interestingly, the concentration of soluble Aβ aggregates, which are considered the primary target of RmAb158, was decreased in the RmAb158-treated group, along with a small but significant decrease in the total Aβ1-42 levels. In tg-ArcSwe mice, Aβ1-42 is typically located at the outer border of the insoluble Aβ plaques, often referred to as the 'halo'. Thus, RmAb158 is more likely to initially interact with Aβ1-42 than with Aβ1-40, primarily due to greater accessibility. ***Conclusion:*** This study suggests that the binding of [^{11}C]PiB to Aβ reflects the presence of Aβ plaques in the brain. This is consistent with the interpretation of amyloid-PET in clinical investigations involving anti-Aβ antibodies. Nonetheless, [^{11}C]PiB PET was not able to identify early treatment effects on soluble Aβ aggregates or Aβ1-42 levels.

EP-0024

Highly activated microglia drive FDG-PET signal changes across neurodegenerative disease models and aging

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Aim/Introduction: Previous studies have shown that microglia activation states determine brain ^{18}F-FDG-PET signal changes in mice. This study aims to investigate the impact of microglia activation on FDG-PET signals across distinct mouse models of neurodegenerative disorders and aging. ***Materials and Methods:*** C57BL/6 (WT), a model of microglial cholesterol dyshomeostasis (Npc1), and two amyloid mouse models (APPki and APPPS1) were injected with 40MBq at the age of 3 months, 7 months and 12 months of age. After a dynamic 45 minute FDG-PET scan, the brain was collected and dissociated, followed by isolation of microglia with immunomagnetic cell sorting. Microglia were then separated into three subsets based on their activation level (CLEC7A low/medium/high) and the cell count as well as radioactivity in the samples were determined to calculate FDG uptake per single cell. FDG uptake was compared between models and microglia subsets. ***Results:*** WT mice showed a moderate increase of FDG-PET signals with age, which was consistent with increasing FDG uptake per single microglia cell with age. No

difference of cellular FDG uptake was observed across microglia subsets with low, medium and high activation in WT mice. During aging, both amyloid models showed a significant higher FDG-PET signal increase compared to WT mice. On the cellular level, higher FDG uptake per microglial cell of the CLEC7A-high subset was detected relative to WT (+37%, p=0.02). Contrary, Npc1 mice, showed a significant decrease in FDG-PET signals with age and had lower FDG uptake per single microglial cell in all age groups (-67%, p=0.01). Correlation between cellular uptake and FDG-PET across all models and ages revealed that FDG-PET changes were determined by highly activated microglia (CLEC7A-high, r=0.437, p=0.0001), but not by homeostatic microglia (CLEC7A-low, r=0.095, p=0.388). ***Conclusion:*** Cell sorting after in vivo FDG injection in mice allows assessment of microglia glucose uptake in subsets with different activation state. Highly activated microglia do not consistently show increased FDG uptake, but they are the driver of FDG-PET signal changes across disease models and ages.

EP-0025

Sex-related differences of whole brain [18F]FDG-uptake between wild type and TgF344-AD elderly rats

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Aim/Introduction: Animal models of Alzheimer's Disease (AD) are useful to understand the underlying pathophysiological process of this illness and to test new treatments; nevertheless, sex and age-related differences in brain glucose consumption between controls and Tx animals are not fully characterized. This work aims to perform a semi-quantitative evaluation of the [18F]FDG uptake in whole brain structures of elderly rats, including a transgenic model of AD and controls. ***Materials and Methods:*** MicroPET imaging was performed in elderly (21 months old) transgenic TgF344-AD (TgAD) rats (5 male, 8 female) and wild-type (WT) Fisher 344 rats (9 male, 9 female). Imaging was performed in a Focus 120 microPET scanner. [18F]FDG (29 ± 8 MBq) was intravenously administered via the tail vain while animals were under anesthesia (2-3% isoflurane). Prior to imaging rats were fasted for 12-18 h. After 60 min of biodistribution an static scan of 10 min was acquired. Images were reconstructed with a 2D ordered subset expectation maximization algorithm (2D-OSEM) with a voxel size of 0.86 x 0.86 x 0.79 mm3, including all corrections but attenuation. MicroPET images were normalized to the W. Schiffer rat space implemented in PMOD 3.7 software and the standardized uptake value (SUV) of each atlas brain region was computed to compare between groups. ***Results:*** No significant statistical differences of FDG-uptake between male and female WT rats were found in cortical and nor subcortical regions; nevertheless, female TgAD rats showed and increased SUV [18F]FDG-uptake in cortical regions (7.6 ±1.2) compared with TgAD and WT males (6.5 ± 1.1, 6.7 ± 1.2), and also with WT females (6.2±1.1). In subcortical regions, including the hippocampus, the amygdala, and the thalamus, TgAD males showed lower SUV [18F]FDG-uptake values (5.2±0.9) compared with TgAD and WT females (5.9±1.1, 5.6 ± 1) and WT male (5.7 ± 1.3) rats. ***Conclusion:*** Statistically significant differences of [18F] FDG-uptake in cortical (female TgAD vs other groups (p< 0.05)) and subcortical regions were found between groups (male TgAD vs other groups (p< 0.05)). Project supported by UNAM-DGAPA PAPIIT-IT201623.

EP-0026

Decreased opioid receptor availability and impaired neurometabolic coupling as a signature of morphine tolerance in rats: a multitracer PET study

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Aim/Introduction: The development of tolerance and dependence to opioid drugs is the cornerstone of the current opioid crisis. Buprenorphine (BUP) is a potent but partial agonist of μ-opioid receptor (MOR), so that full receptor occupancy can be safely achieved with limited risk for respiratory depression. Functional neuroimaging techniques, combined with behavioral assessments, are needed to untangle the impact of tolerance on the pharmacological response to opioid. This study investigated the interplay between the MOR system, brain metabolism and behavior in the development of morphine tolerance. ***Materials and Methods:*** Sprague-Dawley rats received morphine daily to induce tolerance (n=10; 15 mg/kg/day) vs control rats (morphine-naïve animals). Behavioral pain sensitization was tested using the hot plate test after 2-days of withdrawal (Day 8), without (vehicle) or after injection of BUP (0.1 mg/kg, s.c), a dose that occupies 100% of available MOR (1). First, availability of MOR was assessed using [11C]BUP-PET imaging. Microdose [11C]BUP was i.v. injected followed by 90 min brain PET acquisition (tolerant rats n=4; control rats n=4). In other rats, [18F]FDG-PET experiments were performed in tolerant rats 30 min vs control after injection of unlabeled BUP (0.1 mg/kg, n=5, or vehicle (n=6). ***Results:*** In morphine-treated rats, after 2 days-withdrawal, BUP failed to induce analgesia compared to the control group (p<.001), thus confirming opioid tolerance. Compared with control rats, brain distribution (SUV) of [11C]BUP in tolerant rats was lower in most brain regions (p<.01) except in the cerebellum (p>.05). This difference was also observed when using the SUVR (cerebellum) as outcome parameter. Compared with control rats, morphine tolerance decreased the baseline uptake of [18F]FDG in most brain regions except in the cerebellum (p>.05). Significance was reached in the thalamus, cortex, striatum and midbrain (p<.01). In control rats, the pharmacological challenge using unlabeled BUP decreased the uptake of [18F]FDG in most brain regions except the cerebellum. The decrease in [18F]FDG uptake after the BUP challenged in tolerant rats was significantly lower (p<.05), suggesting attenuated pharmacological response. ***Conclusion:*** This study highlights the relevance of the BUP pharmacological challenge, associated with [18F]FDG-PET and MOR mapping, as a multitracer approach to explore the attenuated neurovascular coupling associated with morphine tolerance. This strategy may be used to evaluate protocols to mitigate the

development of opioid tolerance or restoring sensitivity to opioids.
References: Soyer A, et al. (2023): Validation of a pharmacological imaging challenge using 11C-buprenorphine and 18F-FDG-PET to study the effects of buprenorphine to the rat brain.

EP-0027

Pre-Clinical Assessment of Cardiac P-glycoprotein Function In Vivo with [18F]MC225 PET Imaging

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Aim/Introduction: Drug transporter P-glycoprotein (P-gp), an essential efflux pump, is crucial for the transport and interaction of various drugs. Several cardiovascular drugs are defined as P-gp substrates. Changes in P-gp function may limit the effective distribution and bioavailability of these drugs. The functionality of P-gp can be affected by several factors such as modulators, drugs (e.g. chemotherapeutics), age, gender, and pathological conditions. [18F]MC225 is a promising radiopharmaceutical for assessing P-gp function at the human blood-brain barrier (BBB). Given that several cardiovascular drugs are P-gp substrates, it is of interest is to study cardiac P-gp functionality in vivo with Positron emission tomography (PET). In this pre-clinical rat study, [18F]MC225-PET was tested for the first time for its potential to assess cardiac P-gp function. ***Materials and Methods:*** [18F]MC225 (27.13±12.17 MBq) was injected intravenously into rats. The rats were randomly assigned to two groups. One group received 6 mg/kg tariquidar (n=4) to inhibit P-gp. The control group was administered only the vehicle solution (n=3). Dynamic small animal PET imaging with cardiac gating was performed for 60-minutes, followed by ex vivo biodistribution of all organs. All samples were weighted, and radioactivity was counted in a gamma counter. Additionally, as a control experiment, in vitro assay using immunofluorescent staining to indicate the presence of P-gp expression in heart tissues. ***Results:*** In the 40-60-minute frame interval, standardized uptake values (SUV) of the heart were significantly higher in the tariquidar group (Mean ± SD: 0.60 ± 0.12) when compared to the control group (0.47 ± 0.07) (p=0.03). The area under the time-activity curves and the SUV values of the time-activity curves were also higher in tariquidar treated rats, but this was not statistically significant. The tissue uptake of [18F]MC225 as measured ex vivo was significantly different between the two groups in multiple organs (table 1). Uptake of [18F]MC225 in the heart was higher trend in tariquidar treated rats, but not statistically significant. ***Conclusion:*** In this study, a novel PET radiotracer [18F]MC225 was applied for the first time to evaluate P-gp function in rat hearts. The findings suggest that [18F]MC225-PET imaging is promising for assessing the functionality of P-gp. In the future, [18F]MC225-PET may possess the capability to predict the cardiac bioavailability of pharmaceutical agents as well as provide precise, individualized insights for therapeutic optimization, but also the effect of cardiotoxic agents.

EP-0028

The Innovative Curcumin Analog EF-24, Radiolabelled with Gallium-68 Demonstrated Substantial Binding Affinity to Synthetic b-amyloid Fibrils, Indicating Diagnostic Utility for Neurodegenerative Diseases.

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Aim/Introduction: Curcuminoids labeled with fluorine-18 or technetium-99m have been reported to exhibit significant binding affinity for β-amyloid plaques. Curcumin derivatives were successfully radiolabelled with the positron-emitter Gallium-68, showing high affinity for synthetic β-amyloid fibrils [1]. EF-24 is an innovative synthetic curcumin analog with enhanced bioavailability and bioactivity presenting several biological activities, including neuroprotection. Aim of the current study was to successfully synthesize and characterize Gallium-68 EF-24 complex and explore its potential binding affinity to synthetic β-amyloid fibrils. ***Materials and Methods:*** Initially, DTC-EF-24 was synthesized and complexed with Gallium to form [Ga(DTC-EF-24)2]+. DTC-EF-24 was also radio-labeled with Gallium-68. The radio isotope was produced by reacting 68Ga3+ from a 68Ge/68Ga generator with 1mg/mL DTC-EF-24 solution. Reaction parameters (precursor amount, reaction temperature, and pH) were optimized to obtain high and reproducible radiochemical yield and purity. Quality controls and stability studies were performed by radio-TLC. Amyloid-beta (Aβ) fibrils were prepared and incubated with the labeled complex. The binding affinity was estimated according to methods previously published1. Displacement tests with an EF-24 solution were performed to evaluate specificity and interaction dynamics. ***Results:*** Synthesis and complexation of EF-24 with Gallium-68 were confirmed via comprehensive spectroscopic methods. Radiochemical purity (RCP) of 68Ga-complex was >95%, under best radio-labeling conditions. The identity of the [68Ga][Ga(DTC-EF-24)2]+ complex was confirmed by coelution with the equivalent natGa-complex in RP-HPLC analysis. The 68Ga-complex showed high and comparable stability to transchelation and transmetalation when challenged with DTPA solution or 0.9% NaCl solution or human serum. In allcases, the percentage of the intact complex remained >90% over 120 min of incubation. The [68Ga][Ga(DTC-EF-24)2]+ complex showed in vitro significant binding affinity to synthetic Aβ fibrils, retaining 91.5 ± 2.0% radioactivity, markedly higher than the control. These results indicate the diagnostic potentialof EF-24 complex in targeting amyloid-beta structures, a critical pathophysiologic feature in neurodegenerative diseases. ***Conclusion:*** The cureent study descirbes the potential of 68Ga labeled EF-24 complexes as diagnostic tools in neurodegenerative diseases. The specificity towards amyloid-beta fibrils provides the groundwork for advanced in vivo studies, potentially revolutionizing diagnostic approaches in molecular imaging for these disorders. Furthermore, given the neuroprotective role of curcumin analogs, the potential therapeutic effect of these novel compounds needs to be explored. ***References:*** [1] Asti Mattia et al, 'Synthesis and characterization of 68Ga-labeled curcumin and curcuminoid complexes as potential radiotracers for imaging of cancer and Alzheimer's Disease',Inorganic Chemistry , 2014 May 19/53, 4922-33.

EP-0029

Synthesis and Preliminary Evaluation of [18F]-EF-24, a novel synthetic curcumin analog, for PET Imaging of β-Amyloid Plaques in Alzheimer's Disease.

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Aim/Introduction: The innovative synthetic curcumin analog EF-24 presents enhanced bioavailability, and bioactivity while exhibiting neuroprotective properties [1]. Natural curcumin is a promising agent due to its various bioactivities, including antioxidant, anti-inflammatory, anti-cancer and neuroprotective activities. Curcumin and curcuminoids complexes labeled with fluorine-18 or technetium-99m have demonstrated significant binding affinity for β-amyloid plaques encountered in Alzheimer's disease (AD) [2]. Aim of the current study was to successfully radiolabel EF-24 with [18F] and explore t its diagnostic potential as a radiotracer for imaging amyloid plaques, aiming to enhance diagnostic accuracy in AD. ***Materials and Methods:*** Radiolabeling of EF-24 was achieved using a boronic acid precursor, copper (II) trifluoromethanesulfonate, and pyridine in DMF in two steps. Radiochemical purity and yield were assessed by radio-TLC and radio-HPLC. Stability studies were conducted in PBS and serum, with assessments up to 4 hours post-synthesis. Synthetic β-amyloid fibrils were utilized to evaluate binding affinity. Ongoing in vivo imaging studies employing micro-PET/MRI (simulatenous PET and MRI acquisition) and biodistribution studies in healthy and Alzheimer's disease model mice will further investigate the tracer's distribution and binding capabilities. ***Results:*** [18F]-EF-24 was synthesized with low radiochemical yield (10-15%) but high purity (>95%), showing substantial stability in PBS and serum, remaining intact for up to 4 hours. Preliminary in vitro studies indicated significant binding to synthetic β-amyloid fibrils, with a retention of 89 ± 4.0% radioactivity. Early results from in vivo studies are promising, supporting further investigation. ***Conclusion:*** Synthesis and early evaluation of [18F]-EF-24 suggest its potential as a specific and stable PET imaging agent for β-amyloid plaques in Alzheimer's disease. The radiotracer's stability in biological media and strong affinity for amyloid fibrils underscore its potential clinical relevance. The outcomes of ongoing in vivo studies are anticipated to provide critical insights into the tracer's diagnostic utility, while the potential neuroprotective effective of the compoynd will also be explored.

References: [1] He, Yonghan et al., "Bioactivities of EF24, a novel curcumin analog: A Review," Frontiers in Oncology, 2018; 8: 614. [2] Asti Mattia et al., "Synthesis and characterization of 68Ga-labeled curcumin and curcuminoid complexes as potential radiotracers for imaging of cancer and Alzheimer's Disease," Inorganic Chemistry, 2014; 53: 4922-33.

EP-03

e-Poster Area

A: Preclinical Studies -> A1 Medical Preclinical -> A13 Preclinical Oncology

EP-0031

A Novel Bis-boron Tracer for Amino Acid PET Imaging

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Aim/Introduction: Amino acid PET imaging enables a more accurate neuro-oncology diagnosis, especially in clinically equivocal situations. Boramino acid, as a novel class of amino acid analogue, has been developed for amino-acid-transporter-mediated PET imaging. This study aims to develop a novel boramino acid, BR-02 which incorporates two boron atoms, for brain tumor imaging. ***Materials and Methods:*** BR-02 was radiolabeled with fluorine-18 through the 18F-19F isotope exchange reaction and subsequently purified using semi-preparative HPLC. Preclinical studies for IND application, including pharmacology, pharmacokinetics, and toxicology studies, were fully performed. To identify the mechanism of action, a LAT1 high-expressing cell strain, HEK293/LAT1, was constructed. PET imaging of 13 xenograft models was performed. Both in vitro and in vivo pharmacokinetics studies, including an internal dose assessment based on biodistribution study, were conducted. The toxicological profile of BR-02 was evaluated in a series of toxicology studies, including single-dose toxicity, repeat-dose toxicity, genotoxicity, and local tolerance. ***Results:*** A sterile and non-pyrogenic solution with a radioactivity concentration of 10-24 mCi/mL was manufactured using a fully automatic radiopharmaceutical synthesizer. In the pharmacology study, the HEK293/LAT1 tumor uptake of BR-02 was significantly higher than that of HEK293/mock. The PET imaging study of 11 xenograft models demonstrated that the tumor uptake had a significant positive correlation with the LAT1 mRNA and protein expression levels, indicating that BR-02 could be transported and accumulated in the tumor through the LAT1 transporter. PET imaging studies of the U87MG orthotopic xenograft mouse model and the LLC brain metastasis mouse model demonstrated that BR-02 had excellent brain tumor targeting and imaging capabilities. After intravenous injection, BR-02 was mainly distributed in the kidneys and pancreas and was excreted in the urine. The effective doses converted from SD rats to adult men (4.98-9.95 mSv) and adult women (6.22-12.43 mSv) at the intended clinical dose were considered safe for clinical PET imaging. The safety margin was about 1000 times the clinical equivalent dose, and no further signs of toxicity concerning were noted in other toxicity studies. ***Conclusion:*** IND-enabling studies for a novel boramino acid PET imaging tracer were performed and demonstrated an acceptable safety profile, thereby allowing BR-02 to proceed to clinical trials.

EP-0032

Bicycle Radionuclide Conjugates for radioisotope delivery to solid tumors

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Aim/Introduction: Bicycle molecules are a novel peptide-based modality consisting of constrained short peptides stabilized in a bi-cyclic structure using a central chemical scaffold. De

novo identification of Bicycle peptides that bind to biological targets, including proteins overexpressed in tumors, can be performed using the Bicycle phage display platform. One such target is MT1-MMP, a protein which is overexpressed in a number of cancers including lung, esophageal and pancreatic. We are developing Bicycle Radionuclide Conjugates (BRCs), in which Bicycle molecules are employed as targeting vectors to deliver radioisotopes to tumors for cancer imaging and targeted radionuclide therapy. The inherent properties of Bicycle molecules, namely their small size (compared to biologics) and hydrophilic nature, make them an ideal modality for radionuclide delivery. These characteristics, combined with exquisite binding specificity and high binding affinity, allow for rapid delivery to tumor and effective penetration, resulting in high accumulation of payload in the tumor. Their short biological half-life allows high contrast imaging at early timepoints and limits the exposure of normal tissue to payload. (1-4) ***Materials and Methods:*** In vitro cell binding assays were used to establish BRC binding properties. Mouse cell line derived xenograft models were used to determine organ distribution via imaging or ex vivo counting. ***Results:*** BRCs that demonstrate ideal properties for imaging, namely high tumor accumulation and rapid clearance from plasma, were identified across a number of targets and tumor models. Lead optimization of a MT1-MMP targeting BRC series labelled with Lead-212 resulted in compounds with improved biodistribution profiles, including more favorable tumor to kidney ratios, rendering them suitable for therapeutic application. ***Conclusion:*** As radiotheranostic approaches become widely employed in clinical oncology practices, the need for novel targets is well recognized. The Bicycle platform is a powerful tool for de novo identification of high quality binders to important cancer targets, with ideal properties for radionuclide delivery. The ability to optimize biodistribution properties of BRCs, particularly reducing kidney uptake, has been demonstrated, positioning Bicycle molecules as a potentially exciting new modality for targeted radionuclide therapy. ***References:*** 1. Eder, M. et al. Cancer. Research. 2019, 79 (4), 841.2. Bennett, G. et al. Molecular Cancer Therapeutics 2020, 19 (7), 1385.3. Duan, X et al. Clinical Cancer Research 2023, 29 (17), 3395-3407.4. Sharma, A. K. et al. Advanced Science 2024, 2308617.

EP-0034

Impact of pentadecanoic acid conjugation to ^{111}In/^{225}Ac-RGD peptide on pharmacokinetics and therapeutic effects

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Aim/Introduction: Too rapid clearance of peptides is unsuitable for peptide receptor radionuclide therapy. To overcome this, we developed RGD peptides with pentadecanoic acid (PD) as an albumin binding moiety. In this study, we investigated the pharmacokinetics and therapeutic effects of radiolabeled PD conjugated RGD peptides. ***Materials and Methods:*** We synthesized PD-K(DOTA)-c(RGDfK) (PD-K(DOTA)-RGD) and PD-K(DOTA)-E[c(RGDfK)]2 (PD-K(DOTA)-RGD2). To estimate the binding ability to albumin, PD-K(111In-DOTA)-RGD and PD-K(111In-DOTA)-RGD2 were incubated with human serum albumin (HAS), respectively. In comparison, 111In-DOTA-c(RGDfK) (111In-DOTA-RGD) and 111In-DOTA-E-[c(RGDfK)]2 (111In-DOTA-RGD2) without the albumin binding moieties were also evaluated. The albumin fraction was recovered by ultrafiltration using the Amicon Ultra-0.5 (NMWL: 50 kDa) and its radioactivity was measured. The percentage of the albumin binding for the incubated radioactivity was calculated. In U-87 MG xenograft mice, the biodistribution of 111In labeled RGD peptides was determined at 1, 4, and 24 h after the injection. In the therapeutic experiment, PD-K(225Ac-DOTA)-RGD (20, 40 kBq/mouse) was injected. Body weight and tumor size were measured. Hematological, hepatic, and renal toxicity was also examined at the end of the experiment. ***Results:*** Conjugation of PD to RGD peptides significantly increased the binding ability to HSA while there isn't almost the binding of 111In-DOTA-RGD and 111In-DOTA-RGD2 to HSA. The HSA binding of PD-K(111In-DOTA)-RGD was higher than that of PD-K(111In-DOTA)-RGD2. The biodistribution experiment indicated that the PD conjugation significantly increased the radioactivity in the blood and tumor and slowed the clearance. At 4 h after the injection, the blood radioactivity of PD-K(111In-DOTA)-RGD and PD-K(111In-DOTA)-RGD2 was 5.80 and 1.29 %ID/g, respectively while that of 111In-DOTA-RGD and 111In-DOTA-RGD2 was less than 0.1 %ID/g. The tumor uptake of PD-K(111In-DOTA)-RGD was 9.96 at 4 h and 10.68 %ID/g at 24 h after injection. That of PD-K(111In-DOTA)-RGD2 was 8.59 at 4 h and 5.12 %ID/g at 24 h after injection. In the therapeutic experiment using BxPC-3 xenograft mice, PD-K(225Ac-DOTA)-RGD successfully suppressed tumor growth. Median survival times are 48 days for control 70 days for 20 kBq, and 83 days for 40 kBq of PD-K(225Ac-DOTA)-RGD. The hepatic toxicity dose-dependently appeared though the renal toxicity was not obvious. ***Conclusion:*** In this study, the conjugation of PD to DOTA-c(RGDfK) successfully improved the pharmacokinetics of DOTA-c(RGDfK), leading to the prolonged blood circulation and the higher tumor uptake. In addition, PD-K(225Ac-DOTA)-RGD inhibited the tumor growth. These results suggested that PD-K(111In/225Ac-DOTA)-RGD has great potential for radiotheranostics of pancreatic cancers.

EP-0035

Radiosynthesis and quality control of ^{99m}Tc -Temozolomide: a preliminary study.

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Aim/Introduction: Nuclear medicine imaging makes use of 18F-FDG-PET as a valuable tool for diagnosis, therapy-monitoring and prognostication of glioma, but 18F-FDG is also picked up by inflammatory or infectious cells leading to its limitation and also requires cyclotron for its production. Therefore, as an alternate, SPECT-CT based radionuclide (99mTc) is to be exploited for various logistic and technical benefits. The present study aims to radio-synthesise and perform physicochemical characterisation of 99mTc-temozolomide, an alkylating agent, widely used for treating primary and recurrent high-grade gliomas. ***Materials and Methods:*** Radiolabeling of temozolomide with 99mTc was standardized using stannous chloride (SnCl2) reduction method. Various physical conditions viz: concentration of reaction constituents, incubation time, pH, and temperature were optimized to obtain maximum binding of 99mTc with the drug. Percentage protein binding, in-vitro stability and lipophilicity were also assessed. The radiochemical purity of 99mTc- temozolomide was estimated by instant thin layer chromatography (ITLC) and electrophoretic mobility of radiocomplex was assessed using paper electrophoresis. C6 cell lines were used to evaluate cytotoxicity of various concentration of radio-complex after incubating for 24 hours using MTT reagent, while haemoglobin

release assay was performed to test cytotoxicity on erythrocyte membrane. ***Results:*** 99mTc-Temozolomide radiocomplex exhibited maximum radiolabelling yield at 1:1 ratio of SnCl2 and temozolomide when incubated with 500µCi activity of pertechnetate, at 21°C for 10 minutes at pH of 5.5. Rf value of 0.1 was obtained in acetone medium for the bound radiocompex. Average protein binding was 7.03%, in vitro stability was > 90 % up to 6 hours and lipophilicity was high, as indicated by Log P o/w value (≥1.52). The net charge of the radiocomplex was observed to be zero from the electrophoresis run. MTT analysis showed that the viable population decreased gradually with increasing concentration and there was minimal haemolytic activity at the various concentration ranging from 12.5µg to 50µg of temozolomide. ***Conclusion:*** The developed radiocomplex exhibited a high labelling efficiency of ≥ 90% and holds the potential for its bioevaluation as radionuclide probe for glioma imaging at preclinical level and to be assertive for its clinical evaluation.

EP-0036

Impact of molar mass of FAPI on ^{68}Ga/^{177}Lu-FAPI PET imaging and radiotherapy for targeting murine FAP in wildtype tumor cell line derived xenograft

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Aim/Introduction: Since FAP is highly expressed in tumor stroma in various epidermal-derived cancers, FAP-targeted diagnosis and treatment have shown great potentials in preclinic and clinic for tumor theranostics. However, in preclinic, tumor-bearing mice hold relatively low absolute FAP expression level compared to cancer patients, leading to obstacles in detecting FAP expression using FAP-targeted PET as radiopharmaceuticals with higher specific activity is needed. So far there has been no study to make sure the impact of administration molar mass of radiolabeled FAPI on murine FAP-targeted theranostics in wildtype cell line derived xenograft. ***Materials and Methods:*** Specific activity of synthesized 68Ga/177Lu-FAPI-04 was measured by radioHPLC. 68Ga-FAPI-04 was administrated to wildtype 4T1 tumor-bearing mice with various molars of FAPI-04, followed by static PET scanning. Sigmoidal curves were simulated to analyze the correlation of SUVmax and administration molar mass of FAPI-04. Similarly, 177Lu-FAPI-04 with different molars of FAPI-04 and same dose of radioactivity was injected to 4T1 tumor-bearing mice for treatment. ***Results:*** Simulation results revealed the gradient blocking effect of FAPI-04 in 68Ga-FAPI-04 PET imaging. Correlation of SUV of tumor and other organs and administration molar mass fit standard Sigmoidal model (Top tumor SUVmax 0.86; Bottom tumor SUVmax 0.13; IC50 7.71 nmol/kg). Different tumor inhibition effect of 177Lu-FAPI-04 also validated the impact of administration molar mass of FAPI-04 on therapeutic effect that tumor inhibition was seen with treatment of 30 MBq/0.2 nmol 177Lu-FAPI-04 but 30MBq/1 nmol. ***Conclusion:*** The administration molar mass of 68Ga/177Lu-FAPI-04 shall apparently influence FAP-targeted imaging results and therapeutic effect. It's never careful enough to take it in consideration when apply radiolabeled FAP ligands to FAP-targeted PET imaging and radiotherapy in preclinical situation.

EP-0037

Development of porphyrin functionalized nanodroplets for cancer theranostics

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Aim/Introduction: It is known that porphyrins highly accumulate in cancer cells compared to normal cells. Therefore, surface conjugation of porphyrins to nanomaterials could improve the selective overall nanoparticles localization toward cancers. Meanwhile, phase shift nanodroplets that contain a low-boiling point liquid perfluorocarbon core have been used for ultrasound imaging agents and drug delivery carriers. Recently, ultrasound-triggered agents for sonodynamic therapy (SDT) have gained attention due to their non-invasiveness and ability to penetrate deeply seated tumors. In this study, the designed nanodroplets that encapsulate the low-boiling point liquid perfluorocarbon and IR-780 dye, with surface conjugation of 111In-labeled porphyrin derivative ([111In]In-DTPA-TPP), for theranostics were synthesized and evaluated by in vitro and in vivo experiments. ***Materials and Methods:*** [111In]In-DTPA-cysteamine-nanodroplets, which is 111In-labeled nanodroplets without porphyrin as a control, and [111In]In-DTPA-TPP-nanodroplets were synthesized by a simple chelation reaction of [111In]InCl3 with DTPA moiety of nanodroplets. Cellular uptake experiments in Colon 26 cells and biodistribution experiments in Colon 26 tumor-bearing mice of [111In]In-DTPA-cysteamine-nanodroplets and [111In]In-DTPA-TPP-nanodroplets were performed. SPECT imaging experiments were performed after injection of [111In]In-DTPA-TPP-nanodroplets. SDT of DTPA-TPP-nanodroplets was performed. ***Results:*** The cellular uptake of [111In]In-DTPA-TPP-nanodroplets was significantly higher than [111In]In-DTPA-cysteamine-nanodroplets. Biodistribution experiments revealed a higher accumulation in the tumor of mice injected with [111In]In-DTPA-TPP nanodroplets compared to [111In]In-DTPA-cysteamine-nanodroplets. Moreover, the accumulation of [111In]In-DTPA-TPP nanodroplets in the tumor was visualized by SPECT imaging. Sonodynamic therapeutic experiments revealed that DTPA-TPP-nanodroplets with a single ultrasound irradiation onto the tumor area significantly inhibited tumor growth. ***Conclusion:*** These results indicate that [111In]In-DTPA-TPP nanodroplets would be promising cancer theranostic agents.

EP-0038

Standardized analyses of static and dynamic fluorodeoxyglucose PET/CT images in patient-derived orthotopic mouse models of endometrial cancer

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Aim/Introduction: Fluorodeoxyglucose (FDG)-PET/CT imaging allows non-invasive tumor characterization

and longitudinal monitoring in patient-derived orthotopic xenograft (PDX) models. Standards for analyzing FDG-PET/CT experiments in PDX models of endometrial cancer are lacking, which is challenging for the reproducibility and clinical translation. We report and compare standard and novel tumor metabolic parameters in preclinical PDX endometrial cancer models and explore whether the tumor parameters differ according to PDX model/histology/treatment group. ***Materials and Methods:*** The studied mice (n=63) comprised three cohorts including both endometrioid (EEC) and non-endometrioid (non-EEC) subtypes. Cohort 1 (C1) (n=43) consisted of treatment naive mice: PDX: n=13 (EECG2: n=3; EECG3: n=10) and organoid (O)-PDX: n=30 (clear cell: n=3; serous: n=1; EECG1: n=1; EECG2: n=1; EECG3: n=24) imaged with FDG PET/CT at endpoint. Cohort 2 (C2) (n=10) comprised O-PDX mice (EECG3) imaged with FDG-PET/CT at endpoint after treatment with carboplatin (n=5) or saline (control; n=5). Cohort 3 (C3) (n=23) comprised PDX mice (EECG3) imaged with FDG-PET/CT at endpoint following treatment with trastuzumab (n=7), paclitaxel (n=8) or saline (control; n=8). The following metabolic imaging parameters were extracted from all tumors; maximum/peak/mean/10 most intense voxels standardized uptake values (SUVMAX, SUVPEAK, SUVMEAN, SUV10) metabolic tumor volume, total lesion glycolysis, max tumor-background ratio (TBRMAX) and dynamic parameter tumor influx rate (KI). ***Results:*** All mice were successfully imaged by PET/CT depicting uterine FDG avid tumor uptake. Treatment naive mice (C1) had a mean/median [SD] tumor SUVMAX of 4.5/4.4 [1.1]. There were no significant differences in tumor metabolic parameters for the different histological subtypes or between PDX and O-PDX. The metabolic tumor parameters SUVMAX, SUVPEAK, SUV10 and SUVMEAN, were all strongly positively correlated with each other (coefficient RS= 0.91-0.97; $p<0.001$). In C2 median SUVMAX/TBRMAX/SUVPEAK/SUV10 values were similar in the treatment group (SUVMAX/TBRMAX /SUVPEAK/SUV10 = 5.1/10.2/4.4/4.9) vs. control group (median SUVMAX/TBRMAX/SUVPEAK/SUV10 = 5.6/11.2/4.9/5.3) ($p\geq0.17$). The median for the dynamic parameter KI was 0.0719 and 0.0533 ml/cm3/min for the carboplatin and control group, respectively ($p\geq0.81$). In C3, median SUVMAX/TBRMAX/SUVPEAK/SUV10 values were similar in trastuzumab (3.9/7.8/3.6/3.7) vs. paclitaxel (4.3/8.9/3.7/4.1) vs. control group (4.7/8.8/3.9/4.6) ($p\geq0.137$); median KI was 0.0489/0.0533 and 0.0595 ml/cm3/min for the trastuzumab, paclitaxel and control group respectively ($p\geq0.514$). ***Conclusion:*** We report quantitative FDG tumor uptake from a range of endometrial cancer models using conventional and novel parameters, which provides an important baseline for analyses in future preclinical studies. Incorporating multiple imaging timepoints and increasing the sample size may increase the strength of future treatment studies.

EP-0039

Construction of Novel Radionuclide Labeled Molecular Imaging Probes Targeting EGFR

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Aim/Introduction: PET tracers based on small molecule structures are simple to prepare and easier to mass produce. Currently, 18F-labeled epidermal growth factor receptor (EGFR) probes have shown good visualization effect, but there is no molecule based on 68Ga-labeled EGFR small molecules with good visualization effect. DOTA, as a chelating agent of 68Ga, can be 177Lu-labeled for therapeutic purposes. We designed EGFR tyrosine kinase inhibitor (TKI) probe [68Ga/177Lu]-Pip-Gefitinib for EGFR-Sensitive (19del/L858R) tumors. We conducted preclinical evaluation and application of the probe after using 68Ga labeling in order to instantly assess and monitor EGFR gene expression of tumor, guiding clinical dosing, and to explore the therapeutic effect after 177Lu labeling. ***Materials and Methods:*** The structures were screened by computerized molecular docking experiments and other methods, 68Ga and 177Lu labelling conditions were explored, cellular uptake and PET/CT imaging of the corresponding hormonal murine models were performed in cell lines validated for different EGFR expression, and then in vivo distribution and metabolism were evaluated. ***Results:*** 68Ga-Pip-Gefitinib had significantly high uptake in the NSCLC cell lines HCC827 and PC-9, and the human colon cancer cell line HCT116 (19del/L858R high-expressing cell line), and low uptake in A549 (19del/L858R low-expressing cell line), and compared to the pre-existing 68Ga-labelled EGFR probes, there were lower intestinal uptake and performed better in PET/CT. We have now demonstrated the stability of 177Lu labelling in vivo and ex vivo, and will further complete the experiments of SPECT/CT and therapy after 177Lu labelling. ***Conclusion:*** PET/CT of [68Ga/177Lu]-Pip-Gefitinib is capable of demonstrating EGFR expression status and is expected to provide non-invasive immediate clinical screening and long-term monitoring of EGFR-TKI-applicable patient populations, and is expected to guide clinical nuclide therapy.

EP-0040

^{68}Ga/^{177}Lu-labeled theranostic pair targeting fibroblast activation protein with high tumor uptake and retention

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Aim/Introduction: Radiotheranostics allows pre-treatment diagnosis, radionuclide therapy, and post-treatment evaluation using specific radiopharmaceuticals [1, 2]. Fibroblast activation protein (FAP) is specifically expressed on cancer-associated fibroblasts in over 90% of tumors and considered a promising target for cancer theranostics [3, 4]. ***Materials and Methods:*** We developed a novel FAP-targeting ligand DOTA-FAPT and labeled it with gallium-68 and lutetium-177 as a theranostic pair. FAP-positive A549-FAP cells were used for in vitro specific binding evaluation of [68Ga]Ga/[177Lu]Lu-FAPT. Micro-PET/CT scans were performed on A549-FAP and U87MG tumor-bearing mice to compare the in vivo pharmacokinetic properties and tumor uptake between [68Ga]Ga-FAPT and [68Ga]Ga-FAPI-04. Biodistribution and therapeutic efficacy evaluation of [177Lu]Lu-FAPT were conducted on A549-FAP tumor-bearing mice. Lastly, primary clinical studies were conducted on patient with lung cancer. ***Results:*** [68Ga]Ga/[177Lu]Lu-FAPT exhibited high stability and hydrophily, as well as strong affinity to the FAP target (IC50 = 0.42 nM). PET/CT showed that [68Ga]Ga-FAPT had remarkably higher tumor uptake and prolonged tumor retention in A549-FAP and U87MG tumor xenografts compared to [68Ga]Ga-FAPI-04 with favorable in vivo pharmacokinetic properties. Therapeutic studies showed that [177Lu]Lu-FAPT had higher tumor accumulation compared to [177Lu]Lu-FAPI-04, leading to stronger tumor growth inhibition. The therapeutic efficacy of [177Lu]Lu-FAPT was dose-dependent, with 37 Mbq of [177Lu]Lu-FAPT had higher tumor growth inhibition and longer

median survival compared to 18.5 Mbq of [177Lu]Lu-FAPT. The safety of [177Lu]Lu-FAPT radiotherapy was also demonstrated by internal dose assessment and monitoring of mice in the treatment group. PET/CT imaging of [68Ga]Ga-FAPT in patient with lung cancer showed higher uptake in both primary lesion and metastatic lymph nodes compared to [18F]FDG. ***Conclusion:*** [68Ga]Ga/[177Lu]Lu-FAPT exhibit enhanced tumor visualization and stronger anti-tumor efficacy compared to [68Ga]Ga/[177Lu]Lu-FAPI-04. The preclinical study and primary clinical study show that 68Ga/177Lu-labeled DOTA-FAPT is a theranostic pair with a broad application prospect. ***References:*** 1.Aboagye EO, Barwick TD, Haberkorn U. Radiotheranostics in oncology: Making precision medicine possible. CA Cancer J Clin. 2023;73:255-74. doi:10.3322/caac.21768.2.Bodei L, Herrmann K, Schöder H, Scott AM, Lewis JS. Radiotheranostics in oncology: current challenges and emerging opportunities. Nat Rev Clin Oncol. 2022;19:534-50. doi:10.1038/s41571-022-00652-y.3.Liu R, Li H, Liu L, Yu J, Ren X. Fibroblast activation protein: A potential therapeutic target in cancer. Cancer Biol Ther. 2012;13:123-9. doi:10.4161/cbt.13.3.18696.4.Liu T, Han C, Wang S, Fang P, Ma Z, Xu L, et al. Cancer-associated fibroblasts: an emerging target of anti-cancer immunotherapy. J Hematol Oncol. 2019;12:86. doi:10.1186/s13045-019-0770-1.

EP-0041

Elucidating the cellular responses and mechanism of action of ^{177}Lu-based radioligand therapy

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Aim/Introduction: Radioligand therapy (RLT) holds outstanding potential for the treatment of multiple cancer types, particularly those at advanced stage, with high effectiveness and tolerability. Among the expanding repertoire of RLT modalities, 177Lu-PSMA-RLT and 177Lu-Dotatate-RLT stand out as FDA-approved treatments for PSMA-positive metastatic castration-resistant prostate cancer (mCRPC) and somatostatin receptor-positive gastroenteropancreatic neuroendocrine tumors (GEP-NETs) respectively. Despite their clinical success, treated patients often lack durable responses, with complete cure being infrequent. A better understanding of the mechanism of action of 177Lu-RLT and the cellular responses induced by this treatment could unveil novel opportunities for the improvement of therapy and outcome for patients. ***Materials and Methods:*** The phenotypes and cellular responses induced by 177Lu-RLT were assessed in multiple cell lines by several experimental approaches, including viability assays, immunofluorescence and flow cytometry. Additionally, "DDR-ome" targeted genetic screens as well as pharmacological screens were conducted using cells treated with 177Lu-radioligands to unravel its mechanism of action and potential combination partners. ***Results:*** 177Lu-RLT-treated cell lines show induction of multiple DNA Damage Response (DDR) markers, with those indicative of double-strand break (DSB) repair by either non-homologous end-joining (NHEJ) or homologous recombination (HR) being particularly prominent. 177Lu-RLT induced other phenotypes characteristic of genomic instability such as cell-cycle alterations, accumulation of micronuclei and cell death. In agreement with published reports, we show that either the knock-out or chemical inhibition of NHEJ core factors such as the catalytic subunit of DNA-PK (PRKDC) renders cells sensitive to 177Lu-RLT and combination of both agents provides a beneficial tumor growth inhibition in vivo. Additionally, our targeted screens also suggest that DSBs are the most cytotoxic form of 177Lu-RLT-induced DNA damage and have identified novel targets for development of radiosensitizers. We will also show data from the pharmacologic screens including PARP inhibitors and correlate genetic and pharmacological results. ***Conclusion:*** Our work provides better understanding of the cellular responses to 177Lu-based RLT and pinpoints NHEJ as a critical pathway promoting survival to this treatment, which could set the basis for novel combination therapies.

EP-0042

Preparation and Application of Novel ^{68}Ga-labeled Nucleic Acid Aptamers Targeting c-Met

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Aim/Introduction: c-Met is a membrane receptor protein with tyrosine kinase activity that is activated by its physiologic ligand, hepatocyte growth factor (HGF). Once activated, this protein stimulates a series of intracellular signaling pathways, such as those associated with proliferation, motility, and invasive migration of cancer cells. Early c-Met targeting molecule was 64Cu-NOTA-rh-HGF. In 2008-2012 monoclonal antibodies targeting c-Met or its ligand (HGF) were labelled with 89Zr, peptides labelled with 18F, 64Cu and 68Ga and small molecules labelled with 11C and 18F. Unfortunately, despite the availability of such a large number of nucleotide-labelled tracers, only one is currently involved in clinical trials for pet applications. There is a lack of aptamer-based imaging probes, and we have developed an aptamer-based molecular imaging probe by utilizing the unique properties of aptamer. SELEX technology has proven to be a powerful and effective aptamer screening program. Aptamers are composed of DNA or RNA (primarily DNA) and are functionally equivalent to traditional antibodies, with the advantages of small size, flexible structure, ease of synthesis, versatile chemical modifications, high stability and lack of immunogenicity. In this study, we developed a molecular imaging probe with a c-Met aptamer for targeted imaging of positive tumours. Next, we successfully prepared an aptamer-based PET/CT imaging probe, named [68Ga] Ga-NOTA-SL1. ***Materials and Methods:*** First, we successfully labeled [68Ga] Ga-NOTA-SL1 and conducted Radio-HPLC and circular dichroism for validation. Next, flow cytometry, fluorescence confocal microscopy, and cellular uptake studies were performed at the cellular level. We utilized PC-9, HCC827, and HCT116 cell lines for subcutaneous implantation in mice. PET/CT scans were performed when the tumor size reached 0.5-1 cm, and at the end of the imaging, mouse tissues were collected to measure gamma values and calculate %ID. ***Results:*** Through the above experiments, it was demonstrated that [68Ga] Ga-NOTA-SL1 was successfully labeled and had good binding at the cellular level, and it was further demonstrated in PET/CT and biodistribution experiments that [68Ga] Ga-NOTA-SL1 could be specifically bound in c-Met expressing cells with good targeting properties. ***Conclusion:*** Our study explored the feasibility of c-Met imaging probes. Despite this limitation, [68Ga] Ga-NOTA-SL1 can illuminate tumors and is expected to allow for prognostic assessment and development of effective treatment strategies for patients in the future.

EP-0043

Construction of a novel PET tracer for targeting EGFR mutation

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Aim/Introduction: With activating mutations in the EGFR kinase domain, activation occurs in the absence of a ligand, leading to tumor cell proliferation and growth. The most detected mutation in the EGFR tyrosine kinase domain includes exon 19 deletion. In advanced-stage disease, molecular targeted therapy, such as tyrosine kinase inhibitors is the standard first-line treatment for patients with these identified driver mutations. In this project, a novel 18F labeled TKI-PET probe was developed to target EGFR Del19 mutation and monitor mutation status. ***Materials and Methods:*** $^{[18F]}$F-LF50 was radiolabeled with one-step radiosynthesis. Quality control was verified by Radio-HPLC. In micro-PET/CT imaging, $^{[18F]}$F-LF50 probe were researched in bearing HCC827 xenografts mouse models (Del 19), bearing H1975 xenografts mouse models (L858R/T790M) and bearing A549 xenografts mouse models (EGFR wild type). ***Results:*** The radiochemical purity of $^{[18F]}$F-LF50 was over 99%. In immunohistochemistry, HCC827 tumor exhibited Del19 mutation while H1975 and A549 didn't. In micro-PET/CT imaging, $^{[18F]}$F-LF50 showed better aggregation in HCC827 tumor (SUVmax: 0.86 ± 0.03 at 30min), compared with H1975 tumor (SUVmax: 0.56 ± 0.03 at 30min) and A549 tumor (SUVmax: 0.38 ± 0.01 at 30min). This probe was eliminated through intestinal tract rapidly. ***Conclusion:*** $^{[18F]}$F-LF50 exhibited good characteristics of targeting HCC827 tumor, which showed 18F-LF50 was powerful to target EGFR del 19 mutation and potential to apply in monitoring EGFR mutation status in NSCLC patients.

EP-0044

Radiopharmaceutical-mediated in situ excitation of naphthalocyanine for deep tumor therapy

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Aim/Introduction: Naphthalocyanine-based agents exhibit huge potential in imagimh-guided tumor photodynamic therapy (PDT). However, their PDT effect still remains restricted due to the poor tissue-penetrating performance of external laser.1 Based on our previous explorations that utilize radionuclide-emitted Cerenkov radiation (CR) as internal light source for tumor optical imaging and PDT,2-3 silicon naphthalocyanine (SiNC) nano-photosensitizers (NPSs) are rationally designed and constructed to achieve CR-induced PDT without the limitation of penetration depth. ***Materials and Methods:*** SiNC NPSs were prepared via the one-step assembly of SiNC and poly(ethylene glycol)-block-poly(ε-caprolactone) (PEG-PCL) using solvent evaporating method. The CR energy transfer and CR-induced 1O2 generation of SiNC NPSs was confirmed via the IVIS imaging system and fluorescence detention method based on SODG probe, respectively. Standard CCK8 assay was applied to evaluate the dark cytotoxicity and CR-PDT effect of SiNC NPSs at the cell level. Under the visualization guidance of living fluorescence imaging of SiNC NPSs and positron emission tomography (PET) imaging of 18F-FDG, the in vivo tumor treatment was performed on the 4T1 tumor-bearing mice model with the biosafety investigations compromising the body weight measurements and H&E histological staining analysis. ***Results:*** The obtained SiNC NPSs with the size of around 15 nm displayed strong optical absorption in the UV region (< 400 nm), indicating they were responsive to the UV-weighted CR emission. Under the excitation of CR emitted by 18F, SiNC NPSs enabled significant 1O2 generation to induce cancer cell death via type II PDT pathway based on the CR energy transfer progress. Due to the enhanced penetration and retention effect, living fluorescence imaging proved the remarkable tumor-targeting behavior SiNC NPSs, reaching the highest tumor accumulation at 8 h post-injection. Finally, in vivo antitumor experiment demonstrated that the sequential administration of SiNC NPSs (3mg/kg) and clinical PET tumor radiotracer (18F-FDG, 0.8 mCi) was capable of inhibiting the growth of subcutaneous 4T1 tumors, simultaneously causing negligible side effect towards health organs. ***Conclusion:*** Collectively, we firstly demonstrated the feasibility of activating silicon SiNC NPSs using CR within body for efficient tumor PDT, aiming at advancing and enriching the phototherapy application of naphthalocyanine-based agents, as well further expanding the tool box of CR-PDT to synergistically combine nuclear medicine and nanomedicine for the augment of therapeutic benefits. ***References:*** (1) Chem Mater, 2015, 27, 6155–6165. (2) Small, 2020, 16(26), e2001494. (3) Adv Healthc Mater, 2021, 10(5), e2000802.

EP-0045

Development of [^{64}Cu]Cu-Albumin-Glutamate-Urea-Lysine/Fluorescence Complex as an Image-Guided Surgery Agent for PSMA-Expressing Prostate Cancer

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Aim/Introduction: Positive surgical margins in radical prostatectomy specimens occur in 11-48% of cases, increasing the risk of recurrence. To address this, our research group developed a PSMA-targeting albumin-fluorescent complex, aiming to enhance surgical precision and reduce positive surgical margins. ***Materials and Methods:*** To synthesize the PSMA-targeting albumin-fluorescent complex (Alb-GUL/ICG), human serum albumin was conjugated with DBCO-NHS ester (DBCO) and Glutamate-Urea-Lysine (GUL) with azide. The degree of functionalization (DOF) for DBCO and GUL was assessed using Matrix-Assisted Laser Desorption Ionization Time-of-Flight (MALDI-TOF). After masking excess DBCO molecules, Alb-GUL was mixed with indocyanine green (ICG) to form Alb-GUL/ICG. This conjugate, along with a control Alb/ICG, was evaluated for cellular uptake in LNCaP and 22Rv1 cells using confocal microscopy. In vivo PET studies were performed to compare the biodistribution profiles and tumor-targeting efficacy of [64Cu]Cu-Alb/ICG and [64Cu]Cu-Alb-GUL/ICG, aiming to determine the optimal injection time. Further, in vivo fluorescence was obtained using IVIS imaging in 22Rv1 tumor models. ***Results:*** The DOF of DBCO and GUL as 11.2 and 5.3, respectively. In vitro 22Rv1 and LNCaP cell fluorescence signal was approximately 2 times and 10 times stronger in Alb-GUL/ICG than in Alb/ICG, respectively. In the in vivo biodistribution study, [64Cu]Cu-Alb-GUL/ICG showed faster blood clearance through liver compared with [64Cu]Cu-Alb/ICG. Time-activity curve showed, the tumor-to-blood ratio of [64Cu]Cu-Alb-GUL/ICG was highest at

24 h, showing 38% increase over [64Cu]Cu-Alb/ICG. In vivo 22Rv1 tumor fluorescence signal was enhanced by 36% in Alb-GUL/ICG compare to Alb/ICG, 24 hours post-injection. ***Conclusion:*** Alb-GUL/ICG demonstrated superior uptake in PSMA expressing tumors in vitro and in vivo, highlighting its enhanced targeting efficacy with a higher tumor-to-blood ratio. Consequently, Alb-GUL/ICG shows promise as an effective image-guided surgery agent for prostatectomy, potentially reducing the incidence of positive surgical margins. ***References:*** Park, Ji Yong, et al. "Versatile and finely tuned albumin nanoplatform based on click chemistry." Theranostics 9.12 (2019): 3398.Silberstein, Jonathan L., and James A. Eastham. "Significance and management of positive surgical margins at the time of radical prostatectomy." Indian Journal of Urology 30.4 (2014): 423-428.

EP-0046

Non-invasive visualization of HER2 expression using ^{68}Ga and ^{177}Lu labeled anti-HER2 antibody fragments

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Aim/Introduction: The oncogenic potential and activation of human epidermal growth factor receptor 2 (HER2) have been confirmed in various human malignancies, most notably in breast cancer and gastric/esophageal junction cancer. Therapeutic agents targeting HER2 have significantly improved the prognosis of patients with HER2+ cancers. This study designed four antibody fragments targeting Trop2, which were labeled with radionuclides 68Ga and 177Lu for immunoPET and SPECT imaging, respectively, aiming to achieve rapid and accurate assessment of HER2 expression and distribution. ***Materials and Methods:*** We developed F(ab) and F(ab')2 fragments based on the sequence of patuzumab using antibody engineering techniques. Additionally, we coupled these fragments with the albumin binding domain (ABD) to construct F(ab)-ABD and F(ab')2-ABD fragments. Using transfection technology, we obtained a murine colorectal cancer cell line CT26 overexpressing human HER2 (CT26-HER2) and established the murine tumor models. The antibody fragments were first conjugated with the chelator p-SCN-Bn-DOTA at a molar ratio of 1:20, followed by purification using ultrafiltration tubes. The conjugates were then labeled with 68Ga and 177Lu and purified using a PD-10 column. The radiochemical purity was analyzed using radio thin-layer chromatography (radio-TLC). The 68Ga and 177Lu labeled antibody fragments were used for PET and SPECT imaging respectively in the CT26-HER2 tumor models. ***Results:*** The molecular weights of the antibody fragments F(ab), F(ab)-ABD, F(ab')2, and F(ab')2-ABD were approximately 50 kDa, 65 kDa, 100 kDa, and 115 kDa, respectively. The radiochemical purity of antibody fragments labeled with 68Ga and 177Lu was more than 95%. The tumors were clearly visible in immunoPET imaging with 68Ga-DOTA-F(ab)-ABD, 68Ga-DOTA-F(ab')2, and 68Ga-DOTA-F(ab')2-ABD from 2 h to 6 h, and the tumor uptake increased over time. However, 68Ga-DOTA-F(ab) likely experienced rapid glomerular filtration, resulting in no significant tumor uptake (n = 3). Subsequent SPECT imaging showed peak tumor uptake of 177Lu-DOTA-F(ab)-ABD at about 6.34 ± 1.22 %ID/g at 48 h postinjection, and that of 177Lu-DOTA-F(ab')2-ABD about 5.18 ± 1.51 %ID/g at 24 h postinjection (n = 3). The tumor uptake of 177Lu-DOTA-F(ab')2 was lower, peaking at 10 h postinjection with only about 1.79 ± 0.97 %ID/g. Uptakes in the heart, liver, and kidneys gradually decreased over time. Antibody fragments conjugated to ABD showed more retention in the heart and liver. ***Conclusion:*** Radionuclides-labeled HER2-targeted antibody fragments linked to ABD accumulated more in tumors, providing clearer tumor imaging. How to better balance the clearance and targeting ability of antibody fragments in vivo needs to be further explored.

EP-0047

Ga-68-Labelling of a Tetrahydroquinoline-Based Ligand for PET Imaging of C-X-C Chemokine Receptor Type 4 in Animal Models of Glioblastoma (GBM)

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Aim/Introduction: The C-X-C chemokine receptor type 4 (CXCR4) is a promising target for cancer therapy, given its elevated expression in cancer cells during metastasis. This study aimed to develop a novel positron emission tomography (PET) radiotracer, [68Ga]Ga-TD-01, for CXCR4 imaging. To achieve this goal, we have tuned the molecular scaffold of the potent CXCR4 antagonist TIQ152 by conjugation with a chelator to make it suitable for 68Ga radiolabeling. ***Materials and Methods:*** A five-step synthesis process was employed to conjugate the amine functional group of TIQ15 with p-NCSBz-DOTA, to obtain the TD-01 precursor at a moderate yield of 60%. TD-01 was subsequently radiolabeled with 68Ga using 0.1 M ammonium acetate at 90°C for 15 minutes. Furthermore, 1-hour dynamic small animal PET/MRI in GL261-luc2 bearing mice (n=6) was performed, and brain tumor uptake was assessed through advanced pharmacokinetic analyses. Blocking studies involved pre-administration of TIQ15 (10 mg/kg) 10 minutes before PET start. ***Results:*** [68Ga]Ga-TD-01 exhibited a radiochemical yield (RCY) of 36.33± 1.50% (E.O.S.), with a radiochemical purity (RCP) >99% and a molar activity (Am) of 55.79±1.96 GBq/μmol. The radiotracer showed in vitro stability in PBS and human plasma for over 4 hours. Biodistribution studies in healthy animals revealed favorable kinetics for subsequent PET pharmacokinetic modeling and moderate brain uptake was observed indicating BBB penetrability. The highest uptake was found in the kidneys, liver and intestines, indicating a renal-hepatic excretion pattern. Importantly, [68Ga]Ga-TD-01 uptake in GBM-bearing mice significantly decreased upon competition with TIQ15, indicating high specificity. ***Conclusion:*** The newly developed CXCR4 PET tracer, [68Ga]Ga-TD-01, exhibited high affinity for CXCR4, excellent in vitro stability, and favorable pharmacokinetics, suggesting it as a promising candidate for the in vivo characterization of CXCR4 expression in GBM with potential for further development as a tool in cancer diagnostics. ***References:*** Valarie MT, Huanyu Z, Brooke MK, et al. Discovery of tetrahydroisoquinoline-based CXCR4 antagonists. ACS Med Chem Lett. 2013;4(11):1025-30.

EP-0048

Utilizing the chicken chorioallantoic membrane model to assess CXCR4 targeting agents for cancer therapy using multimodal imaging

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Aim/Introduction: The chemokine receptor CXCR4 is upregulated in numerous diseases including cancer, rendering it an attractive target for drug development. Given this premise, our aim is to assess the stability and biodistribution for derivatives of the endogenous peptide inhibitor of CXCR4 (EPI-X4). In addition to the already non-invasive PET-MR approach we also want to consult the principles of replace, reduce and refine (3R) to explore the applicability of the chorioallantoic membrane (CAM) model in this context, comparing the data with findings from mouse experiments. ***Materials and Methods:*** First, we tested the stability of the EPI-X4 derivatives ex vivo by spiking them into plasma samples obtained from humans, mice, and chicken embryos. Retained activity of the spiked peptide samples was evaluated using an antibody replacement assay. Then compounds were labelled with the PET nuclide Zrirkonium-89 via DFO and intravascularly injected into mice and chicken embryos to comparably visualize the distribution by MRI and PET. Furthermore, tumor xenografts of CXCR4-positive cell line TZM-bl, along with HCT-116, were established in both models to assess specific tumor-binding of the peptides. The cell line PC-3, characterized by low CXCR4 expression levels, served as a negative control. ***Results:*** Ex vivo, the peptide derivative EPI-X4 JM#21 exhibits considerable instability in plasma samples of all species, with faster inactivation in mouse plasma than in chicken and human plasma. Accordingly, no retained activity was observed already 10min after injection in the CAM model, which is comparable to data obtained in mice. Furthermore, by using PET and MR imaging, we showed that EPI-X4 JM#21 is rapidly excreted within 24h in the CAM model, with signal primarily in the allantois (4.8 %IA/ml), serving as the equivalent of the bladder. Similarly, in mice the activity was primarily observed in the kidneys (2.0 %IA/ml) and bladder (16.9 %IA/ml). In contrast, the stability optimized and lipid-modified EPI-X4 JM#143 exhibited a circulation half-life of several hours in mice and in the CAM model with accumulation in the lungs (8.5 %IA/ml) and the liver (4.0 %IA/ml) of the tested mice. ***Conclusion:*** Given the consistent results observed with the EPI-X4 derivative JM#21 in the different species, the CAM model emerges as a feasible alternative for studying peptide distribution and tumor-targeting in vivo. In the future we plan to use the CAM model to evaluate further optimized EPI-X4 derivatives to identify the most promising candidate for cancer therapy.

EP-0049

ImmunoPET imaging of Trop2 for PSMA-Negative Prostate Cancer

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Aim/Introduction: Prostate cancer is the second most significant contributor to male cancer mortality. PSMA-PET/CT imaging has promise in detecting prostate cancer without invasive procedures, however it has limits for patients with low PSMA expression. Trophoblast cell surface antigen 2 (TROP2), a transmembrane glycoprotein, is strongly associated with the progression of solid tumors, including prostate cancer. It has the potential to be a target for PSMA-negative prostate cancer. The aim of this work is to evaluate the value of a TROP2-targeted molecular imaging strategy in the diagnosis of PSMA-negative prostate cancer. ***Materials and Methods:*** Flow cytometry and Western blot were used to detect the expression of Trop2 and PSMA in prostate cancer cell lines. The TROP2-specific single domain antibody (T4) was labeled with gallium-68 (68Ga, T1/2 = 68 min) following NOTA chelator conjugation. The diagnostic value of [68Ga]Ga-NOTA-T4 was extensively evaluated by immunoPET imaging, biodistribution studies, and immunohistochemical staining on PSMA-negative xenograft models. ***Results:*** TROP2 was overexpressed in PSMA-negative prostate cancer cell lines. [68Ga]Ga-NOTA-T4 was developed with good radiochemical yield and radiochemical purity. PET/CT imaging demonstrated that [68Ga]Ga-NOTA-T4 specifically accumulated in PSMA-negative PC3 tumors with a high contrast, while [68Ga]Ga-PSMA-617 did not. Immunohistochemical staining also confirmed the strong expression of TROP2 in PC3 tumors. ***Conclusion:*** We have reported the potential for using TROP-2 to detect PSMA-negative prostate cancer and developed a radiolabeled nanobody tracer [68Ga]Ga-NOTA-T4 to specifically image TROP-2 expressing prostate cancer with high contrast. These results support further studies on TROP-2 as a therapeutic and diagnostic target for PSMA-negative prostate cancer.

EP-0050

Brain FDG clearance and brain SUV, but not brain glucose consumption, decrease with increasing tumour burden and blood glucose level

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Aim/Introduction: In FDG PET/CT, brain SUV correlates exponentially with blood glucose level (BGL) with exponential constant of -0.1 mmol/l-1, similar to the corresponding constant for tumours that can be derived from the study of Lindholm et al (JNM 1993) that showed tumour SUV decreasing in response to an increase in BGL. Brain is therefore a surrogate for tumour. Division of brain SUV by blood pool SUV gives an approximation of brain FDG clearance (CI). Viglianti et al (Radiology 2018) showed that such division abolished correlation between brain SUV and tumour metabolic burden. The aim of the study was to compare relationships of brain SUV and CI with BGL between patients with near-normal scans and patients with widespread disease to throw further light on BGL, tumour burden and brain SUV. ***Materials and Methods:*** Retrospective analysis was undertaken on FDG/PET scans of 100 patients with normal or near-normal scans (no/low group) and 100 with abnormal scans showing tumour FDG uptake. Of these 100, 29 had disease and/or marrow infiltration too widespread to measure tumour burden. ROIs were placed over cerebellum, liver, and ascending aorta (AA). Brain SUVmax was divided by AA SUVmax, giving CI. Since brain glucose consumption (MRglu) is constant (=CI*BGL), CI shows a hyperbolic relationship with BGL. The reciprocal of CI was plotted against BGL. Brain SUVmax and CI were then corrected to BGL of 5 mmol/l using their derived relationships with BGL. ***Results:***

Liver SUVmax did not correlate with BGL in either group or was different between them. Brain SUVmax decreased exponentially against BGL with constants of -0.12 and -0.057 mmol/l-1 in no/low and widespread disease groups, respectively. 1/CI showed slightly non-linear relationships with BGL. They were therefore fitted with second order polynomials. Mean brain SUVmax corrected for BGL was 9.7±2.5 and 7.9±2.0 ($p<0.001$) in no/low and widespread disease groups, respectively, while CI corrected for BGL using the polynomial equations was 5.2 and 4.5 ($p<0.01$). (These relationships are non-linear because of unphosphorylated FDG in the brain distribution volume.) In contrast, there was no difference in MRglu. ***Conclusion:*** Tumour SUV is influenced by tumour burden and BGL, which, when increased, decrease tumour SUV. Dividing brain SUV by blood pool SUV, giving CI, does not, however, abolish the dependence of brain SUV on BGL, despite constancy in MRglu. Because it's FDG handling more closely resembles that of tumours, brain is more appropriate than liver as reference tissue for tumours.

EP-0051

Multifunctional Organic Melanin Nanoparticles for Multimodal Imaging Guided Combination Cancer Therapy

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Aim/Introduction: Radionuclide therapy is an effective method for cancer precise medicine. However, the uneven dose distribution and rapid metabolism of nuclides limit the effective killing of tumors. To overcome the limitations of radionuclide therapeutic approaches, combining different therapeutic strategies to treat cancer has manifested great promise in basic and clinical research. Herein, a biocompatible melanin nanoprobe with a highly specific fibroblasts activated protein (denoted as FAM) is developed for magnetic resonance (MR) /photoacoustic (PA)/positron emission tomography (PET) multimodal imaging guided combination cancer therapy. ***Materials and Methods:*** We prepared a multifunctional organic melanin nanoparticles (FMNs) coupled with the small molecule FAP inhibitor (FAPI) with excellent biocompatibility and biodegradability. Additionally, Near-infrared -absorbing FMNs chelated positron nuclide 64Cu and efficiently chelated the paramagnetic metal Mn2+ are used for enhanced the imaging effect of PAI, PET/CT, MRI, respectively. We simultaneously utilized beta-emitting radionuclides 131I to FMNs for radionuclide therapy and photothermal therapy. ***Results:*** In vivo MR/PA/PET multimodal imaging confirms effective tumor accumulation of FMNs. NIR-triggered PTT in combination with 131I-FMNs-based radioisotope therapy is achieved in our animal tumor model experiments, in which a remarkable synergistic antitumor effect is observed compared to monotherapies. Toxicology studies further indicate that 131I-FMNs-Laser induces no appreciable toxicity to mice at the treatment dose. Immunohistochemical staining for confirmed tumor tissue damaged, reduced tumor cell proliferation following treatment and less collagen fibers and significantly apoptosis in the tumor tissues. ***Conclusion:*** In this study, MR/PA/PET trimodal imaging allows more accurate diagnosis and imaging-guided therapy than single modality alone, and FMNs demonstrated significant antitumor efficacy for radionuclide therapy and photothermal therapy. It exhibits strong potential for clinical translation, providing a promising synergistic therapy of cancer. ***References:*** 1.Lin J, Wang M, Hu H, et al. Multimodal-Imaging-Guided Cancer Phototherapy by Versatile Biomimetic Theranostics with UV and γ-Irradiation Protection. Adv Mater. 2016, 28:3273-3279.2.Xia L, Meng X, Wen L, et al. A Highly Specific Multiple Enhancement Theranostic Nanoprobe for PET/MRI/PAI Image-Guided Radioisotope Combined Photothermal Therapy in Prostate Cancer. Small. 2021, 17:e2100378.

EP-0053

Targeting Fibroblast Activation Protein using Radioactively Tagged Sibrotuzumab

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Aim/Introduction: Fibroblast activation protein (FAP) has emerged as a promising target in the stroma of many epithelial tumours due to its expression on cancer-associated fibroblasts.1 Despite the success of imaging FAP with radioactively tagged fibroblast activation protein inhibitors (FAPIs), these small molecules can have limited therapeutic response due to their short residence time at the tumour.2 To improve upon the pharmacokinetics necessary for therapy, we have designed a two-stage project based on the antibody sibrotuzumab.3 The first stage requires validating that sibrotuzumab can image FAP with a high retention over several days, using [89Zr]Zr4+ and [64Cu]Cu2+. In the second stage, we aim to conjugate sibrotuzumab to [67Cu]Cu2+ and determine its effectiveness as a radiotherapeutic agent. ***Materials and Methods:*** PANC-1 and U87MG cell lines were cultured for radioligand binding assays and in vivo studies.4 Sibrotuzumab was conjugated with deferoxamine (DFO) and subsequently radiolabeled with [89Zr]Zr4+. [89Zr]Zr-DFO-sibrotuzumab was also used in magnetic bead binding studies to determine whether there was cross-reactivity between human and murine FAP. In the in vivo studies, each mouse was administered ~1.5 MBq of [89Zr]Zr-DFO-sibrotuzumab. Positron emission tomography/computed tomography (PET/CT) images were obtained at 24 and 144 h for the U87MG xenografted mice, while biodistribution studies were carried out over several days for PANC-1 and U87MG xenografted mice. ***Results:*** In vitro studies showed [89Zr]Zr-DFO-sibrotuzumab did not bind to PANC-1 cells; however, there was low, selective uptake (~3%) in U87MG cells. In the magnetic bead binding studies, the antibody was found to bind to human FAP and not murine FAP. As a negative control, PANC-1 xenografted mice had ~5 %IA/g of [89Zr]Zr-deferoxamine-sibrotuzumab in their tumours between 24 and 72 h. Encouragingly, in U87MG xenografted mice, the radiopharmaceutical achieved >20 %IA/g in tumours from 24 to 144 h, and no high uptake (>10 %IA/g) observed in any off-target organs. Conjugation of [64/67Cu]Cu2+ radioisotopes to sibrotuzumab is currently in-progress. ***Conclusion:*** [89Zr]Zr-DFO-sibrotuzumab had high uptake and retention at the tumour site of mice xenografted with U87MG cells. Given its promising pharmacokinetics, development of therapeutic radionuclide sibrotuzumab conjugates are in progress to assess its ability as a theranostic agent. ***References:*** 1. Backhaus, P.; et al. EJNMMI. 2022, 49, 1822. 2. Kratochwil, C.; et al. J. Nucl. Med. 2019, 60, 801. 3. Scott, M. A.; et al. Clin. Cancer. Res. 2003, 9, 1639. 4. Pandya, N. D.; et al. Molecules. 2020, 25, 3672.

EP-0054

Immuno-PET imaging using a Cu-64 labeled GD2-specific antibody in osteosarcoma

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Aim/Introduction: Osteosarcoma (OS) is a representative primary malignant tumor of the bone, in which normal bone tissue is destroyed by tumor cells, forming a mass, and spreading to surrounding tissues. When it metastasizes through the blood to the lungs or other bones, the 5-year survival rate is 20-30%, indicating a poor prognosis. Although advancements in surgical techniques and the development of effective chemotherapeutic drugs have improved overall patient survival, there is still a limitation of more effective treatment options for OS. Disialoganglioside GD2 is known to be overexpressed on the surface of some cancer cells, including OS, in contrast to normal tissues where expression is limited. Therefore, GD2 has a high value as an effective target for the diagnosis and treatment of OS using radiolabeled tracers. The purpose of this study is to evaluate the potential of an anti-GD2 antibody, hu14.18, for targeted imaging in OS xenograft mouse model. ***Materials and Methods:*** The hu14.18 was conjugated with p-SCN-Bn-NOTA at a molar ratio of 1:20 and labeled with Cu-64. The stability of Cu-64 labeled hu14.18 (Cu-64-NOTA-hu14.18) were tested in human and mouse serum. GD2 expression was measured by flow cytometric analysis in various OS cells. Cell binding study of Cu-64-NOTA-hu14.18 was performed to confirm the specific binding according to the GD2 expression level. Small animal PET imaging was performed at 24, 48 and 72 hours after an injection of approximately 7.4 MBq Cu-64-NOTA-hu14.18 in a GD2-positive OS cell (G-292) xenograft mouse model. ***Results:*** Cu-64-NOTA-hu14.18 was prepared with high radiolabeling yield and radiochemical purity and showed high stability. Flow cytometric and cell binding analysis showed that GD2 expression was highest in G-292 cells among several OS cell lines. High uptake in GD2 expressing tumors was observed in Cu-64-NOTA-hu14.18 PET images obtained from the G-292 tumor xenografted mouse model. ***Conclusion:*** Cu-64-NOTA-hu14.18 was shown to successfully target GD2 both in vitro and in vivo. Immuno-PET using Cu-64-NOTA-hu14.18 can non-invasively visualize the extent of GD2 expression in OS and may be an excellent strategy for planning GD2-targeted therapy in OS and monitoring treatment effectiveness.

EP-0055

Interleukin-4 Receptor Targeted Immuno-SPECT Imaging Visualizes Tumor-associated Macrophages in vivo.

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Aim/Introduction: Within the tumor microenvironment, the interplay between macrophages and tumor cells, alongside other immune cells, profoundly impacts tumor progression, metastasis, and the efficacy of immunotherapy. The Interleukin-4 receptor (IL-4r), a G-protein-coupled receptor predominantly found on immune cell membranes, serves as a specific biomarker for inflammatory diseases, and has recently emerged as a marker for inhibitory macrophages within the tumor immune microenvironment. In this study, IL-4r-targeted monoclonal antibody-based probe was constructed and evaluated in syngeneic models to verify its feasibility tracking tumor associated macrophages (TAMs), following cross-validation of molecular biology techniques. ***Materials and Methods:*** An anti-IL-4r monoclonal antibody (mAbIL-4r)-based radiotracer, 99mTc-HYNIC-mAbIL-4r, was developed through technetium-99 (99mTc, T1/2=6.0h) labeling after chelation with HYNIC. The radiolabeling yield, radiochemical purity and stability were verified. Western blot analysis confirmed IL-4r expression levels in various tumor cells (Panc2: Pancreatic cancer; CT26: Colon cancer; Siha: Cervical squamous-cell carcinoma; PC12: Adrenal pheochromocytoma). SPECT imaging and biodistribution were performed to evaluate IL-4r-tageted immune cells of 99mTc-HYNIC-mAbIL-4r. Immunofluorescence imaging and flow cytometry served as cross-validation methods for co-location of IL-4r expression. ***Results:*** 99mTc-HYNIC-mAbIL-4r was synthesized with high radiolabeling yields of 88.7% and radiochemical purity of 93.3%, alongside excellent radio-stability. The probe exhibited significant differential tumor uptake across varied IL-4r expression xenograft models, with consistent blood radioactivity levels. We then evaluated the image of 99mTc-HYNIC-mAbIL-4r in Panc2 and CT26 syngeneic models, after low tumor IL-4r expression proved by western blot. 99mTc-HYNIC-mAbIL-4r was primarily accumulated in the hearts, livers and spleens and remained in the blood pool for over 24 hours, which is consistent with long-cycle physiological characteristics of antibody. Both models demonstrated peak tumor-to-muscle uptake ratios at 36 hours post-injection (Panc2: 4.37±0.44; CT26: 4.08±0.40). Immunofluorescence imaging and flow cytometry corroborated high IL-4r expression in TAMs, particularly the M2 subtype of activated macrophages. ***Conclusion:*** This study successfully developed a 99mTc-labeled IL-4r-targeting antibody probe, effectively delineating IL-4r expression in preclinical tumor-bearing models via Immuno-SPECT. The findings shed light on the heterogeneity of macrophage activation and warrant further exploration for a comprehensive understanding of immuno-oncology, focusing on TAMs and their implications in tumor development and treatment response.

EP-0056

Preclinical development of a novel nanobody GPA33 tracer of [^{68}Ga]Ga-NOTA-WWH374 in colorectal cancer

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Aim/Introduction: Glycoprotein A33 (GPA33) is a protein encoded by the GPA33 gene in humans. It is overexpressed in more than 95% of human colorectal cancers (CRC). The aim of this study is to identify a GPA33-targeted nanobody and to demonstrate its application in the imaging of CRC using immuno-positron emission tomography (immunoPET). ***Materials and Methods:*** The expression of GPA33 in CRC was verified by immunohistochemistry. The expression of GPA33 in colorectal cancer cell lines was investigated by flow cytometry. To construct immunoPET imaging probes of CRC subcutaneous xenografts, a nanobody targeting GPA33 was designed and labelled with gallium-68 (68Ga, T1/2 = 1.1 h). A GPA33-expressing cell-derived colorectal cancer model was used to evaluate the agent. ***Results:*** GPA33 was overexpressed in human CRC cells. Generation of a GPA33-specific nanobody, WWH374, was successful, and its in vitro binding properties were found to be excellent. Utilization of [68Ga]Ga-NOTA-WWH374 in immunoPET imaging was found to enable clear delineation of a subcutaneous tumor in cell-derived models of CRC. The diagnostic capability of [68Ga]

Ga-NOTA-WWH374 (0.50 ± 0.05 MBq, n = 4) was evaluated in mice bearing subcutaneous LS174T CRC cell-derived xenograft. The microPET/CT imaging results demonstrated the ability to sharply delineate the tumor at 2 h post-injection of [68Ga]Ga-NOTA-WWH374. The results of the region of interest (ROI) quantitative analysis demonstrated that the highest enrichment of [68Ga]Ga-NOTA-WWH374 was observed in the kidney, with a value of 41.30 ± 6.26%ID/g. The tumor uptake value was 2.87 ± 0.67%ID/g (n = 4). The subsequent biodistribution analysis data demonstrated the same trend of organ uptake as that observed in the ROI results. The highest accumulation was observed in the kidneys, with a value of 204.48 ± 42.35%ID/g. The tumor uptake value was 5.68 ± 1.15%ID/g (n = 4). ***Conclusion:*** In conclusion, we conducted preclinical development of a novel GPA33-targeted nanobody, which enabled to the non-invasive visualization of the malignancy of colorectal cancer using immunoPET imaging in a subcutaneous model.

EP-0057

^{68}Ga-NaGdF$_4$-RGD nanoprobesfor PET/MR Dual-Modal Imagingof cancer in Vivo

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Aim/Introduction: The 68Ga-c(RGDCK) peptide PEGylated NaGdF4 nanoparticles (68Ga-NaGdF4-RGD) as a novel multi-modal imaging agent were developed for tumor-targeting PET/MR imaging of various tumors. ***Materials and Methods:*** Their biocompatibility and binding specificity were evaluated through in vitro and in vivo experiments The in vivo tumor targeting of the NaGdF4-RGD was demonstrated by taking T1 MR images in a model mouse with liver tumor, and the signals of tumor from PET imaging. The distribution and metabolism of the nanoprobes in the mice were examined by PET and MRI imaging. The in vivo PET/MR multimodal simultaneous imaging capability of 68Ga-NaGdF4-RGD nanoparticles was validated by a wider variety of tumor models. Additionally, the relationship between the targeting effect and integrin αvβ3 expression levels was explored. ***Results:*** The 68Ga-NaGdF4-RGD exhibit long-term serum stability after labeling with nuclides. The in vivo tumor targeting of the 68Ga-NaGdF4-RGD was demonstrated by taking T1 MR images and PET in a model mouse with liver tumor. The maximum standardized uptake value (SUVmax) of tumor radioactivity was 1.84 ± 0.30 and the biodistribution of the tumor was 5.12 ± 0.42 %ID/g at 3 hours after the injection of 68Ga-NaGdF4-RGD nanoparticles. In MRI imaging, the MRI signals of subcutaneous and orthotopic tumors of Hepa 1-6 after injection of NaGdF4-RGD nanoprobe were significantly higher than those of the corresponding NaGdF4 group ($P < 0.05$). This study employed NaGdF4-RGD nanoprobes to effectively reveal the persistent accumulation and blood redistribution properties of nanoparticles in liver tumors. PET/MR imaging verified the tumoral uptake was positively correlated with the expression level of integrin αvβ3. Three hours after injection, the ratios of radioactive uptake in tumors to muscle were 7.91 ± 2.17 for Renca, 6.18 ± 1.51 for Hepa 1-6, and 3.50 ± 1.48 for 4T1. ***Conclusion:*** The fact suggested that 68Ga-NaGdF4-RGD probes possessed satisfying tumor-specific targeting ability and should be the potential tumor-targeting multi-modal imaging agent. The nanoparticles permitted for synchronized PET/MR scanning and precise multimodal imaging fusion in various tumor models, both temporally and spatially. Additionally, the level of enrichment of the nanoprobes was found to reflect the expression level of integrin αvβ3 in tumors.

EP-0058

Preclinical evaluation of novel theranostic heterodimeric ligands [^{68}Ga]Ga/[^{177}Lu]Lu-DOTA-FAPI-BPsfor tumor bone metastasis

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Aim/Introduction: The rising incidence of bone metastases poses challenges to cancer patient survival. Bone metastasis-induced skeletal-related events (SREs) significantly impact patient survival. Bisphosphonates (BPs), targeted bone imaging agents, have been widely used in clinical bone scanning, while fibroblast activation protein inhibitors (FAPIs) offer advantages in several cancer clinical diagnosis and therapy. To address the integrated diagnostic and therapeutic needs of tumor bone metastasis, this study designed two novel heterodimeric ligands, DOTA-FAPI-BPs (DFP-1, DFP-2) to improve the retention time in tumor, especially in the bone metastasis. ***Materials and Methods:*** Comparative evaluations were conducted between 68Ga and 177Lu-labeled DFP1, DFP2, and FAPI-04, including stability, lipophilicity, cellular uptake/internalization assays, hydroxyapatite binding, and PET/CT imaging studies in tumor-bearing and normal mice. PET/CT imaging utilized Pmod 4.4 for organ delineation and data post-processing, with statistical analyses performed using GraphPad Prism 8. ***Results:*** Synthesis of the desired heterodimeric ligands DFP-1, DFP-2 were effectively accomplished. Labeling with either [68Ga]GaCl3 and [177Lu]LuCl3 in the sodium acetate buffer (pH 4-5) at 95°C in 10 min produced [68Ga]Ga/[177Lu]Lu-DFP-1/2 with high yields and excellent radiochemical purities (>95%). [68Ga]Ga-DFP-1/2 showed high stability in PBS until 2 h and [177Lu]Lu-DFP-1/2 is stable until 5 days in PBS. All [68Ga]Ga/[177Lu]Lu-DFP-1/2 indicated lipophilicity. [68Ga]Ga/[177Lu]Lu-DFP-1/2 exhibiting significantly higher hydroxyapatite binding rates (> 90%) compared to [68Ga]Ga/[177Lu]Lu-FAPI-04 (< 10%). Furthermore, [68Ga]Ga-DFP-2 displayed increased high internalization/uptake in U87MG cells up to 2h (uptake: 4.22 % ID/106 cells), while both [177Lu]Lu-DFP-1/2 showed sustained internalization/uptake in U87MG cells up to 24h (uptake: 5.87 % ID/106 cells and 8.98 % ID/106 cells, respectively), significantly surpassing [177Lu]Lu-FAPI-04 at 24h (uptake: 0.65 % ID/106 cells, respectively). PET/CT imaging of [68Ga]Ga-DFP-1/2 revealed high uptake and prolonged retention in A549-FAP bone tumor (30 min: 2.85% ID/g and 2.57% ID/g; 60 min: 3.02% ID/g and 2.57% ID/g, respectively), contrasting with the rapid decrease in uptake observed with [68Ga]Ga-FAPI-04 (30 min: 3.68 % ID/g and 60 min: 1.99% ID/g, respectively). ***Conclusion:*** Our study successfully synthesized and evaluated novel heterodimeric ligands DFP-1 and DFP-2 for their potential application in the integrated diagnostic and therapeutic management of tumor bone metastasis.

EP-0059

Radiotracer Evaluation in the Chick Embryo Tumour Bearing Brain: A Feasibility Study

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Aim/Introduction: In addition to traditional rodent models for preclinical research, the chick embryo model has gained attention for radiotracer evaluation. Previous studies investigated tumours on the chick chorioallantoic membrane, however, radiotracer imaging of intracerebral chick embryo tumours has not yet been evaluated. ***Materials and Methods:*** Fertilized chick eggs were incubated at 37.8°C with 54% humidity for 18-20 days. On developmental day 5, a window was cut in the eggshell to access the embryo, and human U87 glioblastoma or U87-IDH1 mutant glioma cells were implanted into the developing chick brain. Solid tumours were detectable with magnetic resonance imaging (MRI) after 12-14 days, and the tumour bearing embryos were chosen for next-day radiotracer evaluation. Blood-brain-barrier disruption was shown either with contrast agent injection for MRI, or ex vivo with injection of Evans blue dye. O-(2-$^{[18F]}$fluoroethyl)-L-tyrosine ($^{[18F]}$-FET) (n=3), 3,4-dihydroxy-6-$^{[18F]}$-fluoro-L-phenylalanine ($^{[18F]}$-FDOPA) (n=3), or [68Ga]-labelled quinoline-based small molecule fibroblast activation protein inhibitor ([68Ga]-FAPI-46) (n=4) was injected intravenously, and the chick embryos were sacrificed 60 minutes post injection. Cryosections of the tumour bearing brains were produced and evaluated by autoradiography and immunohistochemistry. In some chick embryos, micro positron emission tomography (µPET) was performed in addition to autoradiography. ***Results:*** The intracerebral implantation technique resulted in the formation of solid tumours with a success rate of 48% (n = 85). For the evaluated radiotracers, the tumour-to-brain ratios (TBR) derived from ex vivo autoradiography as well as the tracer kinetics derived from µPET for intracerebral chick embryo tumours were comparable to those previously reported in rodents and patients; the mean $^{[18F]}$-FET TBRs were 1.7 ± 0.5 for intracerebral chick embryo tumours, 2.2 ± 0.4 for rodents [1] and 2.0 ± 0.5 for patients [2]. Further, similar elimination pathways and $^{[18F]}$-FET clearance through hepatic/pancreatic and urinary excretion could be shown with whole-body µPET imaging. ***Conclusion:*** Intracerebral tumours in the chick embryo offer a fast and reliable model for the evaluation of radiotracer uptake, accumulation, and kinetics. Our results indicate a high comparability of chick embryo intracerebral tumour imaging to xenograft rodent models and brain tumour patients. ***References:*** [1] Stegmayr C, Bandelow U, Oliveira D et al. Influence of blood-brain barrier permeability on O-(2-18F-fluoroethyl)-L-tyrosine uptake in rat gliomas. Eur J Nucl Med Mol Imaging 2017; 44(3):408-16.[2] Stegmayr C, Stoffels G, Kops ER et al. Influence of Dexamethasone on O-(2-18F-Fluoroethyl)-L-Tyrosine Uptake in the Human Brain and Quantification of Tumor Uptake. Mol Imaging Biol 2019; 21(1):168-74.

EP-0060

In Vivo Characterization of TMTH-Sulfoximine (TMTHSI)-Based Linker for the Development of Antibody-Tracer Conjugates

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Aim/Introduction: Antibody-drug conjugates (ADCs) typically consist of a monoclonal antibody (mAb) and a payload that are coupled to each other by a linker system. The classical linkers however are far from being ideal often due to their hydrophobic nature and/or poor reactivity. Recently, a new strain-promoted azide-alkyne cycloaddition (SPAAC) reagent with higher reactivity and hydrophilicity, called TMTH-Sulfoximine (TMTHSI), was developed. Here, as a first proof of principle, the applicability of TMTHSI as a linker for the coupling of a radiolabelled tracer to mAb for diagnostic imaging was investigated with 89Zr-labeled deferoxamine (DFO) and trastuzumab as a model antibody. ***Materials and Methods:*** The in vitro stability and in vivo tumour targeting of 89Zr-DFO-TMTHSI-trastuzumab were evaluated along with 89Zr-DFO-trastuzumab coupled via direct conjugation of a commonly used SPAAC reagent DBCO. Azide-modified trastuzumab was conjugated to DFO-TMTHSI or commercial DFO-DBCO, whereas its unmodified counterpart was used to conjugate commercial DFO-NCS. The mAb-linker-DFO complex was then radiolabelled with 89Zr. In vitro linker stability was determined by evaluating products formulated in 0.9% NaCl or histidine/sucrose buffer at 4°C. At various time points, aliquots were taken and analysed for radiochemical purity by SE-HPLC. In parallel, the biodistribution of the conjugates was assessed in NCI-N87 tumour-bearing nude mice over time. ***Results:*** 89Zr-DFO-TMTHSI-trastuzumab and 89Zr-DFO-DBCO-trastuzumab were more stable in vitro than their NCS-based counterpart under all conditions. Both TMTHSI- and DBCO-based conjugates remained ≥96% intact after 168h incubation at 4°C, irrespective of the buffer used for formulation. Contrastingly, only 80% and 90% intact NCS-based conjugate was left after 168h incubation in 0.9% NaCl and histidine/sucrose buffer, respectively. Biodistribution revealed that the highest uptake was in tumour tissue (about 25 %ID/g). In healthy tissue, tracer uptake was less than 10%ID/g, except for the spleen and bones. 89Zr-DFO-NCS-trastuzumab showed an increased spleen uptake over time resulting in ~11%ID/g at 144h. Little to no difference in spleen uptake was observed over time in DBCO- and TMTHSI-based conjugates (~5% and 4%ID/g at 144h, respectively). PET imaging revealed biodistribution patterns comparable to the ex vivo findings. ***Conclusion:*** Our findings support the use of TMTHSI for the development of antibody-tracer conjugate that can subsequently be used for diagnostic PET imaging. This development allows us to evaluate the in vivo performance of TMTHSI-based conjugates with different payloads and payload-to-antibody ratios, aiming to design ADCs with an optimal therapeutic index.

EP-0061

Inhibition of OXPHOS reduces tumor hypoxia and induces metabolic rewiring as measured by [18F]FDG

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Aim/Introduction: Limited diffusion and increased consumption of oxygen leads to chronic hypoxia in most solid malignancies. Scarcity of oxygen is known to induce radioresistance, but also leads to a more immunosuppressive microenvironment and immunotherapy resistance. By the inhibition of OXPHOS, using mitochondrial inhibitor IACS-010759, we hypothesize that the oxygen demand of the tumor can be decreased. In turn this might lead to a durable normalization of the oxygen concentration, increased therapy efficacy, but potentially also affects metabolism of normal tissues. ***Materials and Methods:*** The effect of IACS-010759 on tumor hypoxia and glucose metabolism was investigated in spheroids and mouse tumor models. Spheroids were produced of murine tumor cells (B16ova, MC38 and MOC1.3D5) containing a hypoxia responsive element (HRE)-eGFP. Using a Live-Cell Analysis System, fluorescence of spheroids was measured over time as an indicator for hypoxia. Glucose uptake of spheroids treated with IACS-010759 was measured using [18F]FDG uptake assays (150kBq/spheroid). Furthermore, C57BL/6 mice bearing B16ova, MC38 or MOC1.3D5 tumors were treated with IACS-010759 (10mg/kg) for 4 consecutive days. Before sacrifice mice were injected with [18F]FDG (10MBq) and pimonidazole. [18F]FDG uptake in tumor and healthy tissue was measured by ex vivo activity counting. Hypoxic fraction was determined by immunohistochemical staining of pimonidazole. ***Results:*** B16ova, MC38 and MOC1.3D5 spheroids containing a HRE-eGFP construct showed fluorescent cores indicating hypoxia. OXPHOS inhibitor IACS-010759 reduced hypoxia in these spheroids at 3 hours post treatment while [18F]FDG uptake was significantly increased (all $P<0.001$). Treatment of mice with IACS-010759 resulted in a reduction of pimonidazole on B16ova, MC38 and MOC1.3D5 tumors sections (all $P<0.05$). Blood glucose levels were not altered, but serum lactate was significantly increased following treatment with IACS-010759 (8.5±1.7mM vs. 12.7±1.4mM). Moreover, [18F] FDG uptake in several healthy organs was significantly increased. ***Conclusion:*** We showed that inhibition of OXPHOS can reduce hypoxia in spheroids and tumors, potentially increasing radio and immunotherapy efficacy. Furthermore, we show tumor cells are metabolically plastic and switch their metabolism from OXPHOS to glycolysis when OXPHOS is pharmacologically inhibited, resulting in increased glucose uptake in tumor cell spheroids. In vivo we observed increased serum lactate levels and increased [18F] FDG uptake in several healthy tissues, but not in the tumor. These systemic effects call for caution when administering OXPHOS inhibitors in a clinical setting, which is in line with adverse effects observed in clinical trials. More selective tumor targeting or less potent OXPHOS inhibitors might be a solution to reduce toxicity.

EP-0062

Development of a Folate-conjugated Albumin/ICG Complex for Preoperative Targeting in Image-Guided agent of Uterine Cancer Metastasis

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Aim/Introduction: Endometrial cancer originates in the lining of the uterus and can potentially metastasize to distant areas such as the lymph nodes in the cervix, abdomen or groin. The use of fluorescence-guided surgery based on indocyanine green (ICG) for sentinel lymph node (SLN) removal is used as a standard procedure for staging evaluation during uterine cancer surgery, despite the absence of targeting ability and washout issues. Therefore, this study aims to develop a contrast agent with enhanced in vivo compatibility and cancer-targeting capabilities to improve diagnostic accuracy while minimizing the need for extensive resection. ***Materials and Methods:*** Folate was conjugated to albumin through click chemistry (Alb-Fol), and quantified by Matrix-assisted Laser Desorption Ionization Time-of-Flight (MALDI-TOF). To determine the optimal concentration of ICG, it was mixed with Alb-Fol at various molar ratios (Alb-Fol/ICG), and analyzed using in vivo imaging system (IVIS). In vitro studies with KB cells were performed to measure binding affinity of folate through cell uptake and binding assays. For in vivo study, [64Cu]Cu- Alb/ICG and [64Cu]Cu- Alb-Fol /ICG were intravenously injected into mouse model with peritoneal tumor and IVIS and PET images were obtained at various intervals. After 24 hours, the tumors were excised, and the images from before and after surgery were compared. ***Results:*** The degree of functionalization (DOF) of folate was 3 (Alb-Fol3), and the optimal ratio of ICG was 2.5 to albumin. Cell uptake experiments based on the number of folate moieties, Alb-Fol3/ICG showed the highest uptake, with a Kd value of 36.9 nM. In vivo study, fluorescence and PET images were observed in metastatic cancers within the abdominal cavity, including intestines, uterus, pancreas and peritoneum. After excision, it was confirmed that fluorescence signals did not remain in organs except the kidneys. ***Conclusion:*** In this study, an optimized Alb-Fol3/ICG complex was developed to specifically target primary and lymph node metastatic endometrial cancer, aiming to minimize resection surgery. In a peritoneal metastasis model, it was observed that the retention time increased compared to conventional ICG and Alb/ICG complexes. Particularly, Alb-Fol3/ICG was found to be concentrated at the tumor site after 24 hours, suggesting its potential for effective operation using fluorescence imaging.

EP-0063

Preclinical assessment of ^{68}Ga-labeled CD38 Peptide for PET Imaging of pharmacokinetics in multiple myeloma

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Aim/Introduction: Multiple myeloma (MM) is a heterogeneous disease with different clinical manifestations and prognosis. Despite conventional chemotherapy and radiotherapy, MM is

highly aggressive. CD38 is highly expressed on the surface of MM cells, making it a characteristic tumor biological target of MM. CD38-targeted peptide, PF381, can overcome limitations of antibodies and achieve precise imaging of tumor sites, providing the possibility for early diagnosis of tumors and dynamic monitoring of immunotherapy. In this study, the diagnosis role of 68Ga-labeled PF381, biodistribution and dosimetry were investigated in tumor-bearing models. ***Materials and Methods:*** After obtaining amino acid sequence through screening of combinatorial chemistry peptide library based on microchip, we synthesized CD38 peptide, PF381, by solid phase synthesis using standard Fmoc scheme. Surface plasmon resonance (SPR) method was used to detect the affinity between PF381 and human CD38 protein. Relative CD38 expression in H929, 8226, U266 and K562 cell lines was assessed using western blot. PF381 was conjugated with 1,4,7,10-Tetraazacyclododecane-1,4,7,10-tetraacetic acid (DOTA) for radiolabeling with 68Ga (t1/2 = 67.7 min). PET imaging was performed after injection of 68Ga-PF381 after the lymphoma tumor-bearing murine model was established. Further, we conducted biodistribution analysis 30 minutes after injection to analyze the differences in radioactive distribution and uptake of CD38 positive tumor H929 and negative tumor U266. ***Results:*** The SPR signal of PF381 gradually increased with the increase of protein concentration, and the KD value reached 10-8 M, indicating that PF381 has a strong affinity for CD38. For HPLC, the radiolabeling efficiency of 68Ga-PF381 was nearly 70%. PET imaging of 68Ga-PF381 showed that, significant radioactive concentration was observed 30 minutes after injection in H929 tumor model, and lasted until 80 minutes . In U266 tumor model, no significant radioactive concentration was observed at all time points. The above results of imaging suggest the high uptake of tumors from radiolabeled PF381. The biodistribution results showed that the uptake of H929 tumors (0.75 ± 0.03%ID/g) is higher than that of U266 tumors (0.26 ± 0.08%ID/g, P<0.01), which was consistent with PET imaging results. ***Conclusion:*** We developed a novel peptide targeting CD38 and proved 68Ga-labeled PF381 had rapid targeting and good tumor penetration ability. Therefore, 68Ga-labeled PF381 could achieve high sensitivity in vivo imaging of multiple myeloma.

EP-0064

Development of ^{68}Ga-DOTA-BP1 peptide PET tracer for detecting BCMA expression in multiple myeloma

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Aim/Introduction: Evaluating multiple myeloma on a systemic scale in a noninvasive, dynamic, and validated manner holds significant clinical importance. B-cell maturation antigen (BCMA) has emerged as a promising focal point for diagnosing and treating multiple myeloma (MM). Therefore, the development of effective non-invasive methods for detecting BCMA-overexpressing lesions is crucial for screening and evaluating the efficacy of patients undergoing BCMA-targeted therapies. ***Materials and Methods:*** We employed a high-throughput microarray chip strategy to screen BCMA-targeting peptides from a one-bead-one-compound peptide library. The dissociation constants (KD) of the peptide ligands from BCMA proteins were determined using surface plasmon resonance imaging (SPRi). Specificity and affinity of the peptides were assessed by flow cytometry. BP1 coupled to 1,4,7,10-Tetraazacyclododecane-1,4,7,10-tetraacetic acid (DOTA) was 68Ga-labeled, and negative control (NC) peptide served as a control. After establishing BCMA-positive (H929) and BCMA-negative (K562) subcutaneous tumor models, 68Ga-labeled targeted BCMA peptides were injected. Subsequent PET imaging, biodistribution, and immunohistochemical staining studies were conducted to assess the imaging utility of 68Ga-DOTA-BP1 in BCMA tumor models. ***Results:*** SPR and flow cytometry confirmed the specific affinity of BP1 for BCMA. 68Ga-DOTA-BP1 had a radiolabeling rate of over 99%. The maximum intensity projection (MIP) results revealed that, in the H929 tumor model, the radiation concentration of 68Ga-DOTA-BP1 was detectable immediately 10 minutes after injection, with a sustained high uptake observed from 10 to 60 minutes. Conversely, in the K562 tumor model, no significant radioactive concentration was observed. Furthermore, the uptake of 68Ga-DOTA-BP1 in H929 tumors surpassed that of 68Ga-DOTA-NC at all time points. Biodistribution findings at 20 minutes post-injection supported the PET imaging outcomes. The uptake of the BP1 probe was notably greater in H929 tumors (3.48 ± 0.68 %ID/g) than in K562 tumors (1.51 ± 0.26 %ID/g) and also exceeded the negative peptide uptake in H929 tumors (0.98 ± 0.50 %ID/g, P<0.05). The analysis of immunofluorescence staining revealed significantly elevated levels of BCMA expression in H929 tumors, characterized by a pronounced green intensity. Conversely, BCMA expression was observed to be lower in K562 tumors. The histopathological staining results aligned perfectly with the aforementioned imaging data, collectively affirming the robust BCMA targeting affinity of BP1. ***Conclusion:*** 68Ga-DOTA-BP1 displayed substantial and rapid tumor uptake in a BCMA-positive multiple myeloma model. These results suggest that 68Ga-DOTA-BP1 has the potential to identify BCMA expression levels for diagnosing BCMA-related tumors. In conclusion, 68Ga-DOTA-BP1 can rapidly and accurately delineate tumors, making it an ideal tool.

EP-0065

Before-after Study of FAPI-04 and the Leading FAP-targeting Radioligands in the Same Mouse

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Aim/Introduction: Recently, we reported a novel modality called covalent targeted radioligand (CTR), which was installed with a sulphur (VI)-fluoride exchange (SuFEx) chemistry-based linker and successfully prevented the excessively fast tumour clearance on fibroblast activated protein (FAP). However, in previous work, FAPI-04 was the only control and no comparative evaluation of other reported leading FAP radioligands was performed. Therefore, we performed a before-and-after study with FAPI-04 in the same mice to robustly compare representative leading FAP radioligands, including our hit (CTR-FAPI). ***Materials and Methods:*** The interaction types of 177Lu-labelled FAP-radioligands were assessed by SDS-PAGE-autoradioluminography tandem assay. HT-1080-FAP cell uptake kinetic profiles of 68Ga-labelled FAP radioligands were then obtained. 68Ga-FAPI-04 was used as an 'internal standard' for comparison of various 68Ga-labelled FAP radioligands in identical cell-derived or patient-derived xenografts (CDX or PDX) based on PET/CT imaging. The SPECT/CT imaging of 177Lu-labelled FAP-radioligands was finally performed to study the dosimetry. ***Results:*** Among the leading FAP-radioligands, e.g. FAP-2286, only CTR-FAPI showed persistent FAP ligation (over 90% ligation yields and at least 144 h covalent binding with FAP). 68Ga-CTR-FAPI also showed higher and faster tumour uptake in cells. 68Ga-PET/CT imaging in the same CDX or PDX mice verified that the CTR-

FAPI had the highest tumour uptake and tumour-to-normal ratio. In addition, 177Lu-SPECT/CT imaging demonstrated a superior dosimetry profile for CTR-FAPI. ***Conclusion:*** The study indicated that covalent engineering based on SuFEx is a competitive strategy to improve tumour uptake and prolong residence time. Further clinical evaluation of 177Lu-CTR-FAPI is underway and this strategy is being applied to other targets.

EP-0066

Clinical potential of ananobody-based PET radiotracer^{68}Ga-TOHP-CD3813 for myeloma imaging

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Aim/Introduction: Daratumumab (DARA) is an anti-CD38 monoclonal antibody for the treatment of multiple myeloma (MM). The tumor CD38 expression level is one of the important factors in determining the efficacy of DARA treatment. Therefore, there is an urgent clinical need for a noninvasive tool to evaluate the CD38 levels in cancer patients before DARA treatment. In this study, we prepared a new molecular imaging probe 68Ga-TOHP-CD3813, the 68Ga-labeled nanobody CD3813, for noninvasive imaging of CD38 expression by PET/CT. ***Materials and Methods:*** Nanobodies were genetically engineered to contain a tag (LPETG) at their C-terminus, which could be recognized by sortase A. Preparation of the 68Ga-nanobody by site-specific labeling. In vitro, fluorescein dye conjugated CD3813 was used to evaluate the cellular uptake. CD38-positive Ramos cells and CD38-negative U266 cells were implanted subcutaneously to build lymphoma murine models. Serial small animal PET imaging was performed after injection of 68Ga-TOHP-CD3813. PET data were analyzed by drawing ROI. Biodistribution study and histological staining were performed at the end of time point. ***Results:*** SDS-PAGE results showed that the molecular weight of CD3813 was about 15 kDa. Fluorescein dye conjugated CD3813 bound with cell membrane, observed by microscopy. After conjugated with TOHP, the CD3813 were labeled with 68Ga (labeling yield > 95%). PET imaging showed 68Ga-TOHP-CD3813 had a rapid and high tumor uptake as early as 1 h post-injection (0.21 ± 0.03 %ID/g) and reached the peak at 2 h (0.26 ± 0.05 %ID/g) in Ramos model (n = 4). In addition, 68Ga-TOHP-CD3813 had very low uptake in the U266 model. Biodistribution results at 2 h post-injection verified the PET imaging results. Finally, immunofluorescent staining confirmed the Ramos tumor showed strong expression of CD38. ***Conclusion:*** 68Ga-TOHP-CD3813 is a promising PET radiotracer for imaging the CD38-positive tumors and has clinical potential as a molecular imaging tool for evaluation of the CD38 expression level in patients before DARA treatment.

EP-0067

Development of a ^{68}Ga-labeled molecular probe targeting insulinoma based on glucagon-like peptide-1 receptor antagonists

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Aim/Introduction: Insulinoma is a rare type of neuroendocrine tumor that still lacks an effective diagnostic approach[1]. Glucagon-like peptide-1 receptor (GLP-1R) exhibits significant upregulation in insulinomas[2]. In 2014, our group conducted the first clinical trial of a positron emitting nuclide labelled exendin-4 in localizing insulinomas. However, owing to the agonistic nature of Exendin-4 towards GLP-1R, a variable reduction in blood glucose levels ensues post-administration of 68Ga-NOTA-exendin-4 in insulinoma patients, thereby accentuating the associated risk. Consequently, we pioneered the synthesis of 68Ga-NOTA-exendin (9-39), a GLP-1R antagonist, aimed at enhancing tracer safety and facilitating positron emission tomography (PET) imaging in mouse models of insulinoma. ***Materials and Methods:*** Exendin (9-39) was synthesized by peptide solid-phase synthesis[3], and the bifunctional chelator 1,4,7-triazacyclononane-N,N,N-triacetic acid (NOTA) was modified at the N-terminus (Asp) and different lysine (Lys) sites of the peptide to construct Lys12-NOTA-Exendin (9-39), Lys27-NOTA-Exendin (9-39) and Asp09-NOTA-Exendin (9-39) probe precursors. 68Ga-NOTA-exendin (9-39) was obtained by reacting with 68Ga-GaCl3 solution. Radiochemical purity (RCP) was analyzed by radio-HPLC. Subsequently, the stability, affinity, selectivity, and pharmacokinetics of the probes were investigated to evaluate the performance of the novel molecular probes. ***Results:*** The RCP of 68Ga-NOTA-Exendin (9-39) modified at three different amino acid sites exceeded 90% and their 24-hour serum stability reached 95%. The dissociation constant (Kd) of GLP-1R was approximately 1 μM. Subsequently, probes were injected into tumor-bearing mice via the tail vein. It was observed that 68Ga-Asp09-NOTA-Exendin (9-39) exhibited significant accumulation in the tumor tissue within 1 h, predominantly excreted through the kidneys and bladder. In the blocking group, administered with a 100-fold excess of Asp09-NOTA-Exendin (9-39) precursor, there was no discernible enrichment of tumor tissue. Furthermore, 68Ga-Lys12-NOTA-Exendin (9-39) and 68Ga-Lys27-NOTA-Exendin (9-39) did not exhibit significant accumulation in tumor regions. ***Conclusion:*** We have devised a pioneering PET probe utilizing the GLP-1R antagonist, demonstrating effective tumor tissue accumulation. Notably, its administration does not precipitate hypoglycemia in patients, suggesting a promising clinical potential for this probe. ***References:*** [1] SADA A, et al. Malignant Insulinoma: A Rare Form of Neuroendocrine Tumor [J]. World journal of surgery, 2020, 44(7): 2288-94. [2] KöRNER M, et al. GLP-1 receptor expression in human tumors and human normal tissues: potential for in vivo targeting [J]. Journal of nuclear medicine : official publication, Society of Nuclear Medicine, 2007, 48(5): 736-43. [3] GASBJERG L S, et al. Exendin(9-39)NH(2) : Recommendations for clinical use based on a systematic literature review [J]. Diabetes, obesity & metabolism, 2021, 23(11): 2419-36.

EP-0068

Modification of the tumor microenvironments (TME) induced by [^{177}Lu]Lu-LNC1004

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Aim/Introduction: Cancer-associated fibroblasts (CAFs) has a crucial role in tumor microenvironment (TME) and driving tumor progression. Fibroblast activation protein (FAP) has been regarded as one of the promising targets for molecular imaging and targeted therapy as FAP overexpression in CAFs has been reported over 90% of human epithelial carcinomas. In this study,

we aimed to evaluate the changes of TME by the specific delivery of internal radiation targeting FAP as a theranostics tool. ***Materials and Methods:*** The HT1080-hFAP cell line was established by transfection with the recombinant lentiviral plasmid expressing human FAP (hFAP). The expression of hFAP in HT1080 cells was detected by qRT-PCR and Western blotting. HT1080-hFAP cells were transplanted into female Balb/c-nude mice (6-weeks-old). LNC1004 (Evans Blue conjugated FAP Inhibitor) was kindly provided by Dr. Xiaoyuan (Shawn) Chen. Radiolabled-LNC1004 with [177Lu]Lu and [68Ga]Ga were injected intravenously into the tail vein. Subsequently, the animals that underwent SPECT/CT imaging were sacrificed, and tumors were extracted for FACS and IHC. ***Results:*** On qRT-PCR and Western blot analysis, approximately 100,000-fold and around 22-fold higher hFAP expression was observed in HT1080-hFAP compared to the control, HT1080. The uptake of [68Ga]Ga-LNC1004 peaked at 3 hours, and measured at 6.96 ± 2.86 %ID/g. [177Lu]Lu-LNC1004 exhibited signals in the heart and bladder at 1 hour, with observable uptake in HT1080-hFAP cells starting at 8 hours, reaching its peak at 48 hours. FACS results showed that the proportion of B cells increased 1.4 times in the treatment group compared to the control group, while myeloid-derived suppressor cells (MDSC), which have an immunosuppressive function, decreased slightly by about 1.2 times in the treatment group. IHC was performed to evaluate the changes in Programmed death-ligand 1 (PD-L1) expression, a key player in tumor immune evasion, showing a decrease following internal radiation therapy. ***Conclusion:*** LNC1004 retained the HT1080-hFAP tumor for a sufficient duration allowing internal radiation to induce modifying the tumor microenvironment, compared to the other FAPI probes with rapid clearance. In this study, [68Ga]Ga-LNC1004 was suitable for imaging and [177Lu]Lu-LNC1004 treatment seemed to promote B cell infiltration and deprivation of MDSC. Whereas it decreased the expression of PD-L1, known as induce T cell exhaustion and immune tolerance. These findings suggest that [68Ga]Ga/ [177Lu]Lu-LNC1004 can be used as a theranostic pair to modify the tumor microenvironment.

EP-0069

Development and preclinical evaluation of a novel radioimmunoconjugate targeting BCMA in multiple myeloma.

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Aim/Introduction: Multiple myeloma (MM) is characterized by the abnormal proliferation of plasma cells within the bone marrow (BM). Considerable advances over the years have improved the diagnosis, management, and treatment of MM patients. Nevertheless, patients still relapse, indicating the presence of residual disease below the level of detection. The B-cell maturation antigen (BCMA) is a transmembrane glycoprotein involved in the proliferation and maturation of plasma cells. Importantly, BCMA is selectively expressed on the surface of malignant plasma cells in most MM cases. We aimed to develop an anti-BCMA ImmunoPET imaging strategy to visualize the expression of BCMA in MM. ***Materials and Methods:*** We designed a novel radioimmunoconjugate targeting BCMA based on belantamab (GSK2857914). This antibody (Ab) was first conjugated at different molar excess (4- and 20-fold), to the bifunctional chelator DFO* (DFO*-pPhe-NCS), and its affinity was evaluated by indirect ELISA. Subsequently, the Ab conjugate was radiolabelled with 89Zr and purified, as reported previously.1 Quality control was performed by size exclusion chromatography-high performance liquid chromatography (SEC-HPLC) and instant thin-layer chromatography (iTLC). The radioimmunoconjugate was further characterized in vitro using BCMA-transduced K562 and wild-type K562 (for nonspecific binding) cells to determine the immunoreactive fraction, the binding affinity, and the internalization kinetics. BCMA expression and binding of Ab conjugates were assessed using Fluorescence Activated Cell Sorting (FACS). ***Results:*** We have selected the DFO*-Belantamab conjugate (4-fold excess), showing the highest affinity for BCMA, with a dissociation constant (Kd) of 0.53 ± 0.01 nM and a preserved affinity compared to the native belantamab (Kd~ 0.28 ± 0.02 nM). FACS results confirmed BCMA expression of the BCMA-K562 cell line and specific binding of the immunoconjugate. [89Zr]Zr-DFO*-Belantamab was obtained with a non-decay corrected radiochemical yield of 90%, >95% radiochemical purity and 74.37 ± 14.7 MBq/mg specific activity (at end of production). The radiotracer remained stable over 7 days with a radiochemical purity >80%. In vitro assays demonstrated good affinity (Kd = 4.01 ± 0.63 nM) and immunoreactivity (about 52%) of the radioimmunoconjugate. [89Zr]Zr-DFO*-Belantamab showed slow internalization in BCMA+ K562 cells, which was maximum at 24 hours (18.2%). ***Conclusion:*** [89Zr]Zr-DFO*-Belantamab was successfully produced and showed favorable stability and binding affinity, supporting further validation as a potential novel immunoPET imaging agent of BCMA expression for in vivo studies. ***References:*** 1. Dewulf, Jonatan et al. "Immuno-PET Molecular Imaging of RANKL in Cancer." Cancers vol. 13,9 2166. 30 Apr. 2021, doi:10.3390/cancers13092166.

EP-0070

Exploring the therapeutic potential of BNCT for soft tissue sarcomas using F^{18}-FBPA PET/CT.

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Aim/Introduction: Boron neutron capture therapy (BNCT) destroys tumor cells using high-LET alpha particles and Li nuclei produced by the nuclear reaction between neutrons and boron (10B). Successful BNCT requires tumor-selective uptake of 4-10B-boron-l-phenylalanine (10B-BPA), and PET can be used with 10B-boron-2-18F-fluoro-l-phenylalanine (18F-FBPA) to estimate the amount of 10B-BPA in the tumor. This study investigated the accumulation of 10B-BPA in soft-tissue sarcomas, which are radioresistant tumors, and the possible therapeutic effect of BNCT with 18F-FBPA PET/CT. ***Materials and Methods:*** Nine patients with soft-tissue sarcoma who underwent 18F-FBPA PET/CT prior to surgery were included (6 males, 3 females; mean age ± SD, 67 ± 14 years). Tumor uptake was quantified by measuring the maximum standardized uptake value (SUV max) and tumor/blood radioactivity ratio (T/B ratio). SUV max and T/B ratio were compared with histopathological grade and Ki-67 expression, respectively. Sarcoma grading was performed using the French Federation of Cancer Centres Sarcoma Group (FNCLCC) and Ki-67 was measured using MIB-1 immunohistochemistry. ***Results:*** Six patients had FNCLCC grade III and three had FNCLCC grade II. SUV max was 4.7 ± 0.8 for grade III and 3.0 ± 0.5 for grade II, with a statistically significant difference between them ($P < 0.05$). SUV max and T/B ratio were significantly correlated with Ki-67 respectively ($P < 0.05$). T/B ratios were 3.8 ± 0.8 for grade III and 2.6 ± 0.5 for grade II. These are T/B ratios of 2.0 or higher, indicating

a potential therapeutic effect of BNCT. ***Conclusion:*** Soft-tissue sarcomas of grade II or higher can be expected to benefit from treatment with BNCT.

EP-0071

Site-specific ^{68}Ga-labeled nanobody for PET imaging of CEACAM5 expression in preclinical tumor models

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Aim/Introduction: Here, we aim to identify a nanobody targeting CEACAM5 and demonstrate its application in positron emission tomography (PET) imaging in non-small cell lung cancer (NSCLC). ***Materials and Methods:*** The CEACAM5 expression and localization of H3122, H2228, PC9, HCC827 and H1975 were confirmed by western blotting, flow cytometry and immunofluorescence. [68Ga]Ga-NB41 was synthesized by site-specifically conjugating [68Ga]Ga with 1,4,7-triazacyclononane-1,4,7-triacetic acid (NOTA) and purified with a PD-10 column. Quality control, metabolic characteristics and cellular uptake were performed on [68Ga] Ga-NB41 to analyze the probe properties. Crucially, small-animal PET imaging and biodistribution studies were performed in CEA-over expressed H3122 and CEA-low expressed H1975 tumor models. ***Results:*** CEACAM5 was highly expressed in H3122, successively decreasing in H2228, PC9, and HCC827 cells, and no expression in H1975. The radiochemical purity was over 99% when purified by PD-10 column and maintained over 90% in saline or 5% human serum albumin over 3h. [68Ga] Ga-NB41 showed significantly higher uptake in CEACAM5 high-expression cells than that in CEACAM5 low-expression cells.The biological half-life of distribution and clearance phases were 2.067 min and 52.81 min, respectively. In vivo immunoPET imaging showed that the probe had high tumor targeting ability in CEACAM5 positive tumors and increased accumulation of H3122 tumors within 3h, manifesting good retention effect, compared with the control. Similarly, the biodistribution of the probe showed high accumulation in H3122 tumor with the uptake of 5.71±1.09 ID%/g, which was much higher than that in H1975 (0.32 ± 0.17 ID% / g, P <0.001). Besides, the uptake of H3122 tumor could be specifically blocked (2.70 ± 0.27 ID% / g, P=0.02) when co-injected with 50 μg cold precursor, while the uptake of H1975 had no significant change (0.37±0.03 ID%/g,P=0.68). ***Conclusion:*** [68Ga]Ga-NB41 bears high targeting ability and specificity for CEACAM5, and shows great potential in the diagnostic detection of CEACAM5-positive tumors. The development of radioactive probes may provide new ideas for the precise diagnosis of tumors and the formulation of subsequent clinical treatment plans.

EP-0072

Development and Evaluation of [^{68}Ga]Ga-DOTA-COL Peptide Tracer for Probing Collagen Damage

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Aim/Introduction: Local ablation of hepatocellular carcinoma (HCC) is one of the major paradigms in clinical treatment, which confronts the challenge of interpretation of post-ablation imaging. As the extracellular matrix (ECM), including a large amount of collagen deposition,the generation of the damaged collagen is accompanied by the ablation procedures simultaneously. Furthermore, collagen damage leads to ECM changes exerting tumor-promoting functions. Thus, characterization of the damaged collagen status shows the potential to predict tumor response post local ablation. Herein, we designed a peptide-based PET tracer [68Ga]Ga-DOTA-COL for probing collagen damage. This study aims to evaluate the feasibility of [68Ga]Ga-DOTA-COL PET tracer for detecting collagen damage in the percutaneous ethanol injection (PEI) ablation model. ***Materials and Methods:*** We synthesized a collagen-targeted molecular imaging probe, [68Ga]Ga-DOTA-COL, which was efficiently prepared manually and performed a series of in vitro and in vivo assays to test its specificity. Pharmacokinetics and biodistribution studies of [68Ga]Ga-DOTA-COL in the KM mice and hepa1-6 tumor-bearing mice, respectively. Next, longitudinal [68Ga]Ga-DOTA-COL PET imaging detected tumor response in hepa1-6 tumor-bearing mice post PEI. H&E and immunohistochemical staining analyzed the pathological features ***Results:*** [68Ga]Ga-DOTA-COL was prepared within 30 min, with a radiochemical purity of over 99%. [68Ga]Ga- DOTA-COL was rapidly cleared from the body. The pharmacokinetics of [68Ga]Ga-DOTA-COL in mice showed a two-phase decay with a very short distribution phase half-life of 0.46 minutes and an elimination phase half-life of 12.08 minutes. In Hepa1-6 tumor xenografts, tumor uptake of [68Ga]-DOTA-COL in the PEI treatment group was significantly higher than the control group at 1 h after injection (SUVmax: 0.36 ± 0.047 and 0.14 ± 0.035, p = 0.00626). H&E results showed the lesion degree of tumor tissue was reduced in the PEI treatment group compared with the control group. IHC demonstrated that Ki67 was lower in the PEI treatment group than in the control group on day 5, indicating high-level accumulation [68Ga]Ga-DOTA-COL was positively correlated with the PEI-damaged lesions. Interestingly, we found that the probes had longer tumor retention times in the PEI-treated group compared to the control group and the ratio of Tumor/Muscle at 4 h after injection (9.06 ± 2.21 vs. 4.78 ± 1.60). ***Conclusion:*** Our results demonstrated the feasibility of [68Ga]Ga-DOTA-COL for monitoring collagen damage in the PEI ablation model. The clinical application of this new PET tracer will be explored to evaluate the HCC response in interventional oncology in future research.

EP-0073

Ga-68-Labelling of Tetrahydroquinoline-Based Compound as a PET Tracer for C-X-C Chemokine Receptor Type 4 Imaging

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Aim/Introduction: The C-X-C chemokine-receptor type 4 (CXCR4) is an emerging target for cancer drug development due to its high expression in cancer cells, particularly during metastasis. This study aimed to develop a new PET tracer for CXCR4 imaging. The potent tetrahydroquinoline-based CXCR4 antagonist, TIQ15 (IC50 = 5 nM)1, was selected as a tracer to prepare a bifunctional chelator (BFC) for Ga-68 labeling. ***Materials and Methods:*** TN-01, a BFC for Ga-68 labeling, was synthesized by conjugating TIQ15 with p-NCS-Bz-NODA-

GA. Semi-preparative HPLC was utilized to purify TN-01, and spectroscopy methods (IR, NMR, and HRMS) were employed to determine its structure. Ga-68 was directly radiolabeled onto BFC for 15 minutes at 70°C in 0.1 M ammonium acetate. The resulting [68Ga]Ga-TN-01 was purified using an HLB SPE cartridge and analyzed by a C-18 column with a mobile phase solution of 0.1% TFA in water and 0.1% TFA in ACN in gradient mode (85-50:15-50). The radiochemical yield and purity were assessed by radio-TLC and radio-HPLC. Stability was evaluated under three different conditions: normal saline pH 7.5, 0.01 M phosphate-buffered saline (PBS) pH 7.4, and human plasma. ***Results:*** The synthesis of the bifunctional chelator TN-01 was successfully achieved with a moderately high yield of 70%, and its assigned structure was confirmed to match the designed structure. The radiochemical yield of [68Ga]Ga-TN-01 was 41.33±2.00%, with a radiochemical purity exceeding 95% and a molar activity of 54.82±2.40 GBq/μmol. Stability studies demonstrated that the radiochemical purity of [68Ga]Ga-TN-01 remained above 97% at 4 hours under all tested conditions. ***Conclusion:*** This study presents an efficient method for 68Ga-radiolabeling of a bifunctional chelator targeting CXCR4. The resulting [68Ga]Ga-TN-01 is poised for further preclinical investigations, including biodistribution and localization studies, to validate its clinical potential for cancer diagnosis. ***References:*** Valarie MT, Huanyu Z, Brooke MK, et al. Discovery of tetrahydroisoquinoline-based CXCR4 antagonists. ACS Med Chem Lett. 2013;4(11):1025-1030.

EP-0074

Evaluation of 89Zr-DFO-T21 in immuno-PET imaging of A549 xenograft models with high TIM3 expression

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Aim/Introduction: T cell immunoglobulin and mucin domain 3 (TIM3) is one of the most researched immune checkpoints after CTLA-4 and PD-1and is considered a promising target in tumor immunotherapy. The purpose of this study is to provide guidance for the noninvasive detection and targeted therapy of TIM3 in tumor microenvironment. ***Materials and Methods:*** Humanized TIM3-targeted monoclonal antibody T21 was radiolabeled with 89Zr to obtain 89Zr-DFO-T21 probe. Flow cytometry and western blot were used to verify the expression of TIM3 on the surface of human lung cancer cells A549. In vitro the affinity of the 89Zr-DFO-T21 probe was evaluated by comparing the uptake of A549 and A549-TIM3 cells to the TIM3 target, and the stability of the probe was assessed in PBS and 5% HSA solution. The biodiversity distribution, metabolic characteristics of 89Zr-DFO-T21were performed, and then 89Zr-DFO-T21 was injected intravenously in the tail and then subjected to static whole-body positron emission tomography (PET) scanning by Micro-PET/CT for 10 minutes at 2, 24, 48, 72 and 96 h, respectively, and the images were quantified by region of interest (ROI) to obtain the maximum uptake value (SUVmax). ***Results:*** In this study, 89Zr-DFO-T21 probe was successfully prepared. A549-TIM3 cells showed high TIM3 expression, while A549 cells showed low expression of TIM3. The radiochemical purity was over 95% and maintained over 80% in saline or 5% Human Serum Albumin for more than 72 h. The Kd value of 89Zr-DFO-T21 to TIM3 protein was 24 nM. Compared with the blockade group or the A549-negative group, the results of cell uptake showed that the 89Zr-DFO-T21 probe was significantly specific for TIM3. The biological half-life of distribution and clearance phases were 2.23 h and 35.18 h, respectively. The effective dose of 89Zr-DFO-T21 estimated from the biodistribution data was 0.0125 mSv/MBq. The results of small animal PET showed that the uptake of 89Zr-DFO-T21 probe in the A549-TIM3 model reached the maximum absolute uptake value at 48 h (SUVmax =11.96 ± 0.01). ***Conclusion:*** The 89Zr-DFO-T21 probe developed in this study showed obvious targeting specificity with TIM3 in vitro and in vitro evaluation. The development of 89Zr-DFO-T21 may provide new insights for the regulation of TME and the formulation of precision diagnosis and treatment programs for tumors.

EP-0075

TNBC Theranostics by Intracellular TRPV1 Radioligands Trapping. Proof of Concept

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Aim/Introduction: Triple-Negative Breast Cancer (TNBC) has a poor prognosis with missing effective targeted therapies. Within this context, the exploration of novel treatment avenues is of paramount importance. Transient Receptor Potential cation channel subfamily V member 1 (TRPV1) is overexpressed in TNBC subtypes, mainly intracellular with specific pattern, especially by the endoplasmic reticulum and the Golgi apparatus. The 6-iodonordihydrocapsaicin was described as a potent ligand of TRPV1 (IC50=10±2.1nM). The aim of this study was to develop the synthesis of [131I]-6-iodonordihydtrocapsacin ([131I]INDC) and to make first proof of concept of intracellular TRPV1 radioligand trapping as a new approach in the field of TNBC theranostics. ***Materials and Methods:*** Nordihydrocapsaicin (NDC) was radioiodinated by electrophilic substitution of iodine-131 with the hydrogen atom in position 6 of the aromatic ring by using chloramine-T. Purification of [131I]INDC was performed by Semi-Preparative HPLC followed by C18 cartridge. Radiochemical stability of [131I]INDC was assayed by Radio-HPLC in saline 0.9%, human serum, and cell culture media. Expression and subcellular localization of TRPV1 were assessed by immunocytochemistry (ICC) in three cell lines: MDA-MB-231, 4T1 and MCF10A. Microautoradiography with hematoxylin & eosin staining (MAR H&E) of these three cells lines was performed after incubation for four hours with [131I]INDC. Microdosimetry was simulated using MIRDcell 3.13 for beta emission spectrum of iodine-131 and 4T1 adherent cells. ***Results:*** A radiolabelling yield of about 70% was obtained for [131I]INDC, with a radiochemical purity of over 95%. After formulation of [131I]INDC in 10% Ethanol in saline 0.9%, the radiotracer was found to be stable over 94% up to 120 h, and over 90% up to 24 h in human serum and 4T1/MDA-MB-231 growth media. As determined by ICC, expression of TRPV1 receptor was high in 4T1, located mostly intracellular around the nucleus, moderate in MDA-MB231 cells and non-specific in MCF10A cells. MAR H&E showed high intracellular uptake for 4T1 cells, moderate for MDA-MB-231 and non-specific for MCF10A. Microdosimetry simulation of [131I]INDC for 4T1 cells predicted absorbed doses delivered of at least 2 Gy to 90% of cells. ***Conclusion:*** In this study, we tentatively demonstrated initial in vitro indications of TRPV1 radioligands potentially being trapped intracellularly in TNBC cell lines. The radiotracer [131I]INDC was successfully synthesized with high radiolabeling yield and radiochemical purity. We confirmed the intracellular overexpression of TRPV1 receptor by ICC in 4T1 and MDA-MB-231 cell lines. Microdosimetry simulation predicted high in vitro delivered absorbed doses to these TNBC cell lines.

EP-0076

Preclinical Evaluation of a α-Fucosidase in therapy inducedsenescence, by[18F]FEtFuc PET

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Aim/Introduction: Cellular senescence is a robust stress-induced state of cell cycle arrest and is reported to be accompanied by an increase in the expression of α-fucosidase. It has been widely observed that chemotherapy can drive tumor cells into therapy-induced senescence (TIS). While growth arrest is seen as a positive treatment outcome, senescent cells often harbor resistance to cytostatic drugs, rendering further treatments ineffective. Drugs that can selectively kill (senolytics) and modify the secretory phenotype (senomorphics) of senescent cells are already in development, but have side-effects. We thus present [18F]FEtFuc, an α-fucoside PET-tracer for the visualization of senescence. ***Materials and Methods:*** Three different models of TIS were used. In a CRC cell line (HCT116), senescence was induced by doxorubicin. In two HCC cell lines (Nras and AMp19), senescence was induced by a ribosomal checkpoint inhibitor (RCI). In-vitro, senescence was confirmed by X-Gal and expression levels of α-fucosidase were evaluated by qPCR and Westernblot. [18F]FEtFuc uptake was measured in a gamma counter in the three senescence models as well as an α-fucosidase overexpressing HCT116 cell line (Fuca). In vivo, tumor cells were injected s.c. and senescence was induced. After i.v. [18F]FEtFuc injection, dynamic PET (55 min) and anatomical MRI were performed for all senescence models and Fuca. All animals were scarified after in vivo imaging and tumor tissue was extracted and sliced for autoradiography, H&E and X-Gal staining. ***Results:*** All cell lines showed a significant increase of α-fucosidase mRNA after senescence induction, further confirmed by Western Blot. In vitro measurements showed a significantly higher [18F]FEtFuc uptake in all senescence models as well as in the Fuca cell line. The uptake was 1.9-fold higher in HCT116 senescent cells, 1.7-fold higher for the Nras and 5.0-fold higher for the AMp19 senescent cells. Fuca cells showed a 2.1-fold higher uptake then control HCT116 cells. In vivo, a significantly higher [18F]FEtFuc uptake was measured in all senescent tumors. The mean uptake in %ID/cc at 15-25 min for the senescent vs. control tumors was: 3.1±1.2 vs 1.8±0.3 for HCT116; 5.2±0.7 vs. 3.8±0.5 for Nras; 4.2±1.2 vs. 2.5±0.5 for AMp19. X-Gal staining confirmed senescence induction in all cell lines. ***Conclusion:*** α-Fucosidase is a robust biomarker in these senescence models and [18F]FEtFuc demonstrates its ability to visualize this cellular condition. This new approach offers an innovative system to detect senescence in vivoand could help for a better understanding of the intertumoral heterogeneity, as well as treatment related changes.

EP-0077

Synthesis and Evaluation of ^{68}Ga-D75CM-NODAGA, which enables Sentinel Lymph Node (SLN) Detection with PET.

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Aim/Introduction: Sentinel lymph node detection (SLND) and subsequent SLN-biopsy is vital for the accurate tumor management, serving as a key determinant in cancer staging and guiding treatment strategies by reducing unnecessary lymphadenectomy. Aim of the current study was to develop and rigorously evaluate the potential utility in SLND of the 68Ga-D75CM-NODAGA, a mannosylated dextran derivative radio-labeled with 68Ga. By employing state-of-the-art radiochemistry techniques and cutting-edge pre-clinical PET/MRI technology,enabling simultaneous PET and MRI acquisition, we aimed to develop and assess a novel imaging agent that will enable highly accurate SLND with PET. ***Materials and Methods:*** The mannosylated compound D75CM was synthesized, followed by the coupling with the succinimidyl ester of NODAGA. Specifically, a reaction of a 75 KD dextran with allyl bromide yielded the intermediate allyl dextran with about 40% coupling. Addition of cysteine to allyldextran resulted in the dextran-S-cysteine derivative D75C. This compound was mannosylated (approx. 65%) by coupling to the in situ activated cyanomethyltetraacetyl-1-thio-D-mannopyranoside. Subsequently, the reaction of the succinimidylester of NODAGA with free amine groups resulted in the formation of the final compound. Purification of the compound has been performed by ultrafiltration. Labeling was achieved by adding 0.5 mL 68GaCl3 to a 100 μL solution of the NODAGA mannosylated dextran and incubating at 40oC for 20 mins. Quality control and stability studies were performed by radio-TLC and radio-HPLC. The biological evaluation was performed by biodistribution and imaging studies in Swiss albino mice after subcutaneous injection in the footpad. ***Results:*** The preliminary biological testing of the 68Ga complex showed high accumulation in the popliteal lymph node (4.09 % ID) and fast injection site clearance (40.61 %/ID) at 120 min p.i. This data is comparable with our previous data1 indicating that the attachment of NODAGA chelator did not alter its biodistribution. Furthermore, a dynamic imaging study using microPET/MRI (enabling simultaneous PET and MRI acquisition; Bruker USA) confirmed the rapid elimination rate from the injection site. ***Conclusion:*** A novel 68Ga-based PET tracer for SLN detection has been developed and evaluated by our group. The innovative 68Ga-labeled D75CM-NODAGA compound showed favorable imaging perfomance as a novel PET imaging agent for SLND, providing the evidence for further evaluation in both the pre-clinical and clinical setting. ***References:*** 1. Papasavva A. et al. "Comparative study of a series of 99mTc(CO)3 mannosylated dextran derivatives for sentinel lymph node detection." Molecules 2021 Aug 7;26:4797.

EP-0078

SYL3C aptamer-engineered DNA tetrahedrons for diagnosing imaging of colorectal cancer via dual PET and fluorescence imaging

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Aim/Introduction: Colorectal cancer (CRC) is one of the diseases with high morbidity and mortality rates. Since early-stage CRC is treated surgically with a cure rate of 90%, how to achieve early diagnosis has become one of the urgent problems to be solved.

SYL3C is a DNA aptamer that can bind Epithelial Cell Adhesion Molecule (EpCam)with high selectivity, which is widely expressed in colorectal cancer cells. DNA tetrahedron (DTN) has emerged as a highly promising nanodrug delivery system owning to high stability, structural designability and explicit biosafety. In this study, we choose fluorescent motif Cy7 and gallium-68 to modifie SYL3C aptamer-engineered DTN for targeted dual imaging modalities, positron emission tomography (PET) and fluorescence, which both non-invasive and real-time imaging on the internal structure at the molecular level, to enhance the early detection and treatment monitoring of colorectal cancer. ***Materials and Methods:*** We designed and synthesized the Cy7-DTN-SYL3C via one-step annealing and click chemistry. Following in vitro stability and cytotoxicity examination, we injected the probe into HT-29 tumor-bearing BALB/c nude mice and performed in vivo fluorescence imaging at different time points and sacrificed the mice at 24 h for biodistribution analysis. Subsequently We obtained 68Ga-NOTA-DTN-SYL3C according to base complementary pairing and injected it intravenously into HT-29 tumor-bearing mice to obtain metabolic information of tumor tissues to perform precise quantification. Imaging data were quantitatively analyzed to evaluate the targeting efficiency and biodistribution. ***Results:*** Cy7-DTN-SYL3C and 68Ga-NOTA-DTN-SYL3C were found to be stable and non-toxic in vitro. In vivo imaging experiments, we found that SYL3C aptamer-engineered DNA tetrahedrons is mainly metabolized by the kidneys and liver. The average fluorescence radiant efficiency of tumor was 6.8 ×10 8 (p/s/cm2/sr)/(μW/cm2) in tumor regions, which is about 1.6 - 2.9 folds targeted performance enhancement and the time of tumor retention in vivo prolonged about 8 - 10 hours compare with the control. Quantitative region of interest (ROI) analysis showed that tumor uptake was 1.4±0.8%ID/g (n=3), and biodistribution analysis confirmed the same conclusion as ROI, indicating that the tumor tissue has a considerable degree of uptake. ***Conclusion:*** The use of SYL3C aptamer-engineered DNA tetrahedrons represents a novel and promising approach for targeted dual imaging of colorectal cancer. It facilitates both early tumor detection and efficacy assessment due to its high specificity and dual imaging capabilities. The translation of this technology into clinical trials and its adaptation to other biomarker-specific cancers will be explored in future work.

EP-0079

Development of $^{[Cu-64]}$RTX-1363S, a high-affinity ligand for FAP-targeted PET imaging

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Aim/Introduction: Fibroblast activation protein-α (FAP) is recognized as a pivotal target in molecular imaging, important in oncology and inflammatory and fibrotic diseases due to its presence in cancer-associated fibroblasts and activated fibroblasts. RTX-1363S, a tri-functional small molecule identified using the Trillium™ platform, integrates a FAP-binding ligand, a pharmacokinetic-modulating albumin-binding moiety, and a chelator for incorporation of radiometals. This high affinity FAP ligand, radiolabeled with Cu-64, Ga-68, and [F-18]AlF, enables specific PET imaging of FAP expressing tissues. ***Materials and Methods:*** The affinity of RTX-1363S and [Cu-nat]RTX-1363S for human FAP was determined by surface plasmon resonance (SPR). Specificity was evaluated against related prolyl peptidases in enzyme assays. Biodistribution of [Cu-67]RTX-1363S in U-87 MG xenograft mice was determined by SPECT/CT imaging and ex vivo gamma counting at 1, 3, and 24 hours post-injection. Biodistribution of $^{[Cu-64]}$RTX-1363S in male and female Sprague-Dawley rats (n=3/sex/time point) was investigated to project human tissue radiation absorbed dosimetry using the %kg/g scaling method. Toxicity was assessed in Sprague-Dawley rats and off-target interactions were assessed with the SafetyScan47 panel. ***Results:*** RTX-1363S and [Cu-nat]RTX-1363S displayed high affinity for human FAP by SPR with dissociation constants (KD) of 0.0123 ± 0.003 nM and 0.0211 ± 0.004 nM, respectively. IC50 values for [Cu-nat]RTX-1363S were >10 μM for human DPPIV and 2.76 ± 0.79 nM for human PREP, demonstrating minimal cross-reactivity with other prolyl peptidases. SPECT/CT imaging showed significant tumor retention in mice, with [Cu-67]RTX-1363S achieving peak tumor accumulation at 1 h post-injection. Tumor:blood, tumor:kidney and tumor:muscle ratios at 1 h were 15.4, 6.3 and 14.1, respectively. In rats, $^{[Cu-64]}$RTX-1363S demonstrated rapid clearance through the kidneys, with >80% decrease in blood concentration by 24 h. The projected effective doses for $^{[Cu-64]}$RTX-1363S in human males and females was estimated to be 31.2 and 17.1 μSv/MBq, respectively. At >100x the anticipated human dose, RTX-1363S produced no toxic side effects in rats. No significant results (defined as >50% inhibition at 10 μM concentration) were observed across a functional panel of 47 targets/pathways commonly implicated in adverse drug reactions. ***Conclusion:*** RTX-1363S is a selective, high affinity FAP inhibitor that demonstrates favorable biodistribution to the tumor and rapid background clearance allowing for early tumor imaging. These data, combined with the clean safety profile, underscore the potential of $^{[Cu-64]}$RTX-1363S for clinical PET imaging of FAP-expressing tissues to provide insights into both cancerous and fibrotic diseases.

EP-0080

^{177}Lu-Labeled GPC3-Targeted Antibodies: In Vivo Behavior and Therapeutic Potential in Hepatocellular Carcinoma

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Aim/Introduction: Hepatocellular carcinoma (HCC) poses a significant global health threat with high cancer-related mortality due to late diagnosis and limited therapy options. Targeted radionuclide therapy, focusing on specific tumor markers, shows promise for cancer treatment. Glypican-3 (GPC3), highly expressed in HCC but absent in healthy liver tissue, is a potential target for HCC therapy. In this study, we developed three 177Lu-labeled GPC3-targeted antibodies (full-length, Fab, and scFv) to explore their potential for HCC theranostics. ***Materials and Methods:*** The GPC3-targeted antibodies were labeled with 177Lu after conjugation with p-SCN-Bn-DOTA. BALB/c nude mice with Hep3B xenografts received intravenous injections of 18.5 MBq probes. SPECT/CT scans were conducted at various time-points for full-length antibody (6 h, 12 h, and day 1-7), Fab and scFv (2 h, 6 h, 12h, day 1 and 2). Ex vivo biodistribution experiments were conducted at the final time point, and blood biochemistry assessed short-term toxicity. ***Results:*** Three 177Lu-labeled GPC3-targeted antibodies were successfully synthesized with high radiochemical purity. SPECT/CT imaging delineated distinct in vivo behaviors of these probes. For 177Lu-DOTA-aGPC3-Fab and 177Lu-DOTA-aGPC3-scFv, rapid accumulation was evident in Hep3B tumors at 2 hours p.i., peaking at 5.4 ± 0.8 %ID/g and 4.1 ± 0.8 %ID/g by 6 hours p.i., respectively. These probes demonstrated rapid

clearance from the blood, leading to notably high tumor-to-blood ratios, approximately 15. However, a decline in tumor uptake was observed after 6 hours. In contrast, 177Lu-DOTA-aGPC3-mAb displayed a different in vivo behavior, primarily accumulating in the blood during the early phase. Tumor accumulation commenced at 6 hours, steadily rising and reaching its peak at 12.6 ± 1.3 %ID/g by day 2. Even by day 7, the uptake in the tumor remained notably high, at 4.37 ± 0.7 %ID/g. Ex vivo biodistribution studies confirmed the findings from SPECT imaging. Blood biochemistry analysis revealed no significant differences compare to the control group. ***Conclusion:*** We successfully developed three 177Lu-labeled GPC3-specific antibodies with high radiochemical purity. SPECT imaging confirmed their robust GPC3-targeting capabilities and observed distinct in vivo dynamics among them. Short-term toxicity assessment revealed no significant adverse effects, indicating their favorable safety profile. Moving forward, our focus will shift towards comprehensive evaluations of their therapeutic efficacy and safety in preclinical models, aiming to further elucidate their clinical potential.

EP-0081

Prostate-Specific Membrane Antigen (PSMA) expression in primary and metastatic kidney cancer (UroCCR-65 study).

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Aim/Introduction: Renal cell carcinoma (RCC) accounts for more than 90% of renal tumors and about 15% of patients have metastatic disease at initial diagnosis. Prostate-specific membrane antigen (PSMA) has been shown to be over-expressed in the neo-vasculature of renal tumors. However, there is no study investigating the pattern of PSMA expression in primary RCC and metastases. The objective of this work was therefore to study, using autoradiography, PSMA expression in a panel of primary RCC and biopsies from RCC metastases. ***Materials and Methods:*** 60 frozen samples of renal cancer, 30 primaries and 30 metastases, were available from the UroCCR project (NCT03293563). PSMA expression was assessed using [177Lu]Lu-PSMA-617 as binding agent and the specific binding was calculated for each sample (1000 fold excess of the PSMA inhibitor PMPA was used to assess non-specific binding). Samples were then dichotomized in low PSMA expression (specific binding 1-10%) and high PSMA expression (specific binding 11-100%) for statistical analysis. A patient suffering from metastatic clear cell RCC (ccRCC) was also injected with [68Ga]Ga-PSMA-11 to evaluate PSMA expression on the known pleural lesions. ***Results:*** Samples from 44 patients were available and suitable for autoradiography processing, including 19 patients for primary renal cell carcinoma (9 ccRCC, 7 papillary RCC and 3 chromophobe RCC) and 25 for metastatic renal cell carcinoma (24 ccRCC and one eosinophilic cell carcinoma (NOS) not otherwise specified). The mean specific binding was 28.9 ± 40.4% for primary renal cancer and 65.0 ± 38.9% for metastasis. There were no association between PSMA specific binding and histology parameters in primary tumors such as pT, histological types and WHO/ISUP grade (p>0.05). A significant increase in PSMA-specific binding was depicted in metastatic samples (p=0.0037)(Figure 1). The patient suffering from metastatic ccRCC and imaged with [68Ga]Ga-PSMA-11 PET/CT showed high PSMA uptake on known pleural lesions. An occult femoral metastasis was also diagnosed (Figure 2). ***Conclusion:*** PSMA is significantly over-expressed in metastases of RCC, here mainly represented by ccRCC. ***References:*** 1. Schollhammer R, De Clermont Gallerande H, Yacoub M, Quintyn Ranty M-L, Barthe N, Vimont D, et al. Comparison of the radiolabeled PSMA-inhibitor 111In-PSMA-617 and the radiolabeled GRP-R antagonist 111In-RM2 in primary prostate cancer samples. EJNMMI Research. 2019;9:52. 2. Schollhammer R, Quintyn Ranty M-L, de Clermont Gallerande H, Cavelier F, Valverde IE, Vimont D, et al. Theranostics of Primary Prostate Cancer: Beyond PSMA and GRP-R. Cancers. 2023;15:2345.

EP-0082

PET imaging to evaluate activated immune cells in hypoxia-enhanced immunotherapy for malignant tumors

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Aim/Introduction: Currently, immunotherapy faces limitations due to its poor therapeutic efficacy and the absence of reliable methods for evaluating treatment responses. Herein, we aimed to enhance immunotherapy efficacy by ameliorating the hypoxic tumor environment and subsequently augmenting immune cell activity at the tumor site. Granzyme B targeted PET imaging was employed to monitor changes in activated immune cell, assessing the response to immunotherapy efficacy in vivo. ***Materials and Methods:*** Lung cancer cell membranes were obtained to coat on the surface of highly oxygenated perfluocarbon for tumor homologous targeting. Tumor hypoxia was monitored via in vitro immunofluorescence staining. Immunotherapy was conducted at 24 h post-injection of a biomimetic homologous-targeted oxygen-delivery system into xenografts. The efficacy of immunotherapy was evaluated using 68Ga-NOTA-GZP PET imaging and ex vivo biodistribution analysis. PET/CT scanning was performed 1 h after probe injection. Immunohistochemical analysis further validated the relationship between tumor uptake of 68Ga-NOTA-GZP and the expression level of CD8, CD3, TNF-α, INF-γ, and PD-1. ***Results:*** In vitro tumor hypoxia detection revealed significantly lower fluorescence intensity representing hypoxia in the oxygen-enhanced group compared to other groups ($P < 0.001$), indicating significant hypoxia relief. The initial labeling yield of 68Ga-NOTA-GZP was 99.99%, after 3 h of incubation with PBS, the labeling yield remained >99%. As for 68Ga-NOTA-GZP PET imaging after immunotherapy, the hypoxia-improved group exhibited the highest tumor site uptake (0.89 ± 0.13%ID/g) compared with the control group (0.32 ± 0.07 %ID/g) ($P < 0.01$). Additionally, the hypoxia-improved group demonstrated much higher tumor-to-blood ratios (T/B) and tumor-to-muscle ratios (T/M) than the control groups ($P < 0.05$). Biodistribution analysis at 2 h post-injection of 68Ga-NOTA-GZP revealed significantly higher accumulation in the hypoxia-improved tumor group (0.56 ± 0.03 %ID/g) compared to the control group (0.32 ± 0.06 %D/g,$P < 0.05$). High expression of CD8, CD3, TNF-α, and INF-γ were observed in the hypoxia-improved group, while control

groups showed moderate expression level. Quantitative analysis indicated a positive correlation between tumor uptake and the expression levels of CD8, CD3, TNF-α, and INF-γ, with no obvious correlation observed with PD-1 expression. ***Conclusion:*** We successfully improved the hypoxia of tumor microenvironment. Both the in vitro immunofluorescence staining and in vivo granzyme B targeted PET imaging confirmed enhanced activity of immune cells at tumor sites after improving the hypoxia. This study provided a new direction for enhancing the efficacy of tumor immunotherapy, and a non-invasive imaging method for therapeutic efficacy evaluation.

EP-0083

Evaluation of the intra-ventricular administration route in therapy delivery using TIM3 blockade antibody in a murine model of midline diffuse glioma: antibody radiolabeling and in vivo and ex vivo biodistribution studies.

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Aim/Introduction: Midline diffuse glioma (DMG) is a highly aggressive pediatric brain tumor and a leading cause of childhood cancer-related death. These tumors are incurable, which increases the need for effective therapies. It has been demonstrated that blocking TIM-3 (cellular receptor 2 for hepatitis A virus) in diffuse intrinsic pontine glioma models promotes regression and antitumor immune memory, prolonging disease-free survival. Intratumoral treatment in the spinal cord is not recommended, so alternative administration via cerebrospinal fluid in the brain ventricles has been proposed. The objective of this work is to evaluate this administration route in a murine model of DMG in the spinal cord using imaging techniques and ex vivo analysis with the anti-TIM3 antibody radiolabeled with technetium-99m. ***Materials and Methods:*** The antibody radiolabeling (BioXCell InVivoMAb 1mg) was performed by reducing technetium-99m with SnCl2 [40µl SnCl2·2H2O (1mg/ml)]. Three µl of 99mTc-TIM-3(26,2±1,1MBq) were administered intraventricularly to male albino C57 mice, and MicroSPECT/CT images were acquired at 0.5, 2, 4, and 20 hours post-administration. At 20 hours, animals were euthanised, organs excised and radioactivity quantified using a Gamma Counter. ***Results:*** Radiochemical Purity (radioTLC) in all cases was greater than 98%. In vivo and ex vivo biodistribution studies demonstrated that the anti-TIM-3 antibody drains along the spinal canal, reaching the tumor area within the first half-hour post-administration. At longer times (20 h), uptake remained stable. ***Conclusion:*** The anti-TIM3 antibody can be directly radiolabeled with technetium-99m with good yields. Biodistribution studies showed that the anti-TIM-3 antibody rapidly drains (30 min) along the spinal cord using this administration route and remains stable in the tumor lesion (20h), opening up the future possibility of its application in patients through an Ommaya catheter. Further work will be expanded through differential studies with L-[methyl-11C]-methionine to accurately delineate the tumoral area, as well as labeling of the anti-TIM3 antibody with gallium-67 to study its behavior over longer periods. ***References:*** Cancer Cell 2023 Nov 13;41(11):1911-1926.

EP-0084

^{18}F radiolabeled lipid-shell microbubbles for simultaneous PET/US imaging: radiolabeling and first in vivo studies

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Aim/Introduction: Positron Emission Tomography (PET) is a gold standard method for molecular, metabolic and quantitative imaging of relevant biomarkers.1 Ultrasound (US) is a real-time imaging modality for anatomical and functional imaging. Their combination will allow to study the microbubble biodistribution and quantification. To leverage the best profit of both modalities, lipid-shell microbubbles (µB) will be radiolabeled with fluorine-18. ***Materials and Methods:*** Biotin-avidin strategy2: The biotin-derivative precursor was radiofluorinated at 160ºC for 5 min on a (Trasis AIO). Then, the avidin was coupled with the 18F-biotin and purified by size-exclusion chromatography. Finally, the microbubbles were incubated with the ^{18}F-avidin complex (PBS, 10 min) to obtain de 18F-µB. As proof of concept, images of the liver were co-registered with a microPET scanner and a US transducer placed in the field of view of the scanner. Click chemistry strategies: the radiolabelled compounds $^{[18F]}$-FPyZIDE3 and $^{[18F]}$-FPyTCO were obtained in DMSO for 5 min at 160ºC or 15 min at 50ºC respectively (Trasis AIO). The SPAAC click reaction was performed between $^{[18F]}$-FPyZIDE and DBCO-liposomes/DBCO-µB in water/DMSO for 60 min. For the IEEDA strategy, the click reaction with $^{[18F]}$-FPyTCO and 3,6-di(4-pyridinyl)-1,2,4,5-tetrazin (as model compound) and MeTz-µB was tested. ***Results:*** Biotin avidin strategy: 18F-biotin derivative was obtained with 49% yield and 230±28 GBq/µmol m.a.. 18F-biotin incubation with avidin followed by NAP-10 purification allowed recovering 96% of 18F-biotinavidin complex. The obtained 18F-µB were injected in healthy mice. The images showed the colocalization of the radioactive signal and the contrast of µB in the liver after 2 min p.i.. After 15 min a renal elimination of the radioactive microbbubles/lipids was observed. Click Chemistry strategies: $^{[18F]}$-FPyZIDE was obtained with 56% yield and 491±2 GBq/µmol m.a.. The optimized SPAAC conditions allowed us to obtain the 18F-DBCO-µB with good yields (over 97%) and ready to inject. For the IEDDA, the radiolabeled $^{[18F]}$-FPyTCO was obtained with 35% yield. The click reaction with the model compound 3,6-di(4-pyridinyl)-1,2,4,5-tetrazin and MeTz-µB showed <40% and 0% conversion respectively. ***Conclusion:*** Lipid-shell-biotinylated microbubbles were successfully radiofluorinated using the bioinspired avidin-biotin strategy. The obtained microbubbles were tested on healthy mice establishing a proof of concept of microbubble radiofluorination and simultaneous PET/US imaging registration. The SPAAC reaction allowed to obtain 18F-µB with 97% radiochemical purity ready to inject.This chemical approach will be transferred to in vivo bimodal PET/US imaging. ***References:*** [1] Springer International Publishing: Cham, 2016/207, 177-205. [2] Bioconjug. Chem. 2017/28 (10), 2524-2529. [3] J Label Compd Radiopharm 2019/62 (2), 95.

EP-0085

Comprehensive Preclinical Study and Administration Protocol for ^{177}Lu-FAP-2286: Validation, Tumor Uptake, and Dosimetry Investigations

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Aim/Introduction: This study aimed to validate the process and methods for the production and quality control of 177Lu-FAP-2286. Additionally, a comprehensive preclinical investigation was conducted using xenograft models to assess tumor uptake through PET/CT imaging with 68Ga-FAP-2286. Furthermore, biodistribution studies in BALB/c mice and dosimetry investigations for 177Lu-FAP-2286 were performed, including the administration of amino acids and furosemide. ***Materials and Methods:*** The production and quality control of 177Lu-FAP-2286 were validated through a series of established processes and methods. Preclinical studies were conducted using 4T1, MCF-7, C6, and HEK-293 cell xenograft models in mice and rats. PET/CT imaging with 68Ga-FAP-2286 was utilized to investigate tumor uptake. Biodistribution studies were carried out in BALB/c mice, and dosimetry investigations included the administration of amino acids and furosemide, with a focus on kidney blockage using lysine and arginine. ***Results:*** The use of both lysine and arginine for kidney blockage, in combination with furosemide, resulted in significantly lower background activity in normal organs. PET/CT imaging revealed promising tumor uptake of 68Ga-FAP-2286. Biodistribution studies in BALB/c mice provided valuable insights into the distribution of 177Lu-FAP-2286. Dosimetry investigations yielded important data on the administration of amino acids and furosemide in relation to 177Lu-FAP-2286. ***Conclusion:*** The validation of production and quality control processes for 177Lu-FAP-2286, along with the comprehensive preclinical studies and dosimetry investigations, demonstrate the potential for effective clinical translation. The use of lysine and arginine for kidney blockage, in combination with furosemide, shows promise in minimizing background activity in normal organs.

EP-0086

^{68}Ga/^{177}Lu labeled bivalent imaging agents targeting hypoxia and PSMA in tumors

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Aim/Introduction: Prostate-specific membrane antigen (PSMA) overexpressed in prostate cancer cells, is an attractive target for prostate cancer diagnosis and therapy. Hypoxia is prevalent in nearly all solid tumor types, and various radioligands based on nitroimidazole can enter through passive diffusion and be trapped inside hypoxic cells. Integrating the nitroimidazole group into the structure of PSMA-targeted radiopharmaceutical holds the potential to enhance tumor uptake and retention. Based on this, we synthesized a series of bivalent nitroimidazole (NI)-PSMA agents (compound 1 - 8) incorporating a hypoxia-sensitive moiety (2-nitroimidazole) and a PSMA-targeting group (glutamate-urea-lysine, GUL). We also added different chelators (AAZTA, HBED-CC, and DOTA) for labeling with various nuclides (such as Ga-68, F-18, Lu-177, etc.). ***Materials and Methods:*** Precursor ligands, 1 - 8, were synthesized and labeled with [68Ga]Ga(III) or [177Lu]Lu(III). Radiochemical purity (RCP) and in vitro stability of the radioligands were determined by radio-HPLC and radio-TLC. In vitro cell uptake studies and competitive binding assays were conducted using PSMA-positive 22Rv1-FOLH1-oe cells. PET/CT imaging, SPECT/CT imaging, and biodistribution studies were performed in 22Rv1 tumor-bearing mice. ***Results:*** [68Ga]Ga-1 to 8 and [177Lu]Lu-8 were efficiently labeled with radiochemical purity > 95%. Among the [68Ga]Ga-complexes, [68Ga]Ga-8 ([68Ga]Ga-AAZTA-NI-PSMA-093) demonstrated superior properties in both in vitro and in vivo experiments. Under normoxic conditions, [68Ga]Ga-8 exhibited comparable cellular uptake and internalization to [68Ga]Ga-PSMA-093 and [68Ga]Ga-AAZTA-PSMA-093. However, compared to the nitroimidazole (NI)-free ligand ([68Ga]Ga-AAZTA-PSMA-093), [68Ga]Ga-8 demonstrated significantly higher cellular accumulation under hypoxic conditions than under normoxic conditions ($P < 0.05$), indicating the advantageous hypoxia-selective trapping conferred by the introduction of nitroimidazole group. Micro PET/CT imaging at 60 min post-injection demonstrated that [68Ga]Ga-8 displayed higher tumor uptake (SUVmax: 2.01 vs 1.53) and tumor-to-muscle ratio (T/M: 34.4 vs 9.15) compared to [68Ga]Ga-PSMA-11. Furthermore, compared to [68Ga]Ga-PSMA-093 (tumor SUVmax: 2.36, T/M: 21.9), [68Ga]Ga-8 also demonstrated excellent image contrast. Micro SPECT/CT imaging at 24 h post-injection revealed that [177Lu]Lu-8 exhibited excellent accumulation and retention in the tumor, along with rapid clearance from non-target tissues, comparable to [177Lu]Lu-PSMA-617. In biodistribution studies, [68Ga]Ga-8 demonstrated similar tumor uptake to [177Lu]Lu-8 (11.73 ± 3.96 vs 11.73 ± 3.98 %ID/g) and T/M ratio (15.07 ± 2.22 vs 13.45 ± 2.41) at 60 min post-injection, respectively. ***Conclusion:*** Preliminary studies indicate that [68Ga]Ga/[177Lu]Lu-8 ([68Ga]Ga/[177Lu]Lu-AAZTA-NI-PSMA-093) may be a promising bivalent agent targeting hypoxia and PSMA binding for diagnosis and radiotherapy. Clinical application is currently under investigation.

EP-0087

Exploring Mycoplasma pneumoniae persistence in murine tumors through radiolabeling with [^{111}In]In-oxinate and in vivo imaging with SPECT/CT.

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Aim/Introduction: Mycoplasma pneumoniae (Mpn) is believed to persist within lung tumors, suggesting its potential as a biotherapeutic agent to deliver treatments for this type of cancer. Our objective was to radiolabel an engineered non-pathogenic strain of Mpn (MpnCV8) with [111In]In-oxinate to evaluate its infective dynamics and persistence in a murine lung adenocarcinoma model using in vivo SPECT/CT imaging. ***Materials and Methods:*** In vitro feasibility of Mpn radiolabeling was assessed by incubating Mpn WT and CV8 strains (10E10 CFUs, n=2) with [111In]In-oxinate (≈6MBq, 37ºC, 15') and quantifying the uptake in a gamma-counter. The infection dynamics was studied in healthy mice by intratracheal administration of either free [111In]In-oxinate (control, n=3, 0.8Mbq/100µL) or 111In-MpnCV8 (10E07 or 10E08 CFU, n=3 per group, 0.9MBq/100µL). SPECT/CT images were acquired at 1,24,48,72, and 96h post-administration, and signal quantification performed by drawing VOIs in the lungs, calculating signal percentage relative to the

1h. A lung metastasis model (n=6) was created by intratracheal administration of 1x106 A549 cells, allowing tumors to grow for three weeks. Then, 10E7 111In-MpnCV8 were administered, and simultaneous SPECT/PET/CT images of Mpn biodistribution and [18F]FDG uptake in the tumors were acquired at 1,48,72 and 96h. ***Results:*** Mpn was radiolabelled in vitro with [111In]In-oxinate with high efficiency (>70%). In healthy animals, signal decrease in the lungs was faster in mice infected with 10E7CFUs compared to 10E8CFUs during the first 72h, showing a similar retention at 96h (≈55%). Free 111In-oxine showed different biodistribution with significantly more retention at late times (77±2% at 96h). In mice with lung tumors, 111In-MpnCV8 persistence was also significantly higher after 72h compared to healthy animals with a final overall retention of 73±6% at 96h. Simultaneous SPECT/PET/CT images showed preferential distribution of 111In-MpnCV8 in the tumor periphery over time, with consistent mismatch with [18F] FDG uptake in all the tumors. ***Conclusion:*** Radiolabeling of Mpn with [111In]In-oxinate is an effective method for in vivo tracking of its lung infection dynamics by SPECT/CT. The results seem to indicate that the 111In-MpnCV8 strain is capable of persisting in the tumors of the murine model to a greater extent over time as compared to healthy parenchyma, potentially modulating tumor metabolism. Molecular imaging techniques can aid in studying the distribution and biology of Mpn in lung tumors, providing insights into its potential as a biotherapeutic agent for this disease.

EP-0088

Novel generation of dimer based GRPR-targeting radioligands for breast cancer imaging and therapy.

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Aim/Introduction: The 2 most promising GRPR-targeted radioantagonists, RM2 and NeoBOMB1, have already been applied for breast tumor imaging. Nevertheless, their limited metabolic stability, caused mainly by the neutral endopeptidase, limits their in vivo performance and tumor-to-background contrast can be enhanced. Therefore, two novel dimeric radioligands were developed to improve accumulation in GRPR positive tumors. ***Materials and Methods:*** To design RM2-based dimers, different platforms were investigated to conjugate the two GRPR-targeting moieties and the bifunctional chelator. Thus, the hdPP-01 homodimer was synthesized via a 2-cyanobenzothiazole (CBT)/1,2-aminothiol click reaction, while the hdPP-02 dimer was prepared from a 1,3,5-triazine core. Labeling with 111In was carried out at 95 °C for 20 min in a solution containing ascorbic/gentisic acids (50 mM), sodium acetate (2.5 M) and L-methionine (50 mM). Affinity (IC50) to GRPR was determined using T-47D cells. In addition, cell uptake/internalization (37 °C, 60 min), lipophilicity (logD7.4) and in vitro metabolic stability in phosphate-buffered saline (PBS), murine serum (MS) and human serum (HS) were carried out. In vivo microSPECT/CT imaging studies, as well as biodistribution, are underway in GRPR tumor-bearing NMRI nude mice to confirm the potential of our dimers. ***Results:*** The novel homodimers, hdPP-01 and hdPP-02, were synthesized, purified and quantitatively radiolabeled with 111In (RCY> 99%, RCP> 98%). The radiolabeled complexes showed high hydrophilicity ([111In]In-RM2: -2.36 ± 0.02, [111In]In-hdPP-01: -2.13 ± 0.07, [111In]In-hdPP-02: -2.27 ± 0.04). They exhibited very good overall stability (> 90%) in HS and PBS at 37 °C for 24 h and an increased stability in MS compared to the monomeric RM2 (> 32% for the dimers vs. 12% for [111In]In-RM2 at 24 h). In vitro binding affinity studies resulted in nanomolar IC50 values for GRPR ([111In]In-RM2: 1.60 ± 0.17, [111In]In-hdPP-01: 3.69 ± 0.53, [111In]In-hdPP-02: 1.07 ± 0.13). Uptake and internalization studies showed increased overall uptake of the radiolabeled dimers compared to RM2 (overall uptake of [111In]In-RM2: 11.42 ± 0.77%, [111In]In-hdPP-01: 13.58 ± 1.15%, [111In]In-hdPP-02: 16.77 ± 0.83%), with loss of the antagonistic properties (increased internalized fraction). ***Conclusion:*** Based on their improved metabolic stability and very promising overall data, the novel GRPR-targeted homodimers might have the potential to outperform the current gold standards among GRPR-targeted ligands (RM2, NeoBOMB1) for targeted radiotherapy in breast cancer. These compounds are currently being evaluated in in vivo studies in tumor bearing mice.

EP-04

e-Poster Area

A: Preclinical Studies -> A1 Medical Preclinical -> A14 Preclinical Therapy

EP-0089

Preclinical evaluation of Cadherin 3 (CDH3) -targeted alpha radiopharmaceutical therapy, ^{225}Ac-PPMX-T002 for the treatment of solid cancer

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Aim/Introduction: Radiopharmaceutical therapy (RPT) typically uses an antibody to deliver primarily β- or α-particle emitting radionuclide to malignant cells in primary or metastatic tumors, selectively localizing it without affecting tissues that do not express the target antigen. CDH3, one of cadherin family, is associated with a more aggressive cancer cell phenotype and expressed minimally in normal adult human tissues. Thus, anti-CDH3 antibody is a promising tool for RPT against several solid cancer overexpressing CDH3 such as head and neck, ovarian, pancreatic and lung cancer. A phase 1 clinical trial of a radiolabeled anti-CDH3 antibody, yttrium-90 (90Y)-PPMX-T002 (former called FF-21101) has demonstrated the safety profile of the RPT with some early signs of antitumor activity (NCT02454010)1. On the other hands, anti-CDH3 antibody with more biologically effective warhead would be desirable for stronger efficacy leading to more benefit to patients. The linear energy transfer of α particles in tissue are much larger than that of β particles and can inflict much more damage to DNA in cancer cells. Here we report the preclinical efficacy data of actinium-225 (225Ac)-PPMX-T002 in comparison with 90Y-PPMX-T002. ***Materials and Methods:*** PPMX-T002 was labeled with 90Y or 225Ac via DOTA (1,4,7,10-tetraaza-cyclododecane-1,4,7,10-tetraacetic acid). The radiolabeled antibody was intravenously administered once into xenograft mouse with human pancreatic adenocarcinoma cell line HPAF-II. Biodistribution of 225Ac-PPMX-T002 was estimated by counting the radioactivity of the isolated each organ over time after the single administration. The maximum tolerated dose (MTD) of those antibodies was evaluated by measurement of the body weight. The efficacy was assessed by measuring tumor size and survival time xenograft mouse model. ***Results:*** Remarkable

tumor accumulation of 225Ac-PPMX-T002 was observed in the mouse xenograft model. The tumor uptake was 45.4 % ID/g on 7 days after dosing. MTD of 90Y- and 225Ac-PPMX-T002 was estimated to be 308 kBq/g or 1.42 kBq/g, respectively. The single administration of 225Ac-PPMX-T002 resulted in the complete inhibition of tumor growth at MTD or half dose of MTD without the regrowth of tumor during the experimental periods while 90Y-PPMX-T002 showed only partial inhibitory effects at MTD. Survival time analysis also demonstrated that 225Ac-PPMX-T002 has the remarkable efficacy, and superior to 90Y-PPMX-T002. ***Conclusion:*** 225Ac-PPMX-T002 RPT exhibited high anti-tumor efficacy with tolerable toxicity in animal experiments, suggesting the potential human clinical application. ***References:*** 1 Clin Cancer Res (2020) 26 (22): 5830-5842.

EP-0090

Therapeutic potential of a lead-212 labeled anti-PTK7 antibody in mice with intraperitoneal ovarian cancer

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Aim/Introduction: The transmembrane protein tyrosine kinase 7 (PTK7) is overexpressed in multiple cancer types, including ovarian cancer, making it of interest for molecularly targeted therapy. The current study was performed to evaluate the therapeutic potential of a novel chimeric anti-PTK7 monoclonal antibody, chOI-1, labelled with the in vivo alpha particle generator lead-212 (212Pb). To the best of our knowledge, there are no other reports on the potential for radionuclide therapy targeting PTK7. ***Materials and Methods:*** The affinity of chOI-1 variants for human PTK7 was evaluated by surface plasmon resonance (SPR) and binding to human ovarian cancer Skov-3-luc cells examined by flow cytometry. chOI-1 antibodies were conjugated to TCMC and radiolabelled with 212Pb. Radiochemical purity (RCP) and immunoreactive fraction (IRF) of the radiolabelled antibodies was determined by iTLC and one point cell assay, respectively. Therapeutic potential of [212Pb]Pb-TCMC-chOI-1 was evaluated in athymic nude mice inoculated intraperitoneally (i.p.) with 5×106 Skov-3-luc cells. The mice were treated i.p. 3 days post cell inoculation with saline, chOI-1 alone, 211 kBq or 384 kBq [212Pb]Pb-TCMC-hIgG, or 180 kBq or 405 kBq [212Pb]Pb-TCMC-chOI-1, at a constant antibody amount (10 µg), n=8 for each group. The animals were euthanised on day 52-53 and all i.p. tumours collected and weighed. ***Results:*** SPR analysis demonstrated KD values of 0.3 nM for chOI-1 against human PTK7. Flow cytometry confirmed the binding of chOI-1 to the Skov-3-luc cell line, with a KD of 16.9±2.8 nM. The RCP of [212Pb]Pb-TCMC-chOI-1 was ≥98% and cell experiments showed that the binding properties were retained after radiolabelling, with an IRF on Skov-3-luc cells of 66.3±4.4%. The average i.p. tumour weight was reduced 4-167-fold in the groups receiving [212Pb]Pb-TCMC-chOI-1 (0.003±0.005 g for 180 kBq; 0.007±0.010 g for 405 kBq) compared to controls. The difference was statistically significant ($p<0.009$) when compared to the saline (0.5±0.3 g) and chOI-1 group (0.4±0.2 g) but not versus the groups given unspecific [212Pb]Pb-TCMC-hIgG (0.12±0.09 g for 211 kBq; 0.03±0.02 g for 384 kBq). However, the tumour burden favoured treatment with [212Pb]Pb-TCMC-chOI-1. Amongst the sixteen [212Pb]Pb-TCMC-chOI-1 treated mice, no animal had a total tumour burden above 0.03 g, whereas 63% (10 of 16) of the mice given [212Pb]Pb-TCMC-hIgG did. ***Conclusion:*** The results from this study warrant further investigation of [212Pb]Pb-TCMC-chOI-1 as a candidate for targeted radionuclide therapy in PTK7-expressing ovarian cancer.

EP-0091

SSTR2-targeted peptide-drug conjugates for the selective inhibition of PARP1

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Aim/Introduction: Peptide receptor radiotherapy (PRRT) targets cancer cells using radiolabelled peptides, but the clinical response is limited, with inevitable disease progression. It has been postulated that the DNA damaging effect of radiotherapy can be potentiated by simultaneous inhibition of DNA repair, e.g. using poly-ADP-ribose-polymerase 1/2 (PARP1/2) inhibitors (PARPi). However, the off-tumour accumulation of PARPi into rapidly proliferating healthy cells can lead to dose limiting side effects, especially in combination therapy settings. We propose a strategy for the selective delivery of PARPi via peptide-drug-conjugates to limit the synthetic lethality of combination therapies to SSTR2-expressing tumour cells and increase the therapeutic index of PARPi/PRRT combination therapy in neuroendocrine tumours. ***Materials and Methods:*** Four SSTR2-targeted rucaparib (ruc) conjugates bearing a custom cyclen analogue for radiolabelling and a glutathione cleavable disulfide linker for intracellular ruc release were synthesized via solid phase peptide synthesis. We determined hydrophilicity (logD7.4) and cell uptake using 68Ga-labelled analogues of the drug conjugates. SSTR2-mediated ruc-delivery was assessed via fluorescence microscopy and flow cytometry. SSTR2-dependent cytotoxicity was determined via AlamarBlue assays. Furthermore, we performed PET imaging with two of the compounds in SSTR2-positive H69 xenograft-bearing mice. ***Results:*** The 68Ga-labelled compounds showed logD7.4 values between −2.58±0.04 and −2.10±0.19. We observed receptor-mediated cell uptake of [68Ga]Ga-Ruc-(PEG)4-TATE that was similar to [68Ga]Ga-DOTA-TATE after 60 min in AR42J (10.89±4.01% vs. 14.55±2.54%) and H69 cells (9.24±2.76% vs. 10.56±0.27%). Using the intrinsic fluorescence of rucaparib, we were able to confirm internalization into SSTR2-expressing cells, whereas minimal uptake was found in SSTR2-negative cells. Viability of SSTR2-expressing H69 cells was reduced after 72 h of treatment with 5 µM of either Ruc-TOC or Ruc-(PEG)4-TATE to 67.6±27.1% and 72.5±1.9%, respectively, as compared to untreated cells and SSTR2-negative HCT116-WT cells (viability >95%). Comparable treatment with free rucaparib reduced cell viability of H69 cells (44.8±4.67%) as well as of HCT116-WT cells (72.9±13.2%). Ruc-TOC and Ruc-(PEG)4-TATE showed specific accumulation in H69 tumours in vivo as determined via PET/MR imaging at 60 min post injection, with uptake values of 2.2 %ID/g and 2.7 %ID/g, respectively. The compounds were excreted renally and showed kidney uptake of 3.7 %ID/g and 2.9 %ID/g, respectively, while all other organs showed low uptake. ***Conclusion:*** We successfully synthesized multiple SSTR2-targeting rucaparib conjugates and observed efficient targeting and cell killing in vitro. SSTR2-dependent uptake was further demonstrated in preliminary in vivo evaluations along with favorable biodistribution and clearance profiles.

EP-0092

[$^{58m/55}$Co]Co-DOTA-hEGF as a novel theranostic pair with efficacy in targeted Auger-electron therapy of glioblastoma

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Aim/Introduction: Glioblastoma is the most common and aggressive primary brain tumour with a median survival of <16 months. The epidermal growth factor receptor (EGFR) is overexpressed in approximately 55% of glioblastomas, making it a highly relevant target. We present the development and preclinical evaluation of the theranostic pair [58m/55Co]Co-DOTA-hEGF for EGFR-targeted Auger-electron radiotherapy of glioblastoma. Cobalt-58m is a highly relevant radionuclide for emerging Auger-electron radiotherapy with favourable dosimetric properties, suitable half-life (9 h), and feasible production. ***Materials and Methods:*** Cobalt-58m and cobalt-55 were produced on a PETtrace cyclotron. DOTA-conjugated hEGF was radiolabelled with cobalt-58m, cobalt-55, or cobalt-57 by 2 min microwave heating. Cellular kinetics and distribution were measured with [57Co]Co-DOTA-hEGF in EGFR-positive LN229 glioblastoma cells, and A431 carcinoma cells. In vitro viability assessment of [58mCo]Co-DOTA-hEGF was performed using RealTime-Glo. In vivo kinetics of [57Co]Co-DOTA-hEGF was evaluated after intracranial administration in orthotopic glioblastoma-bearing rats by SPECT/CT and ex vivo biodistribution. In vivo therapeutic efficacy of [58mCo]Co-DOTA-hEGF was evaluated in the same rat model (n=6/group) following intracranial injection of 125±5 MBq. Side effects were assessed by blood and histological analyses. Large-brain intracranial distribution was evaluated in pigs infused with [55Co]Co-DOTA-hEGF administered through intracranial administration or convection-enhanced delivery (CED) for 3 hours during dynamic PET/MRI. ***Results:*** [58mCo]Co-DOTA-hEGF and [55Co]Co-DOTA-hEGF were labelled in high yields (98.8±0.6% and 93±6.2%, respectively) and radiochemical purities (95±2.7% and 89.3±0.6%, respectively) with apparent molar activities up to 67.4 MBq/nmol and 10 MBq/nmol. In vitro, [57Co]Co-DOTA-hEGF showed an EGFR-specific uptake (21-84%, 4 h) in both cell lines with rapid internalisation. 56-70% of the activity remained in the cells after 24 h. Up to 14.6% of the cell-associated activity was translocated to the nucleus where Auger-electrons are most effective. Consequently, cell viability was impaired by [58mCo]Co-DOTA-hEGF in a dose-dependent manner in both cell lines. Similarly, significant therapeutic efficacy was demonstrated in glioblastoma-bearing rats with 67% survival of [58mCo]Co-DOTA-hEGF-treated rats 90 days after therapy, with 0% survival of untreated rats and 17% of DOTA-hEGF (vehicle) treated rats. No adverse effects were detected. [57Co]Co-DOTA-hEGF was strongly retained in the brain of glioblastoma-bearing rats with little-to-no uptake outside of the brain. In pig studies, a broad intracranial large-brain distribution was observed by CED administration of [55Co]Co-DOTA-hEGF. ***Conclusion:*** We report excellent efficacy and wide intracranial distribution in a large-brain model of the novel theranostic Auger-electron radiotherapy pair [58m/55Co]Co-DOTA-hEGF. Our results warrant clinical translation for image-guided EGFR-targeted therapy of glioblastoma, via intracranial CED administration.

EP-0093

PARP1-targeted alpha therapy enhances target expression

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Aim/Introduction: Alpha particle therapy has high relative biologic effectiveness but does not always result in targeted cell kill. Cells damaged, but not destroyed, by therapy represent an important vector for relapsed and potentially treatment resistant disease if the sublethal therapy inhibits target expression. We hypothesized that targeting activated PARP1, a DNA damage repair enzyme, could increase target expression in sublethally damaged cells as the DNA damage from treatment would induce PARP1 expression. This could potentially enhance the efficacy of fractionated therapy. [^{18F}]FTT is a PET/CT probe that binds to active PARP1 based on the PARP inhibitor rucaparib. [211At]PTT is an alpha-emitting analog. We aimed to test whether [211At]PTT therapy would increase PARP1 expression as measured by [^{18F}]FTT PET/CT and immunofluorescence. ***Materials and Methods:*** IMR-05 (neuroblastoma) flank xenografts were established in female NSG mice (n=3 per group). Two weeks after implantation, imaging of activated PARP1 expression was performed with [^{18F}]FTT PET/CT (10-minute scan 60 minutes after injection). The next day, 370 kBq [211At]PTT was administered IV. PET/CT was repeated at 2 and 6 days after treatment. Regions of interest were drawn around tumors and %ID/g was measured, corrected for decay. Comparisons were evaluated using a paired t test. After imaging, tumors were resected, frozen, and sectioned for immunofluorescence for PARP1 and gammaH2AX, with Hoechst 33342 used to counterstain the nuclei. ***Results:*** Tumor uptake of [^{18F}]FTT increased 25.4% from baseline to day 2 ($p<0.05$), with a decrease back towards baseline by day 6. Indeed, there was no significant difference in uptake at day 6 compared to baseline ($p=0.55$). Immunofluorescence confirms a similar degree of baseline nuclear PARP1 expression at baseline and day 6 with minimal gammaH2AX staining at baseline. On day 2, there is significant gammaH2AX staining with overlapping increase in PARP1 staining. ***Conclusion:*** PARP1-targeted alpha radiopharmaceutical therapy causes a transient increase in nuclear activated PARP1 expression in neuroblastoma xenografts. This creates the potential for fractionated therapy to potentially enhance the therapeutic ratio.

EP-0094

Prostate-specific Membrane Antigen-Targeted Radionuclide Therapy as a Novel Therapeutic Approach in a Syngeneic Immunocompetent Murine Model for Oral Squamous Cell Carcinoma

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Aim/Introduction: The prostate-specific membrane antigen (PSMA) is a clinically implemented target for patients with metastatic castration-resistant prostate cancer. However, its expression on tumour-associated neovasculature also makes PSMA a promising target in other malignancies, such as oral squamous cell carcinoma (OSCC). We aimed to assess the effects of PSMA-targeted radionuclide therapy (TRNT) with [177Lu]Lu-PSMA-I&T on tumour growth in a syngeneic orthotopic immunocompetent murine model for OSCC. ***Materials and Methods:*** MOC-1 oral squamous carcinoma cells were cultured and injected (7.5 × 105 in a 15 µL DMEM/15 µL Corning® Matrigel® Matrix mixture) into the left anterior lateral tongue of adult male C57BL/6J mice (n = 13). Eleven days after inoculation, mice within the treatment group (n = 5) received a mean (± SD) single intravenous dose of 152 ± 6 MBq [177Lu]Lu-PSMA-I&T in ≤ 200 µL; animals in the control group (n = 8) received 200 µL of phosphate-buffered saline intravenously. Animals were weighed and caliper measurements-based tumour volumes were calculated twice weekly during 5 weeks. After sacrification, formalin-fixed, paraffin-embedded tumour tissue sections were stained with haematoxylin-eosin and immunohistochemically evaluated for PSMA and endothelial marker CD31. Growth rates were calculated between sequential volume measurements, and between each volume measurement and baseline volume. ***Results:*** In the group treated with [177Lu]Lu-PSMA-I&T, tumour growth was initially restained, with a significantly lower mean volume compared to the control group 4 days after treatment (p = 0.039). In the treatment group, mean volume initially decreased and was significantly lower 6 days after treatment (p = 0.042). The suppressive effect on tumour growth stagnated one week after treatment, whereafter mean volume increased again. However, mean volume remained significantly lower (p = 0.012-0.040) in the treatment group until 30 days after treatment. Growth rates based on sequential volume measurements did not differ significantly between the two groups, but growth rates based on volume measurements compared to baseline did between 10-21 days after treatment (p = 0.003-0.015). ***Conclusion:*** This study is the first to investigate the effects of PSMA-TRNT in an immunocompetent murine model for orthotopically induced OSCC. Our results suggest that a single intravenous dose of c. 150 MBq [177Lu]Lu-PSMA-I&T not only temporarily impeded tumour growth, but also decreased tumour volume in the MOC-1 model. This highlights the potential of PSMA as a novel target for TRNT in mice with OSCC, and advocates further trials with radionuclide therapy in OSCC with regards to dosage and regimen optimisation.

EP-0095

Targeting ATM reverses radioiodine resistance in differentiated thyroid cancer via genotoxic stresses

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Aim/Introduction: Ataxia-telangiectasia mutated (ATM) is a mutated gene associated with ataxia-telangiectasia disease, encoding a serine/threonine protein kinase. ATM plays a crucial role in maintaining genomic stability by participating in DNA damage repair and cell cycle regulation. It has been implicated in the oncogenesis of various tumors. However, its expression status and clinical significance in thyroid cancer (TC) remain poorly understood. This study aimed to elucidate ATM's role in TC progression and assess its potential as a therapeutic target for TC. ***Materials and Methods:*** Formalin-fixed, paraffin-embedded excised papillary thyroid cancer (PTC) tumor tissue microarrays (TMA) were subjected to immunohistochemistry (IHC) to analyze ATM protein expression levels in PTC. Single-cell transcriptomic and genetic alteration data from patients with various TC subtypes were utilized to examine ATM expression trends across TC subtypes. In vitro, cultured PTC cell lines were used to investigate the mechanism of radioactive iodine (RAI)-131I-induced PTC cell death via RNA sequencing (RNA-seq), immunofluorescence staining, comet assay, and flow cytometry. The synergistic anti-tumor effect of ATM inhibitor and 131I was assessed through CCK8, clone formation, and flow cytometry assays. Furthermore, an in vivo xenograft mouse model of PTC was established to validate the radio-sensitizing effect of ATM inhibitors. ***Results:*** TMA analysis demonstrated heightened ATM expression in radioiodine-resistance (RAI-R) PTC compared to normal PTC in both primary tumors and metastatic lymph node samples. Single-cell analysis revealed a direct correlation between ATM expression levels and the progression of TC malignancy, with increased levels observed in anaplastic thyroid carcinoma (ATC) compared to PTC and normal thyroid tissue. RNA-seq analysis following 131I radiation exposure indicated activation of the DNA damage response (DDR) pathway and cell cycle arrest. Both in vivo and in vitro experiments supported the potential of ATM inhibition to enhance PTC sensitivity to 131I therapy, leading to tumor cell apoptosis via cell cycle regulation. ***Conclusion:*** ATM expression is correlated with the degree of TC malignancy and may play a role in the development of RAI-R by regulating the cell cycle. Additionally, ATM could serve as a therapeutic target for RAI-R in differentiated thyroid cancer (DTC) through genotoxic mechanisms.

EP-0097

Preclinical Evaluation of a Novel Clearing Agent-Independent Approach for Pretargeted Alpha Therapy with ^{212}Pb.

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Aim/Introduction: Over the years, various pretargeted radioimmunotherapy (PRIT) modalities have been proposed to improve the therapeutic window of systemic radiotherapy. These approaches typically involve a tumour-targeting bispecific antibody (BsAb) that distributes within target tissue, followed by a small radiolabelled molecule that efficiently binds pretargeted sites or is rapidly excreted. An intermediate step is often needed to clear or neutralise circulating pretargeting antibodies that

could otherwise capture the radioligand off-tumour. PRIT thereby minimises healthy tissue exposure while increasing the tumour absorbed dose, which is particularly impactful using short-lived radionuclides such as 212Pb (t1/2 = 10.6 h). However, the logistical complexity and added safety risks of incorporating clearing agents pose challenges to the clinical implementation of PRIT. We therefore developed a novel two-step, clearing agent-independent PRIT regimen for carcinoembryonic antigen (CEA)-positive tumours, involving a complementary bispecific antibody pair and a 212Pb radioligand. Efficacy and tolerability of this two-step PRIT approach were compared with a corresponding three-step PRIT scheme. ***Materials and Methods:*** Mice bearing subcutaneous CEA-expressing BxPC3 xenografts received the two pretargeting antibodies with specificity for CEA and a split high-affinity sub-pM 1,4,7,10-Tetrakis(carbamoylmethyl)1,4,7,10-tetraazacyclododecane (DOTAM) binder: one antibody carrying the VH and the other the VL domain. Tumour-bound, these split VH and VL domains assemble to form the complete binder for the radiolabelled effector molecule 212Pb-DOTAM, administered 7 days later. Another group of mice received a pretargeting CEA-DOTAM BsAb with a complete 212Pb-DOTAM binder. After 7 days, circulating BsAb was neutralised using a dextran-based clearing agent, followed by 212Pb-DOTAM after 24 hours. Two- and three-step CEA-PRIT were compared in terms of 212Pb biodistribution, tumour growth inhibition, and tolerability after three treatment cycles of 0.74 MBq. ***Results:*** Two- and three-step CEA-PRIT significantly and comparably delayed tumour growth, with mild transient body weight loss. Excellent 212Pb tumour specificity was confirmed, with an average tumour uptake of 25-30% of the injected activity per gram of tissue (IA/g) at 24 h p.i. for two-step PRIT and 36-45% IA/g for three-step PRIT, while the blood and kidney retention was <0.5% IA/g and <2 %IA/g, respectively, for both regimens. ***Conclusion:*** Therapeutic efficacy was demonstrated for the novel two-step CEA-PRIT approach, with biodistribution and tolerability data confirming preferential retention of 212Pb-DOTAM in tumours rather than in circulation, suggesting that the logistically complex three-step regimen is obsolete. Translation of this optimised approach to a phase I trial is anticipated, offering potential improvements in the clinical implementation of PRIT.

EP-0098

Combination therapy of benfo-oxythiamine and Luetium-177-PSMA radionuclide therapy in a preclinical prostate cancer model

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Aim/Introduction: Prostate cancer is the second most common cancer in men, as well as the most common cause of cancer-associated deaths in men. Therapy options include surgery, androgen deprivation therapy (ADT), chemotherapy and radioligand therapy. The outlook for patients with localized disease is positive, but metastatic castration-resistant prostate cancer (mCRPC) remains a lethal diagnosis. Therefore, there is a need for new and improved therapeutic approaches. Tumor-specific metabolic reprogramming is widely accepted as an emerging hallmark of cancer. In later stages of prostate cancer, when numerous mutations are accumulated, the Warburg effect is exhibited in tumor cells and causes a high glucose uptake. Thus, targeting cancer the cell metabolism can be a promising strategy for the improvement of prostate cancer therapy. Here, we investigate the anti-cancer potential of benfo-oxythiamine (BOT), a vitamin B1 mimetic, in combination with prostate-specific membrane antigen (PSMA) directed radionuclide therapy (PRLT) in vitro. ***Materials and Methods:*** The anti-proliferative potential of BOT or Oxythiamin (OT) together with ADT was quantified by MTT assay in the PSMA-expressing prostate cancer cell lines LNCaP and LNCaP C4-2. The influence of BOT or OT treatment on androgen receptor (AR) and PSMA protein levels was determined in western blot experiments. Growth inhibitory effects of radioligand therapy with Lutetium-177-PSMA I&T in combination with BOT were assessed by colony formation assay. ***Results:*** BOT and OT reduced cell viability in both investigated prostate cancer cell lines in a dose-dependent manner: BOT displayed a half-inhibitory concentration of 1.1 mM in LNCaP cells and 1.2 mM in LNCaP C4-2 cells. OT had approximately 7-fold higher half-inhibitory concentration in both, LNCaP cells (7.9 mM) and LNCaP C42 cells (9.1 mM). In protein extracts, PSMA levels were reduced in OT treated LNCaP C4-2 cells in comparison to BOT treated cells. Treatment with BOT or OT in combination with ADT increased AR levels in comparison to ADT treatment alone. BOT treatment significantly reduced colony formation capacity of LNCaP C4-2 cells alone, as well as in addition to PRLT. ***Conclusion:*** The thiamine mimetics BOT and OT can reduce growth of prostate cancer cell lines in vitro. We confirmed an additive effect of BOT treatment in combination with Lutetium-177-PSMA I&T in a PSMA expressing prostate cancer cell line. Further investigation of the involved molecular processes could provide a rationale for the evaluation of the therapeutic potential of combinatory treatment of nutraceutical compounds together with radionuclides in prostate cancer.

EP-0099

Targeting the DNA Damage Response Boosts Radiopharmaceutical Therapy Efficacy in Castration-Resistant Prostate Cancer

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Aim/Introduction: 177Lu-PSMA-617 radiopharmaceutical therapy (RPT) is an encouraging treatment for men with metastatic castration-resistant prostate cancer (CRPC). However, half of the treated patients do not respond, and progression is inevitable. Thus, to enhance the radiobiological effect of RPT, we pharmacologically disrupted the DNA damage response (DDR) of CRPC cells through combined poly-(ADP-ribose) polymerase 1 (PARP1) and bromodomain and extra terminal (BET) proteins inhibition. ***Materials and Methods:*** We developed ART-101, a longer-acting PSMA-targeting molecule with superior pharmacology than PSMA-617, and employed 177Lu-ART-101 for our combination studies. In vitro, cytotoxicity was determined in PC3-PIP, LNCaP, and 22Rv1 cells treated with 0.3 nM-1 mM Talazoparib (TAZ: PARPi), JQ1 or ABBV-075 (BETi), or combinations. IC50s were determined, and combination effects were evaluated between treatments using established synergy models. Expression changes in the DDR gene (ex. BRCA1/2 and RAD51) were measured 24h-post treatment with BETi by qPCR. In addition, Monte Carlo-based in vitro 177Lu dosimetry estimates

enabled the determination of the absorbed dose-survival response relationship and the combination effects of RPT+BETi. In vivo, 8-week-old male nude mice (N= 5-10) bearing PC3-PIP xenografts received daily oral (for 14 days) TAZ (0.5 mg/kg), ABBV-075 (1 mg/kg), TAZ+ABBV-075, or intravenous 177Lu-ART-101 (18.5 or 37 MBq) alone or combined with TAZ, ABBV-075 or TAZ+ABBV-075. Tumor growth, overall survival, and toxicity were monitored thrice weekly ***Results:*** ABBV-075 showed nanomolar cytotoxic IC50s (100-300 nM) in all cell lines. Interestingly, only 22Rv1 cells responded to TAZ (IC50= 0.4 μM). Synergistic effects were observed for some TAZ+JQ1 combinations in LNCaP and 22Rv1 (CI>10; HAS and Loewe models). Treatments with BETi (0.3 and 3 μM) led to the downregulation of DDR genes BRCA1/2 and RAD51 in all cells: 1.6- to 50-fold difference between treated cells and control. Combination treatments of 177Lu with TAZ/BETi or TAZ+BETi resulted in enhanced cytotoxicity compared to either treatment alone, supporting the purported mechanism of cooperation between 177Lu and DDR disruption. In vivo, 177Lu-ART-101 alone or combined with TAZ/ABBV-075 or TAZ+ABBV-075 demonstrated a strong tumor growth inhibition compared to single-arm treatments. Notably, 177Lu-ART-101 exhibited stronger antitumor effects than 177Lu-PSMA-617, suggesting a potential for an injected-activity de-escalation when combined with DDR inhibitors, thus improving the overall safety of the combination treatment. ***Conclusion:*** Our studies demonstrate the potential of pharmacological DDR inhibition to boost radiobiological response in CRPC. Our preclinical data strongly supports the clinical feasibility of combining TAZ and ABBV-075, two clinical-stage drugs, and RPT in CRPC patients.

EP-0100

[177Lu]Lu-AKIR001 Inhibits Growth of Pancreatic Tumour Xenografts

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Aim/Introduction: Despite therapeutic advancements during the last decades, only a modest increase in overall survival has been seen for pancreatic ductal adenocarcinoma (PDAC) patients. PDAC is refractory to both immuno-, and chemotherapy as well as external beam radiation, surgical resection is currently the only possibility to cure patients. Unfortunately, that is only feasible for the minority that present with local disease. Molecular radiotherapy has the potential to overcome these challenges, and could target both metastases and micrometastases, hopefully returning the cancer to an operable state. This study aimed to assess the anti-CD44v6 antibody AKIR001 labelled with 177Lu as treatment for PDAC, both alone and combined with chemotherapy. ***Materials and Methods:*** chemotherapy.Four PDAC cell lines were evaluated in vitro for CD44v6 expression and specific uptake of [177Lu]Lu-AKIR001. Sensitivity towards paclitaxel and gemcitabine was determined for the BxPC3 cell line. Biodistribution as well as therapeutic effects were studied in Balb/c nu/nu mice bearing BxPC3 tumour xenografts. The therapy study included five treatment groups: PBS control, [177Lu]Lu-AKIR001 monotherapy (4 MBq and 12 MBq), paclitaxel monotherapy, and combination (4 MBq [177Lu]Lu-AKIR001 with paclitaxel). SPECT imaging was conducted to confirm tumour uptake and continuous monitoring of haematoxicity was performed by blood sampling during the study. ***Results:*** All cell lines demonstrated specific [177Lu]Lu-AKIR001 uptake, but BxPC3 had the highest CD44v6 expression and was selected for further experiments. BxPC3 was more sensitive to paclitaxel than gemcitabine (IC50 1.74 vs. IC50 13.50), warranting the choice of paclitaxel for the combination therapy. High and specific tumour uptake in vivo was confirmed by biodistribution (>100%ID/g tissue 96h post-injection) and SPECT imaging. Paclitaxel monotherapy resulted in a modestly increased median survival compared to controls (20 days vs. 13.5 days). At day 46 post-treatment, the percentage tumour-free animals was 80% with 12 MBq, 60% with 4 MBq, and 25% with combination therapy. A slight decrease in white blood cells was observed after treatment with 12 MBq and combination, but levels were quickly restored to baseline. ***Conclusion:*** In conclusion, [177Lu]Lu-AKIR001 monotherapy inhibited tumour growth in vivo and led to prolonged survival without signs of severe haematoxicity, but paclitaxel did not increase the effect. [177Lu]Lu-AKIR001 may be a feasible treatment option for PDAC in the future, but further investigation and optimization of doses and suitable combinations is required.

EP-0101

Evaluation of [^{177}Lu]Lu-radiolabelled bombesin antagonists as potential candidates for GRPR-targeting therapeutic use in prostate cancer

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Aim/Introduction: Gastrin releasing peptide receptor (GRPR) belongs to the bombesin receptor family and is frequently overexpressed in prostate cancer. This study is focused on evaluation of the following analogs: AU-RM26-M2 (DOTAGA-PEG2-Pip-[Sar11]RM26), AU-RM26-M4 (DOTAGA-Arg-Arg-Pip-[Sar11]RM26), AU-SAR-M1 (DOTAGA-AMA-Dig-D-Phe-Gln-Trp-Val-Sar-His-Leu-NHEt) and AU-SAR-M2 (DOTAGA-Arg-AMA-Dig-D-Phe-Gln-Trp-Val-Sar-His-Leu-NHEt) labeled with the therapeutic radionuclide Lu-177.These analogs have been previously chosen as potential radiotherapeutic agents(1,2). ***Materials and Methods:*** After labelling with Lu-177 the radiolabeled analogs were compared in vitro and in vivo. The specificity and cellular uptake over time were tested in PC-3 cells.For in vivo stability, blood from healthy NMRI mice (with/without NEP inhibitor saccubitril pretreatment), was collected 5min pi and analyzed with radio-HPLC. The biodistribution profile of labeled antagonists was tested in PC3 xenografed Balb/c nu/nu mice (pretreated with saccubitril) 4h and 23h pi. ***Results:*** All tested peptides were labeled with Lu-177 with high radiochemical yields (>98%) and high radiochemical purity (>97%). The radiolabeled analogs showed high affinity and specificity for GRPR in vitro. High activity uptake in PC-3 cells demonstrating a typical cellular internalization pattern for radioantagonists. In murine peripheral blood, pre-treatment with saccubitril resulted in a substantial increase of the intact peptide (stability improvement: 13-21%, reaching >80%). All peptides had rapid renal clearance from blood and non-GRPR-expressing tissues. Tumor's activity uptake 4h pi was the highest for [177Lu]Lu-AU-RM26-M4 (19.6%IA/g), followed by [177Lu]Lu-AU-SAR-M1 and [177Lu]Lu-AU-SAR-M2 (16.2 and 15.1%IA/g), and the lowest for [177Lu]Lu-AU-RM26-M2 (4.7%IA/g). Retention of activity in tumors was the best for [177Lu]Lu-AU-RM26-M4 (13.5%IA/g 23h pi). Activity uptake in GRPR-expressing organs (pancreas, stomach and small intestines) didn't show any significant difference. At

23h pi, all healthy tissues, except kidney, demonstrated activity uptake much below uptake in tumors. The highest ratio between AUCs (4-23 h pi) for tumors and kidneys was found for [177Lu]Lu-AU-SAR-M1 (5.4-fold). Under GRPR blocking all analogs showed significant decrease in tumor uptake.[177Lu]Lu-AU-RM26-M4 had the highest kidney uptake at 4h pi (6.1%IA/g), but there was no statistical difference between analogs at 23h ***Conclusion:*** Four new GRPR antagonistic analogues were labeled with Lu-177 and tested on the utility for GRPR-targeting radiotherapy. [177Lu]Lu-AU-RM26-M4, [177Lu]Lu-AU-SAR-M1, and [177Lu]Lu-AU-SAR-M2 demonstrated favorable properties for therapeutic radioligand, i.e. rapid clearance, high in vivo stability, high specific uptake in tumors, and low uptake in excretory organs. Based on tumor retention ratios and the lowest kidney uptake, [177Lu]Lu-AU-SAR-M2 is considered the most promising for a follow up therapy study. ***References:*** (1) Kanellopoulos et al. EJNMMI Radiopharm Chem. 2024;9(1):13 (2) Obeid et al. Pharmaceutics. 2024;16(4):513.

EP-0102

Development of Pb-203 Labeled SSTR-Targeting Peptides as Surrogates for Pb-212 Labeled Radiopharmaceuticals

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Aim/Introduction: Somatostatin receptor subtype 2 (SSTR2) is a key target molecule for peptide receptor radionuclide therapy (PRRT) in neuroendocrine tumors (NET). This study aims to assess the feasibility of Pb-203 labeled peptides as surrogates for Pb-212 labeled radiopharmaceuticals. ***Materials and Methods:*** SSTR2 agonists (i.e., DOTATATE, PSC-PEG2-TOC) and antagonists (i.e., DOTA-LM3, DOTA-PEG2-LM3) were radiolabeled with Pb-203 and evaluated to identify the most promising candidate for PRRT. The labeling efficiency and stability (in saline, human serum; up to 48 h) of the Pb-203 labeled peptides were determined using radio instant thin layer chromatography-silica gel (iTLC-SG) with 0.1 M citric acid, 50% acetonitrile and 75% MeOH as mobile phases. In vivo SPECT/CT imaging and biodistribution studies with the administrations of 203Pb-DOTATATE and 203Pb-PSC-PEG2-TOC were conducted in normal mice (tumor free) to evaluate the initial pharmacokinetics of the radiopharmaceutical candidates. In a separate study, 68Ga-DOTATOC PET/MRI and 177Lu-DOTATATE SPECT/CT imaging was performed in AR42J (SSTR2 positive) and MDA-MB-231 (SSTR2 negative) tumor-bearing mice for the baseline evaluation of NET mouse models. ***Results:*** Excellent radiochemical purity (>98%) was observed for all investigated Pb-203-labeled peptides (DOTATATE, PSC-PEG2-TOC, DOTA-LM3, and DOTA-PEG2-LM3). The stability of the radiopeptides in both saline and human serum was higher than 95% for 48 hours at 37°C. Initial in vivo imaging data suggested that 203Pb-PSC-PEG2-TOC exhibited rapid excretion via the kidneys, with significantly lower retention, compared to 203Pb-DOTATATE for 48 hour (1.18 vs. 2.59%ID/g). In addition, the imaging data using the AR42J-bearing mouse model confirmed the specific tumor uptake of 68Ga-DOTATOC and 177Lu-DOTATATE (15.07 ± 6.05 for AR42J tumors vs. 2.19 ± 0.49 for MDA-MB-231 tumors; 68Ga-DOTATOC; $P < 0.001$). ***Conclusion:*** The SSTR2-targeting peptides investigated exhibited excellent radiolabeling performance and stability with Pb-203. The imaging data suggested the feasibility of using Pb-203-labeled radiopharmaceuticals as surrogates for Pb-212 counterparts, potentially enabling Pb-203 image-guided Pb-212 therapy for NET. Further studies will be followed to evaluate thetherapeutic potential of Pb-212-labeled radiopharmaceutical candidates in NET mouse models.

EP-0103

Multimodality imaging with SPECT/CT and BLI to analyze the efficacy of hepatitis B vaccine candidates

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Aim/Introduction: : To prevent Hepatitis B virus (HBV) infection, the large hepatitis B virus antigen (L-HBsAg), a protein on the surface of HBVs, is used as an antigen, but its effect alone is insignificant. In order to strengthen the immune response, it is common to use antigens and adjuvants together in vaccine candidates, so various adjuvants are being developed. For vaccine candidates consisting of antigens and adjuvants, antigen distribution is important in evaluating vaccine efficacy. Therefore, in this study, SPECT/CT was used to image vaccine candidates and track the distribution of antigens according to different adjuvant compositions. ***Materials and Methods:*** L-HBsAg was labeled with radioactive iodine (125I-L-HBsAg). C57BL6.Albino mice was inoculated with 125I-L-HBsAg or/and Pam3CSK4 or/and Poly(I:C) via intramuscular injection. 125I labeled L-HBsAg was monitored using animal SPECT/CT. To visualize the dynamics of immune cells following vaccination, splenocytes of luciferase transgenic mice were intravenously injected into B6.Albino. Bioluminescence imaging (BLI) signals were acquired using an IVIS 100 System. ***Results:*** Comparing the signal strength and persistence of 125I-L-HBsAg at the injection site after vaccination using SPECT/CT, the mixture of L-HBsAg, Pam3CSK4 and Poly(I:C) administrated group remained highly expressed until 5 days. As a result of visualizing the dynamics of immune cells with BLI after vaccination, the highest expression was seen at the injection site on day 6. Compared to L-HBsAg alone, 3.09 and 4.43-fold higher BLI signals were observed in the group inoculated with one or two types of adjuvants. [유-1] At the spleen, 1.75- and 2-fold higher BLI signals were observed, respectively. In the right inguinal lymph node, the BLI signal from splenocytes of antigen/adjuvants mixture remained higher than antigen alone at all time point. and was 4.73 fold higher on the day 6. In addition, when two adjuvant mixture were administered, IFN- γ secreting cells were observed to be 16 times more than antigen only, and the total IgG response was also observed to be 12 times higher. The increase of luciferase+CD45+ cells demonstrated higher immune responses and increased function in both T and B cells. ***Conclusion:*** PECT/CT with iodine-labeled antigen and BLI of immune cell dynamics allowed successful evaluation of the efficacy of adjuvants in vaccine candidates. In this study, we confirmed that TLR-associated adjuvant to promote immune responses induced more effective immune response than using HBsAg alone.

EP-05

e-Poster Area

A: Preclinical Studies -> A1 Medical Preclinical -> A15 Other Medical Preclinical

EP-0104

Application of TSPO-specific ^{18}F-GE180 PET for the prediction of propacetamol-induced acute liver failure

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Aim/Introduction: Acetaminophen overdose frequently leads to acute liver failure (ALF). Predicting fatal disease progression is crucial for effective therapeutic planning. Translocator protein (TSPO), formerly known as peripheral benzodiazepine receptor, plays a pivotal role in molecular transport, oxidative stress, apoptosis, and energy metabolism. In this study, we aimed to assess whether earlier diagnosis of ALF is feasible using TSPO PET with 18F-GE180. ***Materials and Methods:*** ALF was induced in mice by intraperitoneal administration of propacetamol (a prodrug form of acetaminophen) at a lethal dose of 1500 mg/kg. 18F-GE180 PET images were acquired after 3 hours, and mean standardized uptake values (SUVav) of the liver were determined. TSPO expression levels were assessed using real-time polymerase chain reaction and Western blotting analysis, including histological analysis. ***Results:*** The liver SUVav in the group receiving the lethal dose of propacetamol showed a significant increase compared to the control group ($p = 0.001$ by Mann-Whitney test). During the 48-hour observation period, 6 of the 11 mice did not survive while 5 survived. The liver SUVav in the non-survived group demonstrated a significant increase compared to the survived group ($p = 0.045$ by Mann-Whitney test). Furthermore, both mRNA and protein levels of TSPO were elevated in the ALF group. Immunohistochemistry in the liver of propacetamol-induced liver failure group showed significantly higher TSPO protein expression than the control group. ***Conclusion:*** The TSPO-specific 18F-GE180 PET enabled visualization of propacetamol-induced ALF through TSPO overexpression. These findings highlight the potential utility of hepatic uptake by TSPO PET as a non-invasive imaging biomarker for the early stages of ALF. ***References:*** 1. Yoon, E., Babar, A., Choudhary, M., Kutner, M., & Pyrsopoulos, N. (2016). Acetaminophen-induced hepatotoxicity: a comprehensive update. Journal of clinical and translational hepatology, 4(2), 131.2. Meng, Y., Tian, M., Yin, S., Lai, S., Zhou, Y., Chen, J., ... & Liao, Z. (2020). Downregulation of TSPO expression inhibits oxidative stress and maintains mitochondrial homeostasis in cardiomyocytes subjected to anoxia/reoxygenation injury. Biomedicine & Pharmacotherapy, 121, 109588.3. Fan, Z., Calsolaro, V., Atkinson, R. A., Femminella, G. D., Waldman, A., Buckley, C., ... & Edison, P. (2016). Flutriciclamide (18F-GE180) PET: first-in-human PET study of novel third-generation in vivo marker of human translocator protein. Journal of Nuclear Medicine, 57(11), 1753-1759.

EP-0105

In vivo evaluation of new fibroblast activation protein (FAP) inhibitor as a tumor diagnostic tracer

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Aim/Introduction: Due to high prevalence of cancer in all around the world, early imaging of tumor sites is very important step in their successful treatment. Tumor stroma comprises a significant mass (> 90%) of solid tumors and FAP is highly expressed in that environment without being found in healthy tissues, the strategic targeting of FAP emerges has gained more interest in recent researches. FAP is a key role in feeding, removing waste products from tumors and their evading from immune system (1-2). In present study, we aim to introduce a new FAPI labeled 68Gallium which can detect various cancers. ***Materials and Methods:*** A new cyclic peptide targeting FAP was designed and synthesized using solid phase method. The 68Ga-labeling process was done via DOTA conjugated to the peptide. After quality control of the prepared tracer, the preclinical pharmacokinetic was determined in HEK-293 xenograft Nude mice with biodistribution study and positron emission tomography-computed tomography (PET/CT scan). ***Results:*** The 68Ga-labeled FAPI was achieved with high radiochemical purity (RCP> 99%) and stability during 3 hours in saline and human plasma. The accumulation of 68Ga-FAPI in HEK-293 tumor sites was significantly increased during 4 hours post injection. The radioactivity in non-target tissues was decreased, so that the tumor/blood and tumor/liver ratio were more than four times within this time. Moreover, the amount activity in tumor was not significantly changed after 24 hours. Finally, PET/CT scans in HEK-293 tumor-bearing mice model revealed high tracer uptake in the tumor sites. ***Conclusion:*** The new 68Ga-FAPI is a promising agent which has improved the kinetic behavior and retention properties compared with 68Ga-labeled diagnostic FAPI tracers. Further studies on its therapeutic application in different cancers are ongoing. ***References:*** 1) Roustaei H, Kiamanesh Z, Askari E, Sadeghi R, Aryana K, Treglia G. Could Fibroblast Activation Protein (FAP)-Specific Radioligands Be Considered as Pan-Tumor Agents? Contrast Media and Molecular Imaging. 2022 Feb 22:2022:3948873. 2) Xin L, Gao J, Zheng Z, Chen Y, Lv S, Zhao Z, et al. Fibroblast Activation Protein-α as a Target in the Bench-to-Bedside Diagnosis and Treatment of Tumors: A Narrative Review. Front Oncol. 2021; 11: 648187.

EP-0106

Preclinical imaging evaluation of a bispecific antibody targeting hPD1/CTLA4 using humanized mice

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Aim/Introduction: At present, with the discovery of immune checkpoint, immune checkpoint immunotherapy has been successful in the clinical treatment of cancer, the lack of an efficient way to screen patients who are responsive to immunotherapy challenges PD1/CTLA4-targeting cancer treatment. Immunotherapeutic efficacy cannot be clearly determined by peripheral blood analyses, tissue gene markers or CT/MR value. Here, we used radionuclide 124I to label the PD1/CTLA4 double-targeted antibody cardonilizumab (AK104) and imaging to detect the distribution of PD1/ CTLA4-positive cells in PD1/CTLA4 humanized mice. Here, we used a radionuclide and imaging techniques to investigate the novel dual targeted

antibody cadonilimab (AK104) in PD1/CTLA4-positive cells in vivo. ***Materials and Methods:*** In this study, N-Bromosuccinimide (NBS) was used as an oxidant and labeled with AK104 (~200 kDa) using nat/124/125I, the high quality [nat/124/125I]I-AK104 was purified by a dimensional exclusion column (PD-10). After the binding ability of AK104 to PD1/CTLA4 protein was determined, the Kd value of AK104 uptake by PD1/ CTLA4-positive cells was determined with anti-PD1 monoclonal antibody (AK105) and anti-CTLA4 monoclonal antibody as control groups. Afterwards, the PD1/CTLA4 dual humanized mouse model with hPDL1 MC38 cells inoculated into the armpit was subjected to tail vein injection of 124I-AK104 for biological distribution and imaging experiments. The maximum standard uptake value (SUVmax) of organs in the imaging group of mice was determined. Finally, the distribution of PD1/CTLA4 positive cells was detected by immunohistochemistry and multicolor immunofluorescence assay. ***Results:*** The 124I-AK104 showed high radiochemical purity and specific activity . There was no significant difference in the ability of AK104 and natI-AK104 to bind PD1/CTLA4 proteins. The immuno-PET results showed that 124I-AK104 exhibited strong PD1/CTLA4 targeting in humanized mice, not only at the tumor site but also in the spleen. Compared with AK105 and anti-CTLA4 mAb imaging, 124I-AK104 imaging has excellent SUVmax at the tumor site and a higher tumor to non-tumor (T/NT) ratio. IHC and coimmunofluorescence staining results showed that all tumor sites in the imaging group mice contained PD1/CTLA4 positive cells. The dosimetry estimation study showed that the effective dose of 124I-AK104 is 0.112 mSv/MBq. ***Conclusion:*** The results demonstrated the potential of translating 124I-AK104 into a method for screening patients who benefit from immunotherapy and the efficacy, as well as the feasibility, of this method was verified by immuno-PET imaging of humanized mice.

EP-0107

Inhibition Study of Specific Met/Trk Kinase Inhibitor L009 on In Situ Liver Tumor Animal Model

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Aim/Introduction: To investigate the inhibitory effect of a novel small molecule compound L009 targeting Met and Trk kinases specifically on the BALB/c nude mouse liver in situ tumor model. ***Materials and Methods:*** IVIS Spectrum CT imaging system (PekinElmer); BALB/c nude mice purchased from Beijing Vital River Laboratory Animal Technology Co., Ltd., maintained at 25℃ with a 12-hour light/dark cycle and 55% humidity, fed with sterile water and feed. The breeding conditions and experimental procedures complied with the requirements of animal protection regulations. Hep G2 liver tumor cells were infected with pCDH-luc2-GFP plasmid lentivirus to construct the BALB/c nude mouse liver in situ tumor model. Three days after surgery, nude mice were randomly divided into three groups (N=10). The model control group was given blank solvent (0.5% CMC-Na), the experimental group was given L009 (48 mg/kg), and the positive control group was given Sorafenib (50 mg/kg), administered twice daily for 3 weeks. Bioluminescence imaging technology was used to detect the luminescence intensity of tumor cells in the livers of animals in different groups. ***Results:*** After 21 days of continuous administration, the fluorescence intensities in the liver in situ of the model control group, L009 treatment group, and Sorafenib positive control group were 2.59±5.57×109 p/sec, 2.70±2.03×108 p/sec, and 2.70±2.03×108 p/sec, respectively. The calculated inhibition rates of L009 treatment group and Sorafenib positive control group on nude mouse liver in situ tumors were 78.34±39.44% and 75.76±20.65%, respectively (P>0.05). ***Conclusion:*** The small molecule targeting Met/Trk kinases inhibitor L009 has a good inhibitory effect on BALB/c nude mouse liver in situ tumors, with inhibition effects similar to the positive drug Sorafenib.

EP-0108

Development of a novel ^{68}Ga labeled FAPI-PET tracer for molecular imagingof cancer-associated fibroblasts

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Aim/Introduction: Fibroblast activation protein (FAP) is overexpressed in stroma tissues of most cancers including breast, lung, colorectal and gastrointestinal cancer and low expression in normal tissues making it an ideal target to inhibit tumor cell growth[1,2]. A variety of quinolone based FAP inhibitors (FAPi) were extensively studied and showed promising results as SPECT/PET imaging agents. However, short residence time in tumor microenvironment limits the use of these compounds for radiotherapy. In this study, we have developed a FAPi conjugated NOTA derivative (CB0006NT), labeled it with 68Ga under mild reaction condition and studied the feasibilities of [68Ga]Ga-CB0006NT radiotracer as potential PET imaging agent for detecting cancer-associated fibroblasts (CAFs) which the hope to improve the tumor retention and low normal tissue uptake. ***Materials and Methods:*** A wide variety of labeling conditions were studied, including effect of pH, temperature and amount of NOTA-FAPi (CB0006NT) and incubation time on radiolabeling efficacy using radio-TLC (ITLC-SG/0.1 M citric acid). The in-vitro serum stability with [68Ga]Ga-CB0006NT in a 37°C shaking incubator for 4 h was tested. In-vivo distribution of [68Ga]Ga-CB0006NT was conducted in normal mice and PET/MR image was acquired after 1 h post-injection of [68Ga]Ga-CB0006NT (3.7 MBq/100 µL). ***Results:*** Under optimized conditions (CB0006NT; 40 µg, 45 nmol; 0.1 M acetate buffer, pH 5, 200µL; incubation time, 10 min at RT) [68Ga]Ga-CB0006NT was obtained in high radiochemical efficiency (≥99%). The in vitro stability of [68Ga]Ga-CB0006NT was performed in human serum and demonstrated high stability up to the time period under investigation (4 h). The [68Ga]Ga-CB0006NT showed high uptake rapidly extracted through the intestine and no uptake was observed in normal tissue which showed its normal distribution profile. ***Conclusion:*** In conclusion, we synthesized CB0006NT and optimized radiolabeling conditions of [68Ga]Ga-CB0006NT and in vivo distribution in normal mice. Further studies in animal xenograft are in progress to check the uptake in tumor sites. [68Ga]Ga-CB0006NT was expected to contribute to the CAFs diagnostic agents targeting various diseases related to cancer. ***References:*** [1] Fitzgerald AA and Weiner LM. The role of fibroblast activation protein in health and malignancy. Cancer Metastasis Rev 2020;39:783-803. [2] Kalaei Z, Manafi-Farid R, Rashidi B, Kiani FK, Zarei A, Fathi M, et al. The Prognostic and therapeutic value and clinical implications of fibroblast activation protein-a as a novel biomarker in colorectal cancer. Cell Commun Signal 2023;21.

EP-0109

Count Rate Performance of Pre-Clinical SPECT/CT With Next Generation Multi-Pinhole Collimators

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Aim/Introduction: System deadtime behaviour is an important performance marker for preclinical Single Photon Emission Computed Tomography (SPECT) devices which can inform and optimise imaging protocols. ***Materials and Methods:*** Here we report phantom-based system count rate linearity measurements for a preclinical dual modality SPECT/CT system equipped with novel low- and high-energy multi-pinhole (MPH) collimators (16 pinholes per collimator). Measurements were performed with point- and cylinder sources (Ø1mm and Ø10mm x 10mm length) across an activity range from ~200 MBq to <0.1 MBq for 99mTc and 18F. For 99mTc, standard-energy MPH mouse whole body collimators (up to 300 keV) were used, while for 18F next generation high-energy MPH collimators were used. Data were acquired in list mode until at least 105 counts were acquired per time frame. The detected count rate as a function of input activity, as well as reconstructed image uniformity in the case of cylinder sources, were analysed for a +/-20% energy window centred at 140.5 keV for 99mTc and at 511.0 keV for 18F. Data were reconstructed with an ordered subset expectation maximization (OSEM) algorithm. ***Results:*** For both radionuclides and collimator sets, the measured count rate was linear over the range tested. Count rate showed zero losses up until 100 MBq, with a loss of 10% only occurring at 200 MBq for 99mTc. Total activity determined from reconstructed images mapped against input activity was linear for the same range and matched decay-corrected values from calibrated well-counter measurements with <5% error below 100 MBq for 99mTc. Reconstructed image uniformity of cylinder sources was largely maintained across the range of input activities and only degraded at low input activities of <1MBq as a result of low count noise. ***Conclusion:*** We conclude that the chosen preclinical multi-pinhole SPECT system provides excellent count rate linearity for the test conditions (point sources in air, distributed source in scatter) for both 99mTc and 18F over a significantly wider range than typical activities (~10-25 MBq) currently used in the pre-clinical setting.

EP-0110

The snail Lissachatina fulica as a model for lungworm pathogenesis using radio-labeled parasites

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Aim/Introduction: In Europe, lungworm parasites such as Angiostrongylus vasorum and Crenosoma striatum pose significant threats to both wildlife and domesticated canids. In tropical regions the varieties Angiostrongylus cantonensis and Angiostrongylus costaricensis, which can infect mammals, including humans, can even cause the deadly disease Angiostrongyliasis. With the interconnectedness through global trade and travel, and the ongoing impacts of climate change, the incidence of these diseases is projected to rise in Europe. This study introduces an innovative method for studying parasite pathogenesis by employing the gastropod Lissachatina fulica as a model organism for intentional infection and radiolabeled parasite larvae for in imaging of larva/parasite migration. ***Materials and Methods:*** The larvae of Crenosoma striatum and Angiostrongylus vasorum were acquired through isolation using a modified Baermann-Wetzel technique on infected hedgehog and canid feces. For infection we used doses of 500 - 2000 larvae. These parasites were then incubated with 50 MBq 18F-FDG in 4 ml 0.9% NaCl solution at room temperature for 30 minutes. Subsequently, the larvae underwent washing via centrifugation for 5 minutes at 3500 rpm to remove the supernatant, followed by resuspension in a physiological salt solution at 0.9%. The gastropods received orally administered radio-labeled parasites and were immobilized via cooling. Following this, three subjects were subjected to PET/CT scans immediately and after a 2-hour migration period. Post-scanning, the gastropods were cryo-euthanized and artificially digested in a low pH environment to simulate predator-prey interactions and to confirm the location of the parasites. The number of parasites per organ was quantified and compared against the PET/CT results. ***Results:*** Both A. vasorum and C. striatum exhibited a consistent ability to undergo incubation with FDG. The result of the incubations yielded an activity between (32.5 -72 Bq/Larvae). PET/CT images revealed hotspots primarily in the snail's digestive tract immediately post-feeding indicating limited larval dispersal at that stage. At 2 hours post-feeding, displayed a more widespread distribution throughout the gastropod's body indicative of larval migration. Analysis of digested samples revealed confirmed accumulation of larvae in certain organs, especially albumen gland and hepatopancreas, although at lower levels than after a infection without radiolabeling. The latter might indicate that the 18F-FDG illicits an adverse effect on the parasites. ***Conclusion:*** Our findings highlight the robustness of A. vasorum and C. striatum in incubating with FDG, with notable uptake observed even after washing. PET/CT images revealed dynamic changes in parasite distribution over time, indicating potential avenues for further investigation.

EP-06

e-Poster Area

B: Imaging Clinical Studies -> B1 Oncological Imaging Clinical Study -> B11 Central Nervous System

EP-0111

Optimization of the scanning protocol for patients with primary and secondary tumors according to PET-CT with ^{18}F-FET

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Aim/Introduction: PET-CT with 18F-FET is an important nuclear medicine technique in monitoring the treatment of patients with brain tumors. According to EANM guidelines the standard protocol PET-CT with FET is static scanning from 20 to 40 minutes after injection.We studied 117 patients from 8 to 73 years with foci of pathological hyperfixation FET in brain. Of these, 74 patients were diagnosed with glioma of varying degrees of malignancy, 43 patients had secondary brain damage, 51 patients did not receive any treatment; 66 patients received different types of treatment, including surgery, radiation, and chemotherapy. ***Materials and Methods:*** PET-CT protocol: start scanning 20 min after injection; scanning time is 20 minutes in list-mode; reconstruction of data: from 20 to 40 - «standard», from 20 to 30 - «early» and from 30 to 40 minutes - «late» images. The assessment was carried out using a semi-quantitative method - with the calculation of SUV

max and SUV peak in the lesion and contralateral intact cortex, as well as the ratios of TBR max and TBR peak. ***Results:*** Based on a comparison of «early» and «late» images it was found that regardless of the type of tumor and the type of treatment performed in the lesions the values of all parameters do not differ significantly while in the cortex in «late» images the values of SUV max and SUV peak is significantly higher and accordingly TBR values are significantly lower than in earlier images.In routine practice we can reduce the scanning time to 10 minutes with the period from 20 to 30 minutes after injection being preferable because TBRmax during this period is comparable to that from 20 to 40 minutes. ***Conclusion:*** Thus, reducing scanning time will allow us to:1. make the examination more comfortable for patients and reduce the risk of movement artifacts taking into account that the severity of the patient's condition does not allow them to maintain a stationary position for a long time;2. reduce the time of anesthesia and the dose of medication when scanning children which will increase the safety of the study for them;3. increase the cost-effectiveness of the PET-CT procedure due to the ability to scan a larger number of patients in a shorter time with less radiopharmaceutical consumption.

EP-0112

Direct Reconstruction of Parametric [18F]FET Images on a Long-Axial Field-of-View PET Scanner in Patients with Suspected Glioma Recurrence

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Aim/Introduction: Static and dynamic [18F]fluoroethyltyrosine ([18F]FET) PET has proven itself useful in glioma classification, grading, and response assessment. Dynamic FET imaging in a clinical setting generally entails visual evaluation of time activity curves (TACs), since pharmacokinetic analysis is technically demanding and can necessitate blood sampling for the arterial input function. The advent of long-axial-field-of-view (LAFOV) PET scanners enables the extraction of an image-derived input function (IDIF) from vasculature structures. Herein, we evaluate the feasibility of [18F]FET parametric imaging using direct Patlak modelling with IDIFs derived from the aorta in glioma patients. ***Materials and Methods:*** This retrospective analysis involved 30 patients with suspected glioma recurrence undergoing 40 min dynamic [18F]FET PET on a LAFOV scanner. We extracted IDIFs from the descending aorta using a deep learning-based method [1], and generated tracer net influx (Ki) and distribution volume (DV) parametric images using direct Patlak reconstruction [2]. An experienced nuclear medicine physician segmented 53 lesions for computation of mean Ki and DV values, the corresponding tumour-to-background (TBR) values, and TBR in late static images. Finally, we studied the predictive value of Ki, DV and static TBR for tumour recurrence using ROC analysis, and performed logistic regression against visual TAC assessment. ***Results:*** The mean (SD) magnitude of Ki (mL/cm3/min) was 0.0082 (0.0041) in the lesions confirmed as tumour recurrence, 0.0066 (0.0030) in the benign lesions, and 0.0045 (0.0009) in background. DV (mL/cm3) was 0.74 (0.26) in tumour, 0.26 (0.22) in benign lesions and 0.20 (0.09) in background. TBR was 1.88 (0.84) in the Ki, 3.07 (1.95) in DV, and 2.34 (1.07) in static images. Interestingly, DV performed best in the ROC analysis for the prediction of recurrence (AUC DV: 0.95, Ki: 0.68; static TBR 0.92). There was a significant correlation between DV and visual TAC analysis ($p<0.001$), while Ki showed no such relationship. ***Conclusion:*** Direct parametric reconstruction of dynamic [18F]FET PET using an IDIF from deep-learning based segmentation of the aorta proved feasible for generating high quality parametric Ki and DV maps, with a TBR comparable to static [18F]FET images. DV, but not Ki, in suspected lesions showed significant correlation to negative TAC slope in visual analysis, and DV performed best for the prediction of tumour recurrence. These results indicate that [18F]FET uptake in reversible binding compartments serves for the differentiation of glioma recurrence. ***References:*** 1. Pigg D., JNM 2022;63(suppl. 2) 2. Sari H., EJNMMI 2022;49(6).

EP-0113

Diagnostic utility of ^{68}Ga-Prostate-Specific Membrane Antigen-11 PET/CT in glioma recurrence - a prospective analysis

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Aim/Introduction: Prostate-specific membrane antigen (PSMA), being highly expressed on prostate cancer epithelial cells, is also found in the tumour vasculature of non- prostatic carcinomas. Magnetic resonance imaging (MRI) is the recommended technique for treatment, response evaluation and follow-up of gliomas. However, in patients previously treated with radiotherapy, MRI might be inconclusive as recurrent disease and treatment-related changes often appear similar. The study aimed to assess the diagnostic potential of 68Ga-PSMA PET/CT in patients with histologically confirmed brain tumours and suspected of recurrent disease on MRI. ***Materials and Methods:*** A prospective study was conducted from 2022 to 2024, enrolling patients of histopathologically diagnosed glioma after primary treatment including surgery, chemotherapy and radiotherapy with clinical and MRI suspicion of recurrent disease on follow up. All patients underwent 68Ga-PSMA PET/CT within two weeks of MRI. The PSMA PET/CT images were evaluated by two experienced nuclear medicine physicians. Abnormal PSMA uptake more than the contralateral brain parenchyma with corresponding CT changes were considered as positive study. Visual evaluation based on the intensity of uptake was scored as, no uptake, score 1; mild to moderate uptake ≤ parotid, score 2; and intense uptake ≥ equal to parotid, score 3. Semiquantitative parameters, i.e, SUVmax and tumor to background ratio (TBRmax) of the lesions were also calculated. ***Results:*** 15 patients were enrolled in the study. Median age (IQR) of patients was 36 years (15-58 years). Eight patients had oligodendroglioma, four had astrocytoma, two had glioblastoma, and one had ependymoma, according to the initial histopathological confirmation. Eleven patients had recurrence for the first time and four patients had re-recurrence. Visual interpretation showed increased accumulation of 68Ga-PSMA-11 in the recurrent lesions detected on MRI in all the patients. Interobserver concordance for abnormal sites of accumulation was 100 % for visual assessment and for visual scoring. The mean SUVmax and TBRmax of the recurrent lesions were 12.49 ± 6.97 and 11.9 ± 5.9, respectively. After diagnosis of recurrence, three patients underwent repeat surgery (histopathology confirmed high-grade recurrence in all 3), three received bevacizumab,

five were re-challenged with temozolomide and four patients are planned for redo surgery. ***Conclusion:*** The extremely low background uptake in normal brain tissue and consequently high TBR make 68Ga-PSMA-11 PET/CT highly promising for diagnosis of recurrent disease in brain tumour patients and its potential for theranostics would encourage its use in the treatment of these patients.

EP-0114

[68Ga]Ga-NOTA-anti-HER2-VHH1PET/CT Imaging of brain metastasis: first clinical results in patients with HER2-positive and HER2-negative breast cancer

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Aim/Introduction: The human epidermal growth factor receptor type 2 (HER2) is highly expressed on the cell membrane of several cancer types. HER2-overexpression is associated with tumour aggressiveness and an increased probability for recurrent disease. Targeted therapies for HER2-overexpressing tumours are currently available. At present, HER2-expression is assessed using tissue biopsies, but this is an issue in brain metastasis. [68Ga]Ga-NOTA-anti-HER2-VHH1 PET/CT of the brain has the potential of selecting patients that could benefit from HER2-targeted therapy. ***Materials and Methods:*** This single-centre, open-label, nonrandomized, phase II study evaluates the clinical potential of [68Ga]Ga-NOTA-anti-HER2-VHH1, a radiolabelled single domain antibody fragment for PET/CT imaging of HER2 in patients with HER2-positive (n=5) and HER2-negative (n=2) breast cancer disease with brain metastases. PET/CT imaging with dedicated imaging of the brain was performed at 90 minutes after intravenous administration of 140.63 +/- 30.7 MBq. Per patient, up to three intracranial metastatic lesions of minimal 8mm (assessed via MRI) were assessed. [68Ga]Ga-NOTA-anti-HER2-VHH1 uptake was measured on PET as SUVmax. ***Results:*** Intense focal uptake of [68Ga]Ga-NOTA-anti-HER2-VHH1 was measured in all brain lesions (n=9) of patients with HER2-positive disease: with an average SUVmax of 7.5 ranging between 5.3 and 12.6. One of the HER2-positive patients had no HER2-accumulation (SUVmax< 1) at the level of the lesion suspected for brain metastasis. Histological examination showed radionecrosis instead of tumour invasion. The patients with HER2-negative disease showed low to no uptake of [68Ga]Ga-NOTA-anti-HER2-VHH1 (SUVmax< 1 for all lesions) in the known metastatic lesions. ***Conclusion:*** The first clinical data of [68Ga]Ga-NOTA-anti-HER2-VHH1 PET/CT imaging in brain metastasis indicate specific and intense focal binding of the [68Ga]Ga-NOTA-anti-HER2-VHH1 in lesions of patients with HER2-positive breast cancer. Based on these initial results we have amended the clinical trial to include patients with other potentially HER2-positive cancer types that present with brain metastasis.

EP-0115

[18F]FDOPA PET/MRI hybrid technique in patients with brain tumors and suspicion of tumor recurrence versus radionecrosis

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Aim/Introduction: PET/MRI is an imaging technique that provides valuable metabolic, functional and morphological information needed in neuro-oncological diseases, in a single study. At present, data on its performance in clinical practice are still limited. The aim of this work is to analyse the diagnostic validity of [18F]FDOPA PET/MRI in patients with brain tumors (BT) and suspected tumor recurrence (TR) versus radionecrosis (RNC). ***Materials and Methods:*** Retrospective study of 29 PET/MRI FDOPA performed in 24 patients (12 female, mean age 57 (40-76)) and 33 lesions evaluated: 6 primary tumors and 27 brain metastases.All BT have been treated previously with (surgery+ hypofractionated stereotactic radiation therapy or radiosurgery) and some patients had received quimotherapy and/or immunotherapy also. All PET/MRI examinations were carried out on a 3 tesla PET/MRI (GE SIGNATM) at least 6 months after the radiotherapy.Images were analysed visually and quantitatively, obtaining ratios: SUVmaxlesion/SUVmaxstriatum (L/S), SUVmaxlesion/SUVmaxcortex (L/C). Sensitivity (S), Specificity (Sp), positive predictive value (PPV) and negative predictive value (NPV) were calculated. Mann Whitney test was used to compare difference between groups. Optimal FDOPA PET parameter cut-off were obtained by ROC analysis. Perfusion-weighted imaging (PWI)were visually and quantitative analysed. Results were compared with clinical-radiological follow-up (at least 9 months) and/or histopathology.A multidisciplinary brain tumor board made the final decision based on all available information. ***Results:*** 10/33 lesions (30%) were considered TR and 23 (70%) RNC. FDOPA PET/MRI showed higher ratios in TR (L/S 1.15±0.25, L/C 2.29±0.69) than RC (L/S 0.85±0.26, L/C1.5±0.69) p>0.05. These ratios were assessed together with the visual analysis. S, Sp, PPV, NPV of FDOPA were 100%, 83%, 69% and 100% respectively. 4 false positive and 0 false negative. The best cut-off points were L/C 1.73 and L/S 0.91. S, Sp, PPV, NPV of PWI were 56%, 73%, 45% and 80% respectively, in 2 cases PWI was no valuable. The results of FDOPA and PWI were concordant in 23/31 (74%). ***Conclusion:*** PET/MRI 18F-FDOPA showed high accuracy in differentiating TR from RNC. The information provided by PWI and FDOPA was not always concordant, and the role of both techniques is likely to be complementary. The availability of hybrid PET/MRI equipment allows this information to be obtained in a single scan. In addition, hybrid PET/MRI reduces discomfort in neuro-oncology patients, who are usually in a fragile state.

EP-0116

Proposal of a short acquisition protocol for 18F-DOPA imaging in brain tumors:preliminary results

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Aim/Introduction: Imaging with radio labelled amino acids like

18F-DOPA has emerged in the last years as a very useful tool for brain tumours. In 2019, the "Joint EANM/EANO/RANO practice guidelines/SNMMI procedure standards for imaging of gliomas using PET with radiolabelled amino acids and [18F]FDG: version 1.0" was published. A specific acquisition protocol for 18F-DOPA imaging is described in the guidelines. In our department, we perform a dynamic acquisition in list mode that allows us to follow the protocol in the guidelines, but also generate different static and dynamic reconstructions. In this study we compare performance of the protocol imaging for 18F-DOPA published in the guidelines with a shorter protocol designed after visually analysing time-activity curves from dynamic images. ***Materials and Methods:*** Patients that were referred to our nuclear medicine department for ^{18}F-DOPA brain imaging to distinguish tumour recurrence from radionecrosis were consecutively included (20 patients, 31 lesions). Images were reconstructed using two protocols: - Protocol A (EANM guidelines protocol): static acquisition of 20 minutes of duration, scan initiated 10 minutes after i.v. injection of ^{18}F-DOPA. - Protocol B (proposal): static acquisition of 10 minutes of duration, scan initiated 5 minutes after i.v. injection of ^{18}F-DOPA. We compared lesions' visual scores (0=no uptake, 1= uptake lower than striatum, 2=uptake similar to striatum, 3=uptake higher than striatum) for both protocols and calculated concordance. We analysed Sensitivity, Specificity, NPV and PPV of each protocol (visual scores of 0 and 1 for radionecrosis, and visual scores of 2 and 3 for tumor). Gold standard was histologic results in 11 lesions (35%) and follow up in 20 lesions (65%). ***Results:*** In our sample, there were 16 primary CNS tumors (52%) and 15 metastases (48%). Size of the lesions ranged from 6 mm to 62 mm (mean: 21 mm). Accuracy, Sensitivity, Specificity, NPV and PPV were 0,77, 0,86, 0,70, 0,67, and 0,81 for protocol A; and 0,74, 1.00, 0,20, 1,00 and 0,72 for protocol B. Concordance between both protocols was fair for all visual score values (kappa index = 0,27) and for radionecrosis (values 0-1) versus tumor (visual score 2-3) (kappa index = 0,29) ***Conclusion:*** The proposed short protocol for brain tumor imaging with 18F-DOPA performed similar to protocol recommended by EANM guidelines, analysing visual score. ***References:*** Joint EANM/EANO/RANO practice guidelines/SNMMI procedure standards for imaging of gliomas using PET with radiolabelled amino acids and [18F]FDG: version 1.0. Eur J Nucl Med Mol Imaging. 2019 Mar;46(3):540-557.

EP-07

e-Poster Area

B: Imaging Clinical Studies -> B1 Oncological Imaging Clinical Study -> B12 Head and Neck

EP-0117

Somatostatin Receptor-Directed Theranostics in Esthesioneuroblastoma

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Aim/Introduction: We aimed to report on somatostatin receptor (SSTR)-targeted molecular imaging and therapy in patients affected with advanced esthesioneuroblastoma (ENB). ***Materials and Methods:*** 3 patients with ENB (Kadish stage B in 1/3 [33.3%], Kadish stage C in 2/3 [66.7%]; Hyams Grade 2 in 2/3 [66.7%] and Grad C in 1/3 [33.3%]) underwent SSTR-directed PET/CT using [68Ga]DOTATOC to determine disease extent. We also quantified SSTR-avid tumor volume (TV), maximum SUV (SUVmax) and target-to-background ratios (TBR), thereby providing information on image contrast. In patients scheduled for peptide receptor radionuclide therapy (PRRT), we recorded nephro- and hematotoxicity, including eGFR, haemoglobin, leukocytes, and thrombocytes at baseline and after the last treatment cycle. We classified adverse events following Common Terminology Criteria for Adverse Events (CTCAE) v5.0. Response using RECIST 1.0 and progression-free survival (PFS) was also determined. ***Results:*** All patients (100%) were rated positive on SSTR-PET/CT. On a lesion-based level, we identified 24 SSTR-avid tumor sites with a median TV of 16.25±1.7, and SUVmax of 28.41±4.2. TBR was 21.85±4.2, thereby suggesting excellent image contrast. All subjects were also scheduled for PRRT using a median cumulative activity of 31.4 GBq per patient (median number of cycles, 4 [range, 2-6]). We observed no CTCAE grade III/IV toxicity for eukocytes and thrombocytes and also no CTCAE for renal function. Stable disease after two cycles were recorded in 2/3 (66.7%; progressive disease in 1/3 [33.3%]). Median PFS was 14 weeks. ***Conclusion:*** SSTR-directed molecular imaging provides high image contrast in ENB, thereby suggesting good read-out capabilities in this tumor type. PRRT is also feasible, along with an acceptable safety profile, thereby rendering SSTR-targeted theranostics as a potential treatment option in advanced disease.

EP-0118

Risk Assessment of Xerostomia Using F^{18} FDG PET/CT Metabolic Parameters After Radiotherapy in Head And Neck Cancers

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Aim/Introduction: Xerostomia and radiation-induced salivary gland dysfunction remain common side effects that impair the quality of life for patients undergoing head and neck radiotherapy (RT). This study aimed to investigate using F^{18} FDG PET/CT parameters as a useful tool to predict metabolic changes in the salivary glands, radiation doses received, and severity of xerostomia in patients undergoing RT for head and neck cancers. ***Materials and Methods:*** Our study included 107 non-operated patients who had undergone PET/CT for the staging and treatment response following curative RT. SUVmax and SUVmean of bilateral parotid and submandibular glands were measured on PET/CT performed at staging and 3-6 months after completion of RT. Patients were assessed for xerostomia-related complaints and categorized into three groups after RT: asymptomatic, mild, and severe symptoms. Mean parotid and submandibular gland doses

were determined through analysis of dose-volume histograms. Upon establishing threshold levels of 30 Gy for the parotid gland and 50 Gy for the submandibular gland; symptom severity, ΔSUVmax, and ΔSUVmean were compared. ***Results:*** Nine (8.4%) patients had no symptoms, 30 (28%) had mild, and 68 (63.6%) had severe dry mouth. A significant relationship was found between the mean RT doses of salivary glands and the severity of symptoms. Significant correlations were observed between the mean doses and dose-dependent volumetric ratios of the salivary glands, and ΔSUVmax values, especially in the left parotid gland. A statistically significant relationship was found only between ΔSUVmax and ΔSUVmean of the left parotid gland and symptom presence and severity. In our patient group, left-sided tumors have more nodal involvement than right-sided ones. ***Conclusion:*** We found that despite lower mean RT doses to the parotid glands compared to the submandibular glands, ΔSUVmax and ΔSUVmean of the left parotid gland were significantly related to symptom severity. This result may be attributed to the fact that the nodal involvement was predominantly on the left, with a wider RT field and due to the higher sensitivity of serous acini to RT. As a result, the metabolic changes of the parotid gland due to RT are related to the RT doses and xerostomia, the severity of xerostomia can be predicted by PET/CT parameters.

EP-0119

Tumor Volume Auto-delineation and Survival Prediction for Head and Neck Cancer Patients Using Deep Learning on PET/CT Images

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Aim/Introduction: Identification and delineation of the tumor and malignant nodal volume in medical images are important in treatment planning. In this study, we assessed the applicability of deep learning using ^{18}F-FDG PET/CT images for auto-delineation of tumor volume and survival prediction in patients with head and neck cancer (HNC). ***Materials and Methods:*** 188 patients with HNC who received pretreatment ^{18}F-FDG PET/CT were included. They were divided into training 150 patients, and testing 38 patients sets. In deep learning analyses, three planes of axial, coronal, and sagittal ^{18}F-FDG PET/CT images were assessed by the SegResNet model. The Dice score, f1 score, and precision were used for auto-delineation model evaluation. The performance of the deep learning-based model or clinical stage for survival prediction was assessed by the Concordance index (c-index). ***Results:*** The SegResNet model achieved a Dice score, f1 score, and precision of 74%, 77.2%, and 72.8%, respectively, for automatically delineating tumors in ^{18}F-FDG PET images. The accuracy of the model based on deep learning in predicting the recurrence of cancer patients was 73.6%. The c-index of the DenseNet model was 0.738 for predicting overall survival, which was higher than that of the clinical stage (c-index=0.562). ***Conclusion:*** Using the SegResNet model to analyze ^{18}F-FDG PET/CT images could be a reliable tool for automated delineation in head and neck cancer patients. The deep learning approach appears to more effectively distinguish between patients with favorable and unfavorable survival outcomes compared to traditional clinical staging methods.

EP-0120

Brain metastases in head and neck cancer patients: imaging insights

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Aim/Introduction: This study investigates the incidence of intracranial metastasis in head and neck cancer patients undergoing follow-up ^{18}F-FDG-PETCT (PETCT) scans, to illustrate the lack of need to include 'whole brain' protocol imaging. Drawing upon existing literature establishes a baseline incidence of brain metastases in head and neck squamous cell carcinoma (HNSCC) patients. ***Materials and Methods:*** Retrospective 6-month review of cohort of 2800 HNSCC patients' scans who underwent PETCT scan, on variety of analogue and digital scanners, across Alliance Medical scanning facilities. Scanners were GE710 (12), GE MI DR (3); Siemens Biograph mCT (3); and GE Discovery MI (digital (3)). Scans reviewed were performed post primary treatment (surgery/chemoradiotherapy), on follow-up with suspected recurrence, or Baseline information taken from data from previous studies/reviews reporting brain metastases incidence of up to 2% in HNSCC patients. ***Results:*** Initial retrospective review of 500 cases reveals no instances (0%) of brain metastases among HNSCC patients undergoing follow-up PETCT scans, suggesting eyes-to-thighs protocol would be all that is required in these HNSCC patients. Further analysis ongoing of remaining cases to be completed soon. ***Conclusion:*** Potentially eliminating CT coverage of the top of the brain, potential radiation dose and scan time savings could be achieved, and perhaps even minimal energy use savings, contributing to the optimisation of imaging protocols in HNSCC patients. This study underscores the importance of surveillance protocols and the potential impact of imaging techniques on the detection of metastatic disease in these patients. ***References:*** (1). Aizer AA et al. Brain metastases: Society for neuro-oncology consensus review on current management and future directions. Neuro Oncol. 2022 Oct; 24(10): 1613. (2). Barrett et al. Brain metastases in head and neck squamous cancer patients: A review of literature in genomic era. Neurosurg Focus. 2018 Jun;44(6):E11.

EP-0121

The Potential rule of Ga68-Trivehexin in Head and Neck Squamous Cell Carcinoma; Single Institution Experience

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Aim/Introduction: Integrin αvβ6 transmembrane cell adhesion receptor overexpression occurs in certain malignancies including head and neck squamous cell carcinoma (H&NSCCs). Up-regulation of Integrin αvβ6 is associated aggressive tumor behavior and poor outcome. Trivehexin labelled with Ga68 is a newly developed nanopeptide that selectively targets Integrin αvβ6. ***Materials and Methods:*** Twenty patients of mean age 56 years were recruited diagnosed with H&NSCC (17 males and 3 females) underwent Ga68-trivehexin for staging and restaging (16 vs 4, respectively). Four patients were diagnosed with oral cancer, six nasopharyngeal, three oropharyngeal, six laryngeal, and one cancer of unknown primary. Patients were injected with Ga68-trivehexin with a mean dose of 172.42 MBq (118.4-259 MBq). Two minutes per bed acquisition was obtained using digital PET/CT camera, after a mean uptake time of 65.5 minutes (56-82 minutes).

Within a period of one month, a FDG PET/CT study was carried out as a reference, with a mean dose of 188.7 MBq (111-351 MBq) and mean uptake period of 64 minutes (57-79 minutes). Studies were evaluated visually and semi-quantitatively. ***Results:*** All four individuals diagnosed with oral cancer exhibit αvβ6 expression in the primary tumor. One of these patients did not exhibit αvβ6 expression in the cervical lymph node when compared to FDG. All patients with nasopharyngeal carcinoma exhibit αvβ6 expression in the primary tumor. Nevertheless, αvβ6 expression was absent in cervical lymph nodes and distant metastatic locations for two patients. Regarding oropharyngeal cancer, all three patients exhibited αvβ6 expression in both the primary tumor and cervical lymph nodes. However, one patient had a lower detection rate of αvβ6 expression in the cervical lymph nodes compared to FDG. In relation to laryngeal cancer, all five patients included in the staging process exhibit αvβ6 expression in the primary tumor. Two of these patients had faint αvβ6 expression or negative results at the cervical lymph nodes and distant metastatic locations. A single patient was selected for restaging and yielded negative results on both examinations. The patient diagnosed with cancer of unknown primary exhibited αvβ6 expression in the cervical lymph node and lacked αvβ6 expression in the metastatic mediastinal lymph node compared to FDG. ***Conclusion:*** αvβ6 expression was detected in all sites of primary disease in H&NSCCs. The fact that seven out of twenty patients exhibited decreased αvβ6 expression in cervical lymph nodes and distant metastases in comparison to FDG, supports the heterogeneity of local and distant metastatic involvement.

EP-0122

Prognostic value of plasma Epstein-Barr virus DNA load and pretreatment and recurrent ^{18}F-FDG PET/CT volumetric parameters in patients with nasopharyngeal carcinoma

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Aim/Introduction: To determine the combined value of plasma EBV DNA title (EBV-t) and semiquantitative 18F-FDG PET-derived parameters in predictive models in patients with nasopharyngeal carcinoma (NPC). To serve as a basis for the development of a population model that relates diagnostic techniques and clinical variables to identify patients at earlier risk and adjust individually therapeutic interventions. ***Materials and Methods:*** A total of 15 studies corresponding to 8 different patients were evaluated. EBV-t was recorded at the time of 18F-FDG PET/CT. To define the contouring margins, an SUV of 2.5 based on the experience of previous investigators was used. SUVmax, MTV, and TLG were calculated for whole body (WB), primary tumour (PT), lymph node (LN) and distant metastasis (DM). EBV-t was expressed as number of copies/mL and its logarithm (log10). The primary dependent variable was progression-free survival (PFS). Overall survival was not analyzed due to the insufficient number of deceased patients. The survival analyses were performed using the Kaplan-Meier method. The cut-off value associated with the lowest p value was taken as the optimal cut-off point. The Cox-Mantel log-rank test was then used to calculate the P values for the intergroup differences in survival rates. Multivariate Cox proportional hazards models were used to identify the independent predictors of survival. Pearson's correlation coefficients were used to analyze the correlations between pairs of continuous variables. The statistical significance was set at $p< 0.05$. ***Results:*** The univariate analysis showed that EBV-t > 10000 copies/mL, WB-TLG > 250, WB-MTV > 60, LN-TLG>210, LN-MTV>60, DM-TLG >0 and DM-MTV > 40 predicted PFS ($p<0.05$). In multivariate analysis only EBV-t>10000 copies/mL independently predicted PFS. The 2-year PFS rate of the patients with WB-TLG<250 and WB-MTV<60 was 33.3% and 30.2%, respectively, compared with 0%, for those with WB-TLG>250 and WB-MTV>60. The DM-MTV > 40 was the most significant prognostic factor in this series (hazard ration, HR, 16.4, $p<0.001$). There was a positive moderate correlation between the EBV-t and the WB-TLG, WB-MTV, LN-TLG, LN-MTV, DM-TLG and DM-MTV. Strong correlation was found between the EBV-t and WB-MTV ($r = 0.703$, $p<0.01$) and between WB-TLG and WB-MTV ($r=0.830$, $p<0.01$). ***Conclusion:*** ^{18}F-FDG PET/CT volumetric parameters and EBV-t predict PFS. In pre-treatment and recurrent NPC patients, EBV-t appears to be an independent risk factor.

EP-0123

Head-to-head Comparison of $^{[18F]}$FDG PET/CT and MRI for the Detection of Recurrence or Residual Tumor in Patients with Nasopharyngeal Carcinoma: a Meta-analysis

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Aim/Introduction: The study aimed to compare the diagnostic performance of $^{[18F]}$FDG PET/CT and MRI in detecting recurrence or residual tumors at the primary site in patients with nasopharyngeal carcinoma (NPC). ***Materials and Methods:*** A comprehensive literature search was conducted through April 2024 in the PubMed/MEDLINE and CENTRAL databases to find studies meeting the following criteria: 1) at least 20 patients with NPC undergoing both $^{[18F]}$FDG PET/CT and MRI for detecting recurrence or assessing residual disease at the primary site, 2) a maximum interval of 2 months between PET/CT and MRI, and 3) at least 2 months after therapy completion in case of PET/CT for response assessment and detection of residual tumors. The pooled sensitivity and specificity of PET/CT and MRI were calculated with 95% confidence intervals (CIs) and compared. A significant difference in performance was determined if the 95% CIs of sensitivity or specificity did not overlap between the modalities. The summary receiver operating characteristic (SROC) curve and area under the curve (AUC) were generated using the SROC model. The AUCs were compared using the method of Hanley & McNeil. The I^2 statistic measured heterogeneity, with values of 25%, 50%, and 75% indicating low, moderate, and high heterogeneity, respectively. Heterogeneity was assessed at a significance level of $p=0.05$, and a random-effects model was used for statistical pooling. ***Results:*** Four studies with 1,841 patients (five patient groups) were included in the analysis. PET/CT had higher sensitivity [93.1% (95% CI: 91.1-94.8%); I2=47.4 %] compared to MRI [80.6% (95% CI: 77.7-83.3%); I2=66.5%], but the specificity was similar for both modalities: 93.9% (95% CI: 92.2-95.2%; I2=9.5%) for PET/CT and 93.9% (95% CI: 92.3-95.3%; I2=60.8%) for MRI. The AUCs for PET/CT and MRI were 0.969 and 0.960, respectively, without significant difference ($p=0.59$). For $^{[18F]}$FDG PET/CT and MRI, the results of the Spearman correlation coefficient demonstrated no threshold effect heterogeneity (Spearman correlation coefficient =0.39, $p=0.67$ for PET/CT; Spearman correlation coefficient =0.39, $p=0.62$ for MRI). ***Conclusion:*** This meta-analysis suggests both

imaging modalities are useful for detecting recurrence or residual tumors in patients with NPC. Although the overall diagnostic performance of PET/CT and MRI did not significantly differ, PET/CT showed higher sensitivity than MRI.

EP-08

e-Poster Area

B: Imaging Clinical Studies -> B1 Oncological Imaging Clinical Study -> B13 Breast

EP-0124

Furin-triggered intracellular ^{68}Ga nanofibers formation enhances micro-PET tumor imaging

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Aim/Introduction: This research is dedicated to the design of a novel positron emission tomography (PET) probe through the incorporation of furin-triggered self-assembly nanofibers to enhance PET imaging of tumors. We utilized micro-PET imaging to evaluate the biodistribution of the designed probe, [68Ga]Furin-NOTA, in MDA-MB-468 model mice and analyzed the differential accumulation of the probe in tumor tissues versus non-target tissues. ***Materials and Methods:*** Furin was co-incubated with the probe precursor at 37°C to verify the specificity of the probe for tumor-associated enzymes and to observe the structural features of the probe after the enzyme digestion reaction. When tumors in MDA-MB-468 model mice reached 5-10 mm in diameter, the probe [68Ga]Furin-NOTA was injected intravenously and static PET scans were performed at 0.5, 1.0, 1.5, 2.0, 2.5, and 3.0 h post-injection, respectively. Using ASIPro VM software, PET images were analyzed by outlining regions of interest (ROI) of the tumor versus non-targeted regions, and the uptake rates were calculated to assess the targeting performance and distribution characteristics of the probe. ***Results:*** PET imaging results demonstrated that the uptake of the probe in the tumor significantly increased from 2.81 ± 0.63 %ID/g at 0.5 h to 4.88 ± 0.47 %ID/g at 3 h, indicating an effective internal accumulation of the probe. In contrast, PET signals at non-target sites such as the liver and muscle exhibited a continuous decreasing trend, indicating that the probe was rapidly metabolized and cleared from these non-target tissues. In the enzyme digestion experiments, the probe precursor was subjected to rapid enzymatic digestion by furin to form supramolecular hydrogels, which are semi-solid materials with high biocompatibility produced by aggregation of monomer molecules. We speculate that this property of the probe leads to varying aggregation effects in regions with high furin expression (tumor) compared to those with low expression (e.g., liver and muscle), ultimately resulting in selective PET signal accumulation in different tissues. ***Conclusion:*** By integrating furin-triggered self-assembly nanofibers, we developed a novel PET probe, [68Ga]Furin-NOTA, which demonstrated the potential for selective accumulation in tumors. This approach may offer a valuable new strategy for enhancing the imaging contrast of PET technology in tumor diagnosis.

EP-0125

Clinical impact of $^{[18F]}$FDG PET/CT for initial staging in breast cancer patients prior to neoadjuvant chemotherapy

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Aim/Introduction: Accurate baseline staging is crucial for planning optimal breast cancer (BC) management.$^{[18F]}$FDG-PET/CT has high sensitivity for extra axillary lymph nodes and distant metastasis and its use is agreed for clinical stage ≥IIB. This is a single-institution retrospective study assessing the clinical impact of $^{[18F]}$FDG-PET/CT in patients with BC prior to neoadjuvant chemotherapy (NC), including a subgroup of early stage patients (stage ≤IIA). ***Materials and Methods:*** We included BC patients who underwent $^{[18F]}$FDG-PET/CT before NC. Patients clinical stage was I to IIIB (83 patients at an early stage), including luminal like, HER2+ and triple negative (TN) phenotypes. Initial stage was determined from conventional mammography, breast ultrasound and breast MRI. The clinical impact of $^{[18F]}$FDG-PET/CT findings was studied taking into account changes in the treatment strategy, considering that upstage to IIB or IIIC stages does not represent a change in treatment modality (intra-modality i.e., radiotherapy fields) whereas upstage to IV represents a change in treatment modality (inter-modality i.e., palliative). In addition, the relationship of $^{[18F]}$FDG-PET/CT findings with histology (ductal vs lobular), Bloom-Richardson grade (I-III), proliferative index (Ki67) and tumor phenotype (luminal-like, HER2+ and TN) was studied. Differences in the distribution of categorical variables were assessed using Chi Square test. Biopsy and follow-up were used as a reference standard for the analysis. ***Results:*** From January 2021 to December 2023, 210 patients were included. $^{[18F]}$FDG-PET/CT findings had clinical impact (upstage) in 49 patients (23%). Of these patients, 41% experienced an intra-modality treatment change and 59% experienced an inter-modality treatment change (p=0.19). Upstage was found in 7 patients (8,4%) with early stage disease, and 42 patients (33%) with locally advanced disease. $^{[18F]}$FDG-PET/CT did not significantly change patient management based on tumor phenotype (upstage in 24% of patients luminal-like, 24% of patients HER2+ and 20% of patients TN, p=0.90), tumor histology (upstage in 23% of patients with ductal carcinoma, and 23% of patients with lobular carcinoma, p=0.98), proliferative index (upstage in 22% of patients with low Ki67, and 23% of patients with high Ki67, p=0.89), or tumor grade (upstage in 15% of G1 patients, 25% of G2 patients and 22% of G3 patients; p=0.59). ***Conclusion:*** $^{[18F]}$FDG-PET/CT is useful for staging patients with BC prior to NC. Upstage findings did not relate to histology, Bloom-Richardson grade, proliferative index or tumor phenotype, either in locally advanced or early stage patients.

EP-0126

^{18}F-FDG PET-CT as a Tool for Predicting the Immunohistochemical Profile of Breast Cancer

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Aim/Introduction: The aim of this retrospective study was to demonstrate the value of ^{18}F-FDG PET-CT in predicting the immunohistochemical profile of breast cancer and promote its role as a non-invasive tool to help plan treatment. ***Materials and Methods:*** 48 women with 50 histopathologically and

immunohistochemically characterized breast cancer lesions were included in this study. Data regarding parameters pertaining to their breast mass, like SUVmax, ER, PR, Her2Neu status, ER, PR, Her2Neu & MBR scores was extracted from the electronic health records at our hospital. Descriptive statistics along with correlation coefficients and regression analysis were performed on the data. ***Results:*** Our study cohort had a mean age of 56.4±11.4 yrs, SUVmax: 6.2±4.7, ER score: 5.3±3.6, PR score: 4.4±3.4, Her2neu score: 1.1±1.0, MBR score: 7.2±1.2. 70% of the lesions were ER positive, 60% were PR positive & 32% were Her2Neu positive. 92% were infiltrating ductal carcinomas & 8% were infiltrating lobular carcinomas. Spearman's correlation coefficients were calculated for the variables mentioned above, which demonstrated a significant correlation between tumor SUVmax & ER score (ρ=-0.389, p=0.006), SUVmax & PR score (ρ=-0.432, p=0.002) and SUVmax & MBR score (ρ=0.545, p<0.001). Linear regression analysis of the relation between SUVmax & ER score gave us a regression equation of: ER score=-0.293(SUVmax)+7.133 (R2=0.153, p=0.007). Similar analysis between SUVmax & PR score and SUVmax & MBR score gave us the regression equations: PR score=-0.316(SUVmax)+6.436 (R2=0.199, p=0.002) and MBR score=0.12(SUVmax)+6.392 (R2=0.246, p<0.001). Following this, we performed a logistic regression analysis to ascertain the effect of SUVmax on the ER and PR status of the tumors. The logistic regression model was statistically significant (p=0.029) and explained 18.6% of the variance in the tumor ER status. Tumors with a higher SUVmax were 0.82 times more likely to be ER positive. Similarly, the logistic regression model was also significant (p=0.003) and explained 31.4% of the variance in the tumor PR status. Tumors with higher SUVmax were 0.74 times more likely to be PR positive on immunohistochemical analysis. ***Conclusion:*** This retrospective study was therefore able to demonstrate that breast cancer lesions with a higher SUVmax tend to have lower ER, PR expression and higher MBR scores. We were also able to generate regression models that helped predict the ER, PR & MBR scores along with the probability of ER, PR positivity using the ubiquitous semiquantitative parameter of SUVmax. However, no significant relation could be established between SUVmax & Her2 expression.

EP-0127

The value of ^{18}F-FDG PET/MR in bone lesions of breast cancer patients

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Aim/Introduction: Purpose The aim of this study was to evaluate the role of Fluorodeoxyglucose (^{18}F) positron emission tomography/magnetic resonance imaging (^{18}F-FDG PET/MR) for detecting bone metastasis in breast cancer. ***Materials and Methods:*** Between May 2017 and May 2023, 135 histologically proven breast cancer patients who underwent both ^{18}F-FDG PET/MR and 99mTc-MDP planar bone scintigraphy (PBS) for tumor staging were included. With the exception of the head, the skeletal system was classified into four groups: the spine, the pelvis, the thorax and the appendix. ***Results:*** 38 (28.1 %) of 135 patients were confirmed to have bone metastasis. There was no statistical difference between PET/MR and PBS in patient-based analysis (P = 0.125). 2 patient with a super scan was confirmed to have extensive and diffuse bone metastases and excluded for lesion-based analysis. Of the 36 patients, all the 185 ture metastatic lesions were positive in PET/MR while only 105 ture metastatic lesions were positive in PBS. PET/MRI was observed to be more sensitive than PBS in lesion-based analysis (sensitivity 100.0% versus 56.8 %; P < 0.001). ***Conclusion:*** Compared with PBS for tumor staging of breast cancer, PET/MR was observed to be more sensitive in lesion-based analysis of bone metastasis.

EP-0128

The clinical value and cost-effectiveness of Using ^{18}F-FDG PET/MR as an staging procedure for breast cancer patients

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Aim/Introduction: The purpose of this study was to determine the clinical value and cost-effectiveness of PET/MR as an staging procedure for breast cancer compared with the PET/CT. ***Materials and Methods:*** From May 2017 to December 2022, 425 breast cancer patients confirmed by pathology in our center were included in this study. Among them, 165 patients underwent PET/MR before treatment and 260 underwent PET/CT. Charges were used as issued in 2021 by the Medical Insurance Administration Bureau of Zhejiang, China. Each patient should be followed up for at least 1 year, with the final clinical staging as the gold standard. Incremental costeffectiveness ratio (ICER) measured cost of using PET/MR per percent of patients who avoid missed or misdiagnosis. ***Results:*** A total of 45 patients with missed or misdiagnosis results were observed. More patients with missed or misdiagnosis results were observed in the PET/CT group (14.2% vs. 4.8%, p<0.001). Small lung metastases (3 cases) and false positive lymph nodes (5 cases) resulted in missed diagnosis and misdiagnosis in the PET/MR group. However, the missed lesions in the PET/CT group mainly appeared in the liver (10 cases), bones (7 cases),brest(5 cases), and brain (2 cases), with false positive (7 cases) and false negative (6 cases) lymph nodes simultaneously.The mean interval from pathological diagnosis to initiation of treatment was 12.5 days in the PET/CT group versus 7.4 days in the PET/MR group (p< 0.001). Mean cost per patient was $739 for PET/CT and $1381 for PET/MR. The ICER was $68 for each percent of patients who avoided a missed or misdiagnosis results. ***Conclusion:*** Compared with PET/CT, PET/MR reduced missed or misdiagnosed cases risk and decreased workup of incidental findings, allowing for earlier treatment start. Meanwhile, PET/MR can significantly reduce radiation exposure in patients during examination. It may be cost-effective in initial staging procedure for breast cancer patients.

EP-0129

Impact of ^{18}FDG PET/CT on clinical management, cost effectiveness and radiation exposure in newly diagnosed breast cancer patients

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Aim/Introduction: For initial staging of breast cancer (BC), 18FDG PET/CT is recommended by professional guidelines in stage III (except T3N1) and inflammatory BC (T4d) and optional when conventional imaging is equivocal or suspicious. However, growing evidence also supports its role in staging of intermediate

risk group (IIA, IIB, T3N1 of IIIA). Aim of this study was to compare impact of 18FDG PET/CT with conventional imaging (CT-chest+abdomen+pelvis and bone scan; CT-CAP+BS) in staging, cost effectiveness and radiation exposure in initial staging of BC. ***Materials and Methods:*** A retrospective study (April 2020-Feb 2024) included 115 biopsy proven BC patients who had CT-CAP+BS and 18FDG PET/CT for initial staging. Data were analyzed to see impact of 18FDG PET/CT on change in staging, cost effectiveness and radiation exposure compared to CA-CAP+BS. ***Results:*** Out of 115 patients (113 female and 02 male), 110 had unilateral and 5 had bilateral BC (Invasive Ductal Ca. 107; Non-IDC: 08) with non-significant laterality. Overall upstaging rate for regional nodal and/or distant metastases was 36% (24/66; excluded 49 with stage-IV). Overall upstaging rate due to unsuspected higher nodal metastases was 20% (predominantly stage IIA, IIB). Upstaging rate to stage-IV was seen in 17% (11/66; predominantly in IIIA-C). The overall concordance (no change in staging) was seen in 64% (42/66) while no downstaging was found in any patient. In patients with stage-IV disease (n = 49), 18FDG PET/CT identified higher number of hypermetabolic lesions in 18 (37%), lesser in 07 (14%) and similar in 24 (49%) cases. Estimated cost in Pak rupees for CT-CAP+BS and PET/CT was 139000 and 106000 respectively. Mean effective dose imparted by ^{18}FDG PET/CT was 8.85 mSv compared to reported 26.6 mSv by CT-CAP+BS. ***Conclusion:*** We conclude that in initial staging of BC, ^{18}FDG PET/CT compared with CT-CAP+BS has a significant impact upon decision making by upstaging the disease in stage-II and III and detects more metastatic lesions in stage-IV disease. Furthermore, ^{18}FDG PET/CT is more cost effective and imparts significantly lower radiation exposure as compared with CT+CAP+BS. These findings support the inclusion of ^{18}FDG PET/CT in initial staging of stage II-IV BC. ***References:*** [1]. Shoukat Z, Shah AJ. Breast Cancer Awareness and Associated Factors among Women in Pakistan: A Cross-Sectional Descriptive Study. Asian Pac J Cancer Prev. 2023 May 1;24(5):1561-70. doi: 10.31557/APJCP.2023.24.5.1561. [1]. Menhas R, Umer S. Breast Cancer among Pakistani Women. Iran J Public Health. 2015 Apr;44(4):586-7. PMID: 26056679; PMCID: PMC4441973.

EP-0130

Assessment of new lesions in [18F]FDG-PET/CT scans of metastatic breast cancer patients: A proposal for metastatic breast cancer imaging reporting and data systems (mBI-RADS)

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Aim/Introduction: Metastatic breast cancer (MBC) diagnosis often relies on CE-CT, but the use of [18F]FDG-PET/CT is expanding for staging and response monitoring because of its higher sensitivity. Studies indicate that [18F]FDG-PET/CT detects MBC progression six months earlier than CE-CT1, enhancing 5-year overall survival for the patients2 due to possible earlier adaption of therapy. Such results are based on the application of the PERCIST criteria, following the one-lesion methodology. The experience from these studies suggests, however, that PERCIST may generate false positive decisions, in particular due to misinterpretations of new lesions as signs of progression. Our objective was to explore the feasibility of mitigating this problem by implementing a classification system for new lesions. ***Materials and Methods:*** We developed the metastatic breast cancer imaging reporting and data systems (mBI-RADS) for assessing new lesions in [18F] FDG-PET/CT scans of MBC patients. This was accomplished by abstracting clinical experience and through reevaluation of all new lesions detected in the above mentioned study1 involving 87 patients. Particular features of interest were FDG-avidity (non-avid/equivocal/avid), CT findings (benign/equivocal/malignant/no finding), and lesion localisation (typical/atypical of MBC). We studied to which degree a combination of these features together with additional information from biopsy, anamnesis, or previous imaging might be useful to distinguish between false-positive and true-positive new lesions. ***Results:*** The new classification mBI-RADS categorises new lesions into five main groups (1-5) with subcategories, classifying them as clearly benign (1), likely benign (2), equivocal (3), likely malignant (4), or clearly malignant (5). For equivocal lesions, a follow-up scan with an evaluation according to the confirmatory mBI-RADS is recommended, allowing for reclassification of the initially evaluated lesion based on its development and appearance of new equivocal lesions. Using this two-step approach, 6 out of 7 false positive decisions due to new lesion could be avoided without substantially delaying or removing true positive decisions. ***Conclusion:*** The mBI-RADS is a promising contribution to the assessment of [18F]FDG-PET/CT for monitoring response of MBC patients. It may prevent mischaracterization of false positive lesions, a problem that can arise using the existing PERCIST criteria. The possibility of extending its use to MBC staging is also under consideration. ***References:*** 1. Vogsen et al. Response monitoring in metastatic breast Cancer: a prospective study comparing ^{18}F-FDG PET/CT with conventional CT. JNuclMed 2023; 64.3: 355-361. https://doi.org/10.2967/jnumed.121.263358. 2. Naghavi-Behzad et al. Response monitoring in metastatic breast cancer: a comparison of survival times between FDG-PET/CT and CE-CT. BrJCancer 2022; 126:1271-1279. https://doi.org/10.1038/s41416-021-01654-w.

EP-0131

Advancing Care: ^{18}F-FDG fdPET/CT input for treatment response monitoring in metastatic breast cancer (MBC) - focus on combined cyclin-dependent inhibitors (CDK4/6i)/endocrine therapy (ET) for better disease prognosis

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Aim/Introduction: Metastatic breast cancer poses significant clinical challenges, necessitating effective treatment strategies. Monitoring the effect of the combined therapy with CDK4/6i/ET would be of great value for the further establishment of this kind of therapy and there is still missing information about standardize PET/CT monitoring. The aim of our retrospective study was to assess the role of ^{18}F-FDG "full-digital" PET/CT for the response evaluation in MBC patients treated with CDK4/6i. ***Materials and Methods:*** The retrospective study included 241 PET/CT studies in 80 patients with de novo (43p.) or recurrent (37p.) MBC who started treatment with CDK4/6i/ET at the

Department of Oncology at USHATO, Sofia, Bulgaria. The data was recruited between December 2021 and December 2023. All patients received a combination of aromatase inhibitor (71,3%) or Fulvestrant (28,7) and a CDK4/6i, 44 of them (59,5%) as first-line treatment. We divided metastatic sites into visceral (n=33) and non-visceral (n=64), with bone only - 53p. We selected up to 4 lesions with highest FDG uptake at PET1 and measured the same lesions on the follow-up scans. Treatment response was evaluated according to EORTC criteria, using qualitative interpretations and quantitative indices classifying patients into 4 response groups: complete metabolic response (CMR), partial metabolic response (PMR), stable metabolic disease (SMD) and progressive metabolic disease (PMD). ***Results:*** All 80pts (median age: 63y.o.) had initial staging (PET1) and a second restaging -PET2, 51 pts (63,7%) from PET2 were restaged with PET3 and 30pts (37,5%) from PET3 had subsequent PET4. Restaging PETs showed SUV-decrease, corresponding with therapy response - (SUV1mean for primary tumor from 8,7 to 3,3; regional lymph node 7,5 to 2,9; visceral metastasis from 6,1 to 4,9 and nonvisceral - 8,4 to 4,1). Most of the patients demonstrated PMR at PET2 (73.8%) and PET3 (16.3%). CMR was achieved in 20.0% and 25.0% of patients at PET2 and PET3, respectively. PET4 revealed SMD in 11,3%, and 22.5% of patients achieved CMR. From all 80pts, 6pts (4,8%) showed PMD (4pts after PET3 and 2pts after PET4), 4 of them were with visceral and 2 - with bone progression - they were referred for next line treatment. Additionally, progression-free survival (PFS) analysis demonstrated a mean PFS of 18.89 months (11-34), indicating favorable treatment efficacy and disease control. ***Conclusion:*** In conclusion, our retrospective study defines PET/CT as a pivotal tool in assessing treatment response among MBC patients undergoing CDK4/6i/ET and shows the promising efficacy of this treatment combination.

EP-0132

[18F]FDG PET-CT in staging, re staging and assessment of breast cancer response in men

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Aim/Introduction: To assess the usefulness, in terms of diagnostic validity, and the therapeutic impact of PET-CT in the diagnosis and follow-up of breast cancer in men. ***Materials and Methods:*** Retrospective observational study (January 2009/ September 2023) in men with an anatomopathological diagnosis of breast cancer who underwent a PET-CT study at diagnosis and/ or follow-up. Diagnostic validity parameters were calculated using as reference the anatomopathological results of the lesions, the results of diagnostic reference tests and/or clinical follow-up of at least 6 months. ***Results:*** 96 PET-CT studies were analyzed in 19 men (mean age 72 ± 17.1 years): 7 for initial staging, 5 for re-staging, 11 for suspected recurrence, 46 for follow-up, and 27 to assess response to treatment. The most frequent histological type was infiltrating ductal (18/19), grade 2 (7/19). The tumors showed expression of ER in 18/19p, RP in 15/19p and HER 2(+) in 2/19. Synchronous tumors in 3 patients (choroidal melanoma, Hodgkin lymphoma and mucosis fungoides) PET-CT was positive in 57/96 studies (54 VP, 3 FP) and negative in 39 (37 VN, 2 FN). S:0.96 (95% CI 0.92-1.01), E:0.93 (95% CI 0.84-1.01), PPV:0.95 (95% CI 0.89-1.01), and NPV:0.95 (95% CI 0.88-1.01). Unsuspected injuries were detected in 32/96 studies (33.3%) and the therapeutic management was changed in 24/96 (25%). ***Conclusion:*** [18F]FDG-PET-CT in men with breast cancer showed high sensitivity, detecting lesions not known by conventional imaging tests (33.3%). These injuries changed the therapeutic management in 25% of the cases.

EP-0133

Predictive role of baseline [18F]FDG PET/CT quantitative parameters for response to neoadjuvant treatment with atezolizumab, trastuzumab, pertuzumab and epirubicin in HER2-positive early breast cancer - a substudy of the ABCSG-52/ATHENE phase II trial

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Aim/Introduction: HER2-positive breast cancer is an aggressive breast cancer subtype and is routinely treated with combinations of HER2-directed drugs and chemotherapy as (neo)adjuvant therapy. While excellent long-term outcome has been achieved, concerns regarding treatment-induced toxicity remain. Therefore, identification of patients who may respond to the de-escalated regimens is of critical importance. In this study, we aimed to evaluate the predictive role of baseline [18F]FDG PET/CT quantitative parameters for response to neoadjuvant treatment in HER2-positive breast cancer patients receiving neoadjuant therapy with atezolizumab in combination with dual HER2 blockade plus epirubicin within the ABCSG-52/ATHENE trial. ***Materials and Methods:*** [18F]FDG PET/CT quantitative parameters of a sub-group of HER2-positive invasive unilateral breast adenocarcinoma patients from a randomized open-label, two-arm phase II study were correlated with postsurgical pathological findings. In the setting of randomized clinical trial, patients were assigned to two neoadjuvant treatment arms (atezolizumab, pertuzumab and trastuzumab vs pertuzumab and trastuzumab) followed by four cycles of epirubicin plusatezolizumab, pertuzumab and trastuzumab in both arms and subsequent surgical resection of the tumor. Complete pathologic response (pCR) and residual cancer burden (RCB) class (RCB 0-III) were evaluated. All patients underwent standard pre-treatment and post-treatment [18F] FDG PET/CT scans. Semi-quantitative measurements (SUVmax, SUVmean, SULmax, SULpeak, SULmean, MTV and TLG) were performed in all detected lesions. ***Results:*** A sub-group of 12 patients (mean age: 55.68±9.67 years) were included in this pilot study (11 patients evaluable for pCR/RCB). RCB classes of 0, I and II were reported in 6 (54.5%), 3 (27.2%) and 2 (18.1%)

patients, respectively. Primary tumor SUVmax and SUVmean were significantly higher in pCR group compared to RCB-II (8.22±1.12 vs 4.12±0.91, p=0.018; 4.93±0.83 vs 2.59±0.81, p=0.007). SUVmax, SULmax and SULmean in metastatic lymph nodes of pCR patients were significantly lower than RCB-I group (p<0.05). There was no patient with positive lymph node metastases in RCB II class. Total TLG was significantly higher in pCR compared to RCB-II group. ***Conclusion:*** The results of this study showed that higher metabolic activity of malignant lesions on [18F]FDG PET/CT is significantly associated with pathological response after neoadjuant therapy with atezolizumab in combination with dual HER2 blockade plus epirubicin in HER-2 positive breast cancer patients. Given these initial findings, baseline [18F]FDG PET/CT parameters could potentially be used for approaching de-escalation strategies and identification of patients who will benefit from this treatment regimen. Future studies with larger sample populations are needed to confirm these findings.

EP-0134

Phase I trial of gastrin releasing peptide receptor antagonist [99mTc]Tc-DB8 for SPECT imaging of GRPR expression in breast cancer.

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Aim/Introduction: An accurate non-invasive staging of luminal breast cancer remains an unmet clinical need. The tumours with a high expression of gastrin-releasing peptide receptors (GRPR) might respond to therapy using radiolabelled bombesin analogues. There is a strong correlation between GRPR and oestrogen receptor (ER) expression. Thus, quantitative visualization of GRPR expression in breast cancer might provide important information enabling personalized treatment of breast cancer. Preclinical studies have demonstrated that antagonistic bombesin analogue [99mTc]Tc-DB8 binds to GRPR with high affinity and specificity. The aim of this study was to evaluate distribution, safety, tolerability and dosimetry of [99mTc]Tc-DB8 after injection in patients with primary breast cancer. ***Materials and Methods:*** This was a prospective, open-label, non-randomized Phase I diagnostic study was performed in patients with primary breast cancer (ClinicalTrials.gov Identifier: NCT05940298). Fifteen patients with primary ER-positive breast cancer (ER6-ER8) were in three cohorts, five patients each. The injected peptide mass was either with 40, 80, or 120 µg. The injected activity was 362±90 MBq [99mTc]Tc-DB8. Planar scintigraphy was performed after 2, 4, 6 and 24 h and SPECT/CT imaging after the planar imaging 2, 4 and 6 h after injection. Vital signs were monitored before, during and after the imaging. The imaging data were used for calculation of dosimetry using OLINDA/EXM 1.1 (female phantom). Additionally, four patients with ER-negative primary tumours were injected with 80 µg [99mTc]Tc-DB8 and SPECT/CT imaging was performed 2 h after injection. ***Results:*** No adverse events were detected after injection of any mass of DB8. The effective dose was 0.019±0.004 mSv/MBq. The normal organs with the highest accumulation (%IA per organ) were breast, kidney, liver, lung and pancreas. The uptake in the pancreas after injection 120 µg was significantly (p<0.005, Mann-Whitney U test) lower compared with 80 µg . The effective dose was 0.009 ± 0.001, 0.011 ± 0.004 and 0.014± 0.003 mSv/MBq for patients injected with 40, 80 and 120 µg respectively. Injection of 80 µg provided significantly (p<0.05, one-way ANOVA) higher uptake in primary ER-positive breast cancer 2 h after injection (SUVmax 5.3±1.4) than injection of 40 µg (SUVmax 2.0±0.3) or 120 µg (SUVmax 3.2±1.4). The uptake in ER-negative tumours (SUVmax 2.0±0.8) was significantly (p<0.05, Mann-Whitney U test) lower than in ER-positive. ***Conclusion:*** Imaging using [99mTc]Tc-DB8 is safe. The injected protein dose of 80 µg provides the highest tumour uptake. The data indicate that discrimination between ER-positive and negative lesions might be possible using [99mTc]Tc-DB8.

EP-0135

Combining [18F]FDG PET/CT with machine learning can predict neoadjuvant therapy failure in breast cancer patients

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Aim/Introduction: In the treatment of locally advanced and high-risk breast cancer, neoadjuvant chemotherapy (NACT) plays a crucial role. Predictive models are essential in identifying patients at risk of therapeutic failure for personalized treatment strategies. This study aims to assess and define the predictive capabilities of FDG-PET metabolic, clinical, and pathological data using machine learning techniques in optimizing NACT outcomes for breast cancer patients. ***Materials and Methods:*** Clinical and pathological variables including patient demographics, histological characteristics, hormone receptor status (ER, PGR), MIB-1, and staging information were collected in 84 patients. All patients underwent [18F]FDG-PET/CT at initial staging before preoperative NACT and 74 out of 84 underwent surgery. Ten patients were not included: 8 out did not perform surgery and 2 of them dropped out. The response to NACT was classified into three classes: pathological Complete Response (CR), pathological Partial Response (PR), and No Response (NR). A total of 9 predictors, including 5 clinical features (HER-2, MIB-1, ER, PGR, Histology), 3 metabolic features extracted from the PET/CT studies (SUVmax, MTV, TLG) and age were included in the analysis. The PET/CT metabolic features were obtained by using segmentation algorithms implemented on the same software platform in AW 4.6 (Advantage Workstation, GE Healthcare). Least absolute shrinkage and selection operator (LASSO) was used to identify the optimal variables for predicting the response to NACT. The LASSO regression was performed using R software with the "glmnet" package. Multinomial logistic regression analysis with selected variables was used to predict the response for each outcome class. The predictive performance was assessed with ROC curves and the AUCs. Mantel-Haenszel statistic was used to generate odds ratios and to assess the strength of association between predictors and outcome. ***Results:*** Twenty-eight patients showed a CR, whereas 13 and 33 were classified as NR and PR respectively. AGE, MTV, TLG, MIB-1, HER-2 variables showed highest predictive value at LASSO regression analysis. The best predictive models of treatment failure to NACT using feature selection obtained an area under the curve of 81.46, [CI=58.91, 92.37] with a sensitivity of 46.15

and a specificity of 95.08. The Mantel-Haenszel chi-square was 3.9 p<0.05 with an odd ratios of 2.15 (CI=1.06, 4.35). ***Conclusion:*** These findings suggest that integrating semiquantitative [18F]FDG-PET/CT data with clinical information into a unified predictive model can effectively forecast neoadjuvant treatment failure in breast cancer patients. This insight may facilitate the selection of individualized treatments for those facing an adverse prognosis.

EP-0136

^{68}Ga labeled single domain antibody for non-invasive determination of the HER2 expression

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Aim/Introduction: Human epidermal growth factor receptor 2 (HER2) is overexpressed in several cancers. Therefore, HER2 represents a good target for monoclonal antibodies with vehicles for specific drug delivery. Single domain antibodies (sdAb), in particular, were investigated in depth in the last years, since they offer the advantage of a more accurate determination of the HER2 status compared to monoclonal antibodies. Especially the HIS-tag attached to the nanobody can affect its bioavailability and therefore its tumor uptake rate. Here, a 68Ga-labeled anti-HER2 sdAb ([68Ga]Ga-DOTA-GA-NM-02) with and without HIS-tag was examined in terms of its biodistribution and tumor targeting potential in a HER2 xenograft. ***Materials and Methods:*** Rj:ATHYM-Foxn1nu/nu mice were subcutaneously injected with SKOV-3 cells to form a HER2 positive tumor. After the tumor reached a volume of about 200 mm^3, the mice (n=6) were injected with 10 MBq of the 68Ga-labeled nanobody with HIS-tag and scanned in the PET/CT immediately after injection and 3h post injection (p.i.). On the following day, the same mouse was injected with the 68Ga-labeled nanobody without HIS-tag and scanned again 0h and 3h p.i. in the PET/CT. Another group of mice (n=6) was subjected to the same experimental procedure, but additionally injected with an excess of cold nanobody. All mice were injected with gelofusine as renal protection three minutes before the injection of radioactivity. ***Results:*** The [68Ga]Ga-DOTA-GA-NM-02 products were prepared with a high radiochemical purity (99.8 ± 0.5%). Imaging with the nanobody with HIS-tag showed a mean Standardized Uptake Value (SUVmean) of 1.32 ± 0.36 in the kidney and 0.25 ± 0.19 in the liver 3h p.i.. The tumoral uptake showed 3h p.i. a SUVmax of 0.69 ± 0.11 (45 min p.i. SUVmax 1.2 ± 0.2). In comparison, the SUVmean in the mice injected with the nanobody without HIS-tag was 0.98 ± 0.27 in the kidney and 0.12 ± 0.14 in the liver. The SUVmax in the tumor was 0.54 ± 0.07 (45 min p.i. SUVmax 1.1 ± 0.3). By addition of unlabeled nanobody the tracer uptake in the tumor was reduced by 65% for the nanobody with HIS-tag (SUVmax 0.24) and by 33% for the nanobody without HIS-tag (SUVmax 0.36). ***Conclusion:*** We could demonstrate the feasibility of the use of [68Ga]Ga-DOTA-GA-NM-02 with and without a HIS-tag. For both nanobodies, images with a high tumour-to-background ratio can be obtained only 45 minutes p.i.. The blocking experiment underlined the specific uptake in the tumor.

EP-0137

Development of Trop2-targeting Nanobody 68Ga-MY6349 for PET/CT assessment of Trop2 expression in 15 types of cancers

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Aim/Introduction: Trophoblast cell surface antigen 2 (Trop2) is overexpressed in many human epithelial cancers. Here, a nanobody targeting Trop2 (MY6349) was developed as a molecular agent for PET imaging. This study primarily aimed to quantify tumor uptake of 68Ga-MY6349 in various malignancies to identify the most promising markers for clinical applications. Additionally, we analyzed the safety, biodistribution patterns, and preliminary dosimetry of this new class of Trop2 radiopharmaceuticals. ***Materials and Methods:*** A tris(hydroxypyridinone) (THP) chelator was chemically linked to the anti-Trop2 nanobody (MY6349) through a site-specific Michael addition conjugation, then subsequently labeled with the radioisotope 68Ga. Preclinical evaluation were performed using different Trop2 expression level tumor-bearing models to evaluate the Trop2-targeting capacity and specificity in vivo. Subsequently, proof of concept was realized by PET imaging with 68Ga-MY6349 in various malignancies. After dosimetry evaluation, the clinical feasibility of 68Ga-MY6349 PET/CT was evaluated in patients with various types of cancer, and the results were compared with conventional PET tracers. ***Results:*** Preclinical studies demonstrated high intratumoral uptake of 68Ga-MY6349 and fast clearance, resulting in high tumor-to-background contrast. The effective dose was 1.46E-02 mSv/MBq. In 83 patients with 15 types of cancer, 68Ga-MY6349 accumulation well above the background level was demonstrated in most identified sites of disease. The highest average SUVmax (>10) was found in PTC, breast cancer (HR+ and TNBC), and prostate cancer. The lowest 68Ga-MY6349 uptake (average SUVmax < 5) was observed in colorectal cancer, pancreatic cancer. The 68Ga-MY6349 uptake in nasopharyngeal carcinoma, urothelium carcinoma, head and neck cancer, and NSCLC was intermediate (SUV 5-10). A comparison with the commonly used radiotracer (18F-FDG, 68Ga-PSMA) revealed that 68Ga-MY6349 was clearly superior, with higher radiotracer uptake and tumor-to-background ratios, particularly in TNBC, PTC, and prostate cancer. In addition, Trop2 expression by IHC is highly correlated with 68Ga-MY6349 uptake in various tumors. Finally, 68Ga-MY6349 PET/CT was performed before and 24h after Trop2 ADC treatment in 3 patients, which revealed a notable reduction in the tumor uptake of 68Ga-MY6349 after treatment. ***Conclusion:*** 68Ga-Trop2-Nanobody (68Ga-MY6349) PET/CT is a safe procedure with a radiation dose comparable to that of other routinely used PET tracers. Tracer accumulation in Trop2-positive metastases was remarkably higher than that of the commonly used radiotracer 18F-FDG, particularly in patients with PTC, prostate cancer, HR+ breast cancer, and TNBC. In addition, PET imaging of Trop2 expression using 68Ga-MY6349 may provide a method for non-invasive evaluation of Trop2 ADC clinical trials of various malignancies.

EP-0138

Focal FDG uptake in the breast of patients with cancers other than breast cancer

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Aim/Introduction: This study aimed to evaluate the occurrence of malignant focal FDG uptake in the breast among patients

diagnosed with cancers unrelated to breast cancer. ***Materials and Methods:*** A retrospective review of 12,403 consecutive FDG PET/CT scans was conducted on patients with various non-breast primary cancers. We identified and examined 32 instances of unexpected focal breast FDG uptake, confirmed histopathologically. These cases comprised patients with malignancy in uterine cervix/endometrium/ovary (n=9), lung (n=4), colon/rectum (n=3), thyroid/parathyroid (n=3), liver/gallbladder (n=3), and others (n=7). SUVmax values were calculated for each focus, then the Student's t-test and a SUVmax-based logistic classification were utilised to differentiate between benign and malignant lesions. Statistical significance was set at $p < 0.05$. ***Results:*** Among the 32 foci with increased FDG uptake, eight were confirmed malignant lesions, while 24 were benign. Malignant lesions exhibited significantly higher SUVmax values compared to benign lesions (4.5 ± 1.1 vs. 2.4 ± 0.9, $p = 0.017$). Using a SUVmax cut-off value of 3.2, sensitivity and specificity for detecting malignant lesions were 0.750 and 0.750, respectively. Application of logistic classification did not yield significant improvement in diagnostic accuracy. ***Conclusion:*** This study underscores the prevalence of malignant focal FDG uptake (25%) in the breast among patients with non-breast cancers. Furthermore, our findings demonstrate the utility of SUV quantification in distinguishing between benign and malignant breast lesions in this population.

EP-0139

Somatostatin Receptor Imaging with ^{68}Ga-DOTATATE PET/CT and its Comparison with ^{18}F-FDG PET/CT in Patients with Estrogen Receptor Positive Metastatic Breast Cancer

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Aim/Introduction: The present study aimed to investigate whether somatostatin receptor (SSTR) expression in estrogen receptor positive (ER+) metastatic breast cancer (mBC), as identified by pathology and immunohistochemistry studies, represents a clinically meaningful target for PET imaging and potential theranostics. ***Materials and Methods:*** Thirty (29 female:1 male) patients with ER+ mBC were prospectively recruited and underwent PET/CT with 18F-FDG and 68Ga-DOTATATE (within three weeks). Detection rates (per-patient, per-region), number of lesions detected, SUVmax values, adapted Krenning scores, SSTR-FDG visual scores and PET-based staging were compared for both tracers. ***Results:*** The median time gap between the two PET/CT studies was 4.5 days (IQR, 3-10.25). 29/30 (96.7%) patients had positive lesion(s) on both 18F-FDG and 68Ga-DOTATATE PET/CT. 1 patient (3.3%) had 18F-FDG+ and 68Ga-DOTATATE- disease. Per-region and per-lesion analyses showed comparable detection rates with 18F-FDG and 68Ga-DOTATATE for local/breast lesions (number of lesions, 26 vs 26, respectively), regional nodal (79 vs 77), extra-regional nodal (120 vs 119) and skeletal metastasis (181 vs 174). 18F-FDG significantly outperformed 68Ga-DOTATATE for detection of visceral/other metastasis (95.7% vs 56.5% patients, P=0.012; 235 vs 128 lesions, P=0.003). Dominant local/breast lesions (median SUVmax 10.6 vs 4.0, respectively, P=0.01), regional nodal (median SUVmax 8.6 vs 3.8, P=0.01), extra-regional nodal (median SUVmax 9.4 vs 4.2, P=0.04) and visceral/other metastases (median SUVmax 7.8 vs 3.2, P=0.012) had significantly higher 18F-FDG uptake than 68Ga-DOTATATE uptake, while skeletal metastases (mean SUVmax 8.6±3.5 vs 8.0±4.3; P=0.573) had comparable tracer uptake. Most lesions (73.6%-86.9%) had an adapted Krenning score ≤ 2 and an SSTR-FDG visual score of ≥ 4 (52.6%-83.3%). The overall SSTR-FDG visual score was ≤ 2 in 3/30 (10%) patients. There was no significant correlation between the biopsy ER (P=0.669) or progesterone receptor (P=0.208) Allred scores and highest 68Ga-DOTATATE lesional SUVmax. The highest 68Ga-DOTATATE lesional SUVmax showed a trend of being higher in the HER2- sub-group compared to the HER2+ sub-group (median 9.0 vs 3.8, P=0.078). 3/30 (10%) patients had a lower PET-based M-stage with 68Ga-DOTATATE compared to 18F-FDG, while T- and N-stages were concordant in all (weighted kappa (κ) = 1). Both PET modalities showed excellent inter-reader agreement for region-wise lesion detection (κ values, 0.863-1.0) and overall SSTR-FDG visual scoring (intraclass correlation coefficient, 0.895). ***Conclusion:*** 68Ga-DOTATATE PET/CT can visualize malignancy in patients with ER+ mBC. However, poor sensitivity for visceral metastasis, low levels of radiotracer uptake and significant inter-lesion heterogeneity hinder the meaningful clinical translation of SSTR-based theranostics in breast cancer.

EP-0140

Changes in tumor uptake and physiological uptake over time in dual-time-point ^{18}F-FES PET/CT in patients with breast cancer

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Aim/Introduction: 18F-FES PET/CT is a promising imaging modality for estrogen receptor (ER)-positive breast cancers (BC). However, distinguishing tumor uptake from physiological uptake is sometimes challenging due to limited contrast. 18F-FES PET/CT is typically performed as a single static image 1 hour (1h) after radiotracer injection, but the impact of delayed-time-point imaging on uptake has not been well understood. This study aimed to investigate the effect of imaging time-point on tumor uptake and physiological uptake. ***Materials and Methods:*** This prospective study was approved by the Institutional Review Board. Patients with primary BC or known/suspected metastatic BC who underwent 1h and 2h dual-time-point 18F-FES PET/CT without selective estrogen receptor modulator (SERM) or selective estrogen receptor degrader (SERD) treatment were included. SUV (SUVmax or SUVmean) was measured for physiological uptake and FES-avid primary or metastatic BC lesions. Tumor-to-background ratio (TBR) using blood pool or bone marrow as background (TBRblood and TBRbone, respectively), and retention index (RI), defined as (SUVmax2h-SUVmax1h)/SUVmax1h×100 (%), were calculated for each lesion. Differences in SUVs and TBRs between the two static images were assessed using the Wilcoxon signed-rank sum test. ***Results:*** Ten women (age 46-81 years; 8 postmenopausal, 2 unknown menopausal status) were included. Estradiol (E2) levels were <20 pg/mL in all patients. The median dose of 18F-FES was 193.8 MBq (interquartile range [IQR] 173.8-212.5 MBq). SUVmax of the uterus and gall bladder significantly increased from 1h to 2h, whereas SUVmean of the liver and bone marrow significantly decreased. Retained uptake of the injected vein also significantly decreased over time. No significant change was observed in SUVmean of the aorta, breast tissue, and fat. There were 62 FES-avid BC lesions (35 bone, 14 lymph node, 3 breast, 5 pleura, 2 lung, and 3 others), with median SUVmax of 6.15 (IQR 3.6-8.7) at 1h and 7.5 (IQR 4.3-10.4) at 2h, median TBRblood of 5.1 (IQR 2.9-7.7) at 1h and 6.3 (IQR 3.6-10.1) at 2h, and median RI of 13.3 (IQR 2.9-28.9). Both SUVmax and TBRblood significantly increased from 1h to 2h ($p<0.001$ and $p=0.016$, respectively). In respect of bone

metastases, TBRbone significantly increased over time (median 4.7 [IQR 2.6-9.7] at 1h, median 7.8 [IQR 4.5-19.6] at 2h, p<0.001). ***Conclusion:*** Our preliminary study suggests the advantage of delayed-time-point imaging in enhancing FES-avid tumor uptake. Specifically, bone metastases, the most common distant metastases, exhibited improved contrast with delayed imaging.

EP-0141

The predictive role of [18F]FDG PET radiomics in breast cancer patients undergoing neoadjuvant chemotherapy: preliminary results from a prospective cohort

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Aim/Introduction: In the last decade, radiomics has emerged as a source of image-derived biomarkers with diagnostic, predictive, and prognostic potential in various diseases, including breast cancer. However, existing data predominantly stem from retrospective analyses. This study aims to assess the role of [18F] FDG PET radiomics in the prediction of pathological complete response in a prospective cohort of breast cancer (BC) patients eligible for neoadjuvant chemotherapy (NAC). ***Materials and Methods:*** We prospectively enrolled stage I-III BC patients eligible for NAC as per standard of care who underwent staging [18F]FDG PET/CT from 2019 to 2022. The present preliminary analysis included patients who had available data regarding pathological treatment response assessed in the breast post-NAC surgical specimen. Accordingly, patients were grouped into two classes: those with pathological complete response (pCR) and those with residual disease (non-pCR). Clinical and histological data were collected. Seventy-one first-order radiomic PET features were extracted from the volume of interest drawn semiautomatically on the primary breast lesion. The ComBat approach was used to harmonize radiomic data. The predictive role of clinical, histological, and radiomic data with respect to pCR was assessed. Univariate and multivariate statistics were used for inference while principal component analysis (PCA) was used for dimensionality reduction. ***Results:*** We enrolled 53 HER2+ and 40 triple-negative (TNBC) BC patients. pCR was obtained in 24/53 (45%) HER2+ and 20/40 (50%) TNBC patients. The clinical stage was I in 4/93 (2/4, 50% pCR), II 76/93 (38/76, 50% pCR), and III in 13/93 (4/13, 31% pCR) cases, respectively. Distribution of age, molecular subtype, ki-67, and stage was not statistically different in the two classes. None of these variables was a significant predictor of pCR at multivariate analysis. At univariate analysis, 10 radiomic features (1 morphology-based, 7 intensity-based, and 2 histogram-based) resulted with a p<0.1. Upon PCA, 3/22 radiomic principal components (PC) among the ones explaining at least 95% of the variability were found to be discriminative for pCR. Using a cross-validation approach, the radiomic PC failed to discriminate pCR vs. non-pCR groups but were able to accurately predict the stage (mean accuracy=0.79±0.08). The addition of clinical variables to radiomics did not improve the cross-validated results of Logit in terms of pCR prediction. ***Conclusion:*** This preliminary analysis demonstrates the potential role of [18F]FDG PET radiomics for the prediction of clinical stage in BC patients undergoing NAC, while its possible role in predicting pCR to NAC needs to be further investigated.

EP-0142

Correlation between tumor uptake on [18F]FES PET imaging and ESR1 mutation status in metastatic HR+/HER2- breast cancer patients after first-line endocrine therapy

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Aim/Introduction: The estrogen receptor one (ESR1) gene encodes the estrogen receptor alpha (ER) protein, which is pivotal in hormone receptor-positive (HR+)/HER2-negative (HER2-) breast cancer (BC). Prolonged exposure to selective pressure from first-line aromatase inhibitors (AI), which decrease the synthesis of estradiol, is the most likely mechanism driving the acquisition of ESR1 mutations (ESR1m). ESR1m stabilizes ER in an active conformation in the absence of estradiol usually leading to AI resistance. We tested whether the presence of a mutated ER could influence the [18F]Fluoroestradiol (FES) uptake in tumor lesions. ***Materials and Methods:*** We conducted a retrospective bicentric analysis of metastatic HR+/HER2- BC patients who experienced relapse after first-line treatment with AI and CDK4/6 inhibitors (CDK4/6i). All patients underwent both [18F]FDG and [18F] FES PET imaging before starting second-line treatment (endocrine therapy or chemotherapy). ESR1m(+/-) status was assessed using droplet digital polymerase chain reaction on circulating tumor DNA (ctDNA) or through molecular profiling of tumor tissue obtained after progression on AI+CDK4/6i. PET biomarkers, including the maximum standardized uptake values (SUVmax) of FDG and FES, as well as the FDG/FES SUVmax ratio, were analyzed and correlated with ESR1m status. ***Results:*** A total of 38 patients were included: 31 (81%) with invasive carcinoma of no-special type (NST), 6 (16%) with invasive lobular carcinoma (ILC), and 1 (3%) with mixed carcinoma (NST/ILC). ESR1m status was assessed using tumor tissue in 6 pts or ctDNA in 32 pts. Eight patients (21%) were ESR1m+. Using a SUVmax threshold ≥ versus <2, the PET was FES-negative in 9 (30%) ESR1m- patients versus 1 (12.5%) ESR1m+ patient (p-value=0.27). ESR1m+ patients demonstrated higher SUVmax values on [18F]FES PET compared to ESR1m- patients, although this difference was not statistically significant (median: 7.88 versus 3.85, p-value 0.15). No significant differences were observed between SUVmax values on FES and FDG PET/CT scans (8.35 versus 7.87, p-value=0.84), nor between the SUVmax FDG/FES ratio (0.97 versus 1.68, p-value=0.27) among ESR1m+ versus ESR1m- patients. ***Conclusion:*** Our results indicate that [18F]FES PET imaging can still detect ER+ disease regardless of ESR1m status with a sensitivity of 74% with a positivity threshold set to SUVmax ≥2. A trend towards higher FES uptake was observed in ESR1m+ patients compared to ESR1m- patients suggesting a higher binding affinity of FES to the receptor. While reinforcing the existing trend in (pre-)clinical literature, future prospective studies with larger sample sizes are warranted to confirm these findings and explore their clinical usefulness.

EP-0143

Molecular imaging of Avβ6-integrin using Ga68-Trivehexin PET/CT in cases of Triple Negative Breast Cancer; Single Institution preliminary Experience

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Aim/Introduction: αvβ6 is a subtype of integrin which is a class of heterodimeric transmembrane cell adhesive receptors with established evidence that correlates' αvβ6-integrin expression to the severity of various malignancies including breast cancer. Avβ6-integrin is known for its role in facilitating invasion, inhibiting apoptosis, regulating expression of matrix metalloproteases and activating TGF-β; therefore, the expression of αvβ6 is associated with poor prognosis. Ga68-Trivehexin has 85%-88% affinity of this specific integrin. Our objective in this preliminary study was to explore the viability of Ga68-Trivehexin PET/CT in diagnosed cases of triple negative breast cancer. ***Materials and Methods:*** A sample of 6 patients were involved in this preliminary study of whom five are female and one is male patients. All of the cases were biopsy proven cases of triple negative breast cancer whom were referred for staging and restaging. All patients had Ga68-Trivehexin PET/CT scan after signing an informed consent. Ga68-Trivehexin was performed with constant dose of 4 mCi and images were acquired after an average of 65 minutes post-injection with 2 min/bed from vertex to mid-thigh on digital PET/CT camera. The images were then analyzed visually and semi-quantitively in terms of SUVmax and tumor-to-background ratio and the result were compared to either clinical data, recent conventional radiological images or F^{18}-FDG PET/CT scan done within less than a month. ***Results:*** In all of the 6 patients, the Ga68-Trivehexin showed abnromal localization in the known primary and metastatic lesions that were documented by either recent conventional radiological imaging or molecular imaging using F18-FDG PET/CT. In one of the cases with known biopsy proven non-malignant lymphadenopathy, Ga68-Trivehexin showed no abnormal localization in these enlarged lymph nodes; these lesions were showing mild false-positive hypermetabolic activity in a recent F18-FDG PET/CT. However, Ga68-Trivehexin showed abnormal localization in two cases with post-radiation fibrosis. Another patient who had complicated bilateral total mastectomy with wound infection showed diffused localization of the radiotracer at the surgical beds. ***Conclusion:*** Imaging of αvβ6-integrin expression with Ga68-Trivehexine is an excellent prognostic tool with lean potentials for developing theragnostic target that delineat fast-growing malignant cells. One of the main privileges of this radiotracer is its almost negligible background activity which allows better delineation of targeted tumor. This advantage is essential privilege when considering the potential development of a theranostic agent. Correlation with immunohistopathology and follow-up to assess disease prognosis of a larger number of patients are required for further validation of this radiotracer.

EP-0144

Prisma: A single-center, prospective phase II imaging study using ^{68}Ga-PSMA-11 PET/CT to assess the expression of prostate specific membrane antigen (PSMA) in patients with progressive triple-negative breast cancer

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Aim/Introduction: High rates of prostate-specific-membrane-antigen (PSMA) expression have been reported in triple-negative breast cancer (TNBC)[1]. In this study we assessed PSMA expression in patients with metastatic TNBC (mTNBC) via positron-emission tomography/computed-tomography (PET/CT). ***Materials and Methods:*** PRISMA is a prospective, single-center study enrolling patients with progressive mTNBC. TNBC was defined according to ASCO/CAP guidelines. Patients with measurable disease on 18F-FDG-PET/CT underwent 68Ga-PSMA-11-PET/CT. For quantitative lesion-based analysis, target-lesions (TLs) were defined as ≥1.5 cm in diameter and PERCIST measurable on 18F-FDG PET/CT. TL volumes were propagated to the 68Ga-PSMA-11-PET/CT to measure maximum standard uptake value corrected for lean body mass (SULmax). Mann-Whitney U test assessed differences in SULmax between subgroups of patients based on age (>50yo), PDL1 positivity, Ki-67 index and number of prior treatment lines. A qualitative analysis was performed by three nuclear physicians who classified patients based on the highest PSMA expressing lesion and PSMA expression in the majority of lesions into four groups respectively: 0 (<blood-pool), 1 (>blood-pool), 2 (>liver) and 3 (>parotid-uptake). In case of discordance, the majority determined final visual score. Interreader reliability for the qualitative classification was evaluated by intraclass correlation coefficient (ICC). ***Results:*** Three out of twenty patients were excluded due to lack of measurable TLs on 18F-FDG-PET/CT. Median age at time of diagnosis was 49yo (range 36-68), median number of TL per patient was 7 (range 1-12). SULmax on 68Ga-PSMA-11 PET/CT of all TLs ranged between 1.2 and 18.7, indicating substantial inter-patient and intra-patient heterogeneity. Overall 65.6% (80/122) of TLs had SULmax above Liver-SULmean. SULmax on 68Ga-PSMA-11-PET/CT of TLs was significantly higher in patients younger than 50yo at diagnosis (4.5vs3.1,p=0.02) and in cases of PDL1 positivity (4.4vs2.9,p=0.001). Number of prior treatment lines and Ki-67 index were not associated with SULmax. Visually 70.6%(12/17) and 41.2%(7/17) had a score of 2(>liver) based on highest PSMA expressing lesion and PSMA expression in the majority of lesions. Interreader reliability was excellent with ICC of 0.91 (95% CI 0.79-0.93) and 0.89 (95% CI 0.74-0.96) for both visual approaches, respectively. ***Conclusion:*** PSMA expression in TNBC is heterogenous between patients but also within patients. We observed in the majority of lesions an uptake higher than the liver. Whether this will be sufficient for the success of radioligand therapy targeting PSMA remains to be explored. ***References:*** Tolkach Y et al. PSMA in breast cancer: a comprehensive evaluation of expression and a case report of radionuclide therapy. Breast Cancer Res Treat. 2018.

EP-0145

A Head-To-Head Comparison of ^{68}Ga-FAPI-RGD and ^{18}F-FDG PET/CT for the Detection of Early Breast Cancer

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Aim/Introduction: Early breast cancer is asymptomatic and difficult in preoperative staging. 18F-FDG PET/CT based on glucose metabolism, is paramount for clinical practice. However, the physiological uptake of breast increased the miss rate of small masses and non-mass malignanices. FAP and RGD, which are respectively known to be highly expressed in tumor

stroma, exhibits rapid tracer accumulation in target lesions and low background signal. The aim of this study was to compare diagnostic ablities of 68Ga-FAPI-RGD, a dual fibroblast activation protein (FAP)- and integrin avβ3- (RGD) targeting tracer, to 18F-FDG PET/CT in a single group of patients with early breast cancer. ***Materials and Methods:*** This was a pilot exploratory study of patients with breast malignancies confirmed by biopsy. All 20 patients were recruited by ultrasound and MRI screening. The participants underwent 68Ga-FAPI-RGD and 18F-FDG PET/CT scan within one week before surgery. SUVmax was measured in the primary tumor region, positive regional lymph nodes. Final diagnosis was made based on histopathological analyses or clinical follow-up reports. The expression of fibroblast activation protein and integrin receptor in the primary lesion was analyzed by immunohistochemistry. ***Results:*** All patients had at least one positive lesion on each of the two scans. Twenty patients (100%) and 17 patentis (85%) showed postive lesions on 68Ga-FAPI-RGD and 18F-FDG PET/CT, respectively. For primary lesions, 68Ga-FAPI-RGD had a higher tumor uptake (SUVmax 10.6 ± 6.2 vs. 8.7 ± 5.6, P = 0.003) and higher tumor-to-background ratio than 18F-FDG (SUVmax 7.0 ± 3.9 vs. 6.1 ± 4.1, P = 0.005). Both tracers produced comparable results for detecting primary tumours (8 vs. 9, P = 0.665), lymph node metastases (11 vs. 15, P = 0.365). There was also a significant difference between the size of 68Ga-FAPI-RGD and 18F-FDG in primary lesions (diameter 4.2 ± 1.4 cm vs. 2.7 ± 1.5 cm, P= 0.038). Immunohistochemistry showed that the SUVmax and TBR of 68Ga-FAPI-RGD PET/CT were positively correlated with fibroblast activation protein and integrin expression (P < 0.001 for both). ***Conclusion:*** 68Ga-FAPI-RGD PET/CT gave a higher tracer uptake, improved detection of small size primary lesions and lymph node metastases compared with 18F-FDG PET/CT in early breast cancer. Since the lesions positive on the dual tracer showed greater cellular affinity, which increased tracer retention in the body. The novel dual-target molecular agent could be expected to optimize clinical staging, and 177Lu-based theranostics can be a potential application for those advanced breast cancer patients.

EP-0146

The prognostic role of [18F]FDG PET/CT for suspected recurrence or monitoring systemic treatment in triple-negative breast cancer: preliminary results of the TRINE-PET trial

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Aim/Introduction: triple-negative breast cancer (TNBC) is an aggressive neoplasm frequently causing metastatic spread. [18F] FDG (FDG) Positron Emission Tomography (PET) is often used in daily clinical practice in case of suspect of recurrency, or for monitoring systemic treatment, although its prognostic relevance still requires further investigation. TRINE-PET is an Italian, multicenter, retrospective study, aiming to investigate the prognostic meaning of FDG PET/CT in different clinical settings of TNBC. ***Materials and Methods:*** data of TNBC patients who performed FDG PET/CT for suspected recurrency or for monitoring systemic treatment were retrospectively collected from 23 Italian centers. A minimum of 2 years of follow-up was required for inclusion. Correlation between FDG PET/CT positivity per district (T, N and M) and survival outcomes (progression and death) was evaluated with long-rank test. In patients imaged for suspected recurrency, Mann-Withney test was used to correlate the value of the onco-marker Ca-15.3 and the evidence of N+ or M+ disease at FDG PET/CT. In patients monitoring systemic treatment, the change of therapeutic management according to FDG PET/CT was collected. ***Results:*** 81 patients performing FDG PET/CT for suspected recurrency were retrieved. The median value of Ca-15.3 was 31 U/mL and lymph node and distant metastases were identified in 35 (43.2%) and 38 (46.9%) patients, respectively. After a median follow-up of 3.4 years, progression and death were reported in 45 (55.6%) and 37 (45.7%) patients. Median values of Ca-15.3 were significantly higher in patients with N+ and/or M+ disease at FDG PET and dead at follow-up (38.1 vs 15.8 U/mL; p=0.01). N recurrence (p=0.018) and M recurrence (p<0.0001) at FDG PET were significantly correlated with progression at follow-up and M recurrence was also associated to death (p<0.0001). Data of 39 patients who performed FDG PET/CT for monitoring systemic treatment were collected, for a total of 93 studies. FDG PET/CT changed the therapeutic management in 51.2% of cases. In a per-study analysis, progression was reported in 65 (69.9%) cases and death in 43 (46.2%). A statistically significant correlation was found between the presence of N+ and M+ disease at FDG PET/CT and both progression and death at follow-up (both p<0.0001). ***Conclusion:*** TNBC patients with high Ca-15.3 values and evidence of N or M recurrence at FDG PET/CT have an increased risk of death. In TNBC patients with suspected recurrency or undergoing systemic therapy the evidence of N+ or M+ disease at FDG PET/CT is a strong negative prognostic factor.

EP-0147

Prediction of Treatment Response in HER-2 Positive Breast Cancer Patients Undergoing Neoadjuvant Treatment Using PET/CT Parameters and Body Composition Indices

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Aim/Introduction: Neoadjuvant treatment (NACT) improves survival in locally advanced HER2+ breast cancer and Sarcopenia is also one of the factors affecting survival in breast cancer. In this study, we aimed to investigate the predictive relationship between PET/CT and CT-derived sarcopenic indices and metabolic parameters with treatment response in HER2+, breast cancer patients who received (NACT). ***Materials and Methods:*** 64 patients who were HER-2 positive in the initial diagnostic biopsy were included in the study. The pathological treatment response, staging PET/CT parameters and tissue section areas

(cm^2) were evaluated. Hounsfield Units (HU) thresholds were determined as -39 to 150 for skeletal muscle (SM), -190 to -30 for subcutaneous adipose tissue (SAT), and -150 to -50 for visceral adipose tissue (VAT). The calculated SM and AT section areas were normalized to patients' body surface areas (m^2) to derive SM index and AT indices (cm^2/m^2). Additionally, SUVmax values of SM and AT sections at the level of L3 vertebra and PET parameters of primary lesions/metastatic lymph nodes were calculated. The relationship between parameters and treatment response rate was investigated using the Mann Whitney U test (SPSS.v26.). ***Results:*** All patients received neoadjuvant chemotherapy regimen. pCR was in 17 (30.9%) patients, near-complete response (TisN0) in 23 (41%) patients. Partial response was obtained in 7 (10%) patients, while chemotherapy response was not obtained in 17 (18.1%) patients. The demographic informations of the patients and the measurements and parameters obtained are given in Table 1. A statistically significant result was found between the primary tumor MTV value and near-complete treatment response among metabolic parameters. Furthermore, in the ROC analysis, the threshold value for primary tumor MTV was determined as 5.93, and it was observed that as MTV decreased, the response rate increased (sensitivity 67%, specificity 65%, p=0.025). ***Conclusion:*** In this study, an inverse relationship was found between the primary tumor MTV derived from PET/CT parameters and near-complete treatment response in HER-2 positive locally/locally advanced breast cancer patients. Additionally, for the prognostic value of sarcopenic indices obtained with CT component, larger series and prognostic studies are needed. ***References:*** Cruz-Jentoft AJ, Bahat G, Bauer J, Boirie Y, Bruyère O, Ceder-holm T et al (2019) Sarcopenia: revised European consensus ondefnition and diagnosis. Age Ageing 48:16-31. https://doi.org/10.1093/ageing/afy169Chen Y, Chen Z, Tan X, Zhang Q, Zhou Y, Yuan L, Jiang L-Annals of Hematology (2023) Role of body composition and metabolic parameters extractedfrom baseline 18F-FDG PET/CT in patients with difuse large B-celllymphoma. https://doi.org/10.1007/s00277-023-05379-z.

EP-0148

Noninvasive imaging of breast cancer and tumor metastasis with ^{68}Ga-DOTA-conjugated TROP2 targeting peptide PET/CT

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Aim/Introduction: Recently, the role of TROP family members in breast cancer has received much attention. Human trophoblast cell surface antigen 2 (TROP2) is a widely expressed glycoprotein belonging to the TROP family. According to studies, TROP family members are overexpressed in approximately 80% of breast cancer cells, but they are not expressed in normal tissues or are low expressed. This protein is involved in cell self-renewal, proliferation, and invasion, and is linked to breast cancer development and prognosis1. ***Materials and Methods:*** Based on phage libraries, we previously screened TTP (Trop2-targeted peptide), a polycyclic peptide with a high affinity for TROP2, and constructed the nuclide probe 68Ga-DOTA-TTP.Then we constructed stable cell lines with high TROP2 expression using two different breast cancer cell lines, 4T1 and MDA-MB-231. Using these cells, the mouse model of breast cancer lymph node metastasis, breast cancer lung metastasis, and breast cancer in situ was constructed to test the probe's ability to detect tumors in situ and metastatic tumors. In addition, we observed the imaging effect of the probe using a spontaneous breast cancer model. ***Results:*** The probe has high radiochemical purity and stability. Through non-invasive in vivo immune pet /CT imaging, we showed that 68Ga-DOTA-TTP has an excellent ability to specifically detect primary tumors in mouse models. In addition, it can accurately identify lymph nodes with tumor metastasis and tumor lesions in lung metastasis models, with excellent clarity and signal-to-noise ratios that outperformed conventional 2-fluorodeoxyglucose PET/CT imaging. ***Conclusion:*** Results of this study suggest that TROP2-targeted PET imaging could be used as a diagnostic tool in breast cancer and metastasis. ***References:*** 1.Liu X, Deng J, Yuan Y, Chen W, Sun W, Wang Y, Huang H, Liang B, Ming T, Wen J, Huang B, Xing D. Advances in Trop2-targeted therapy: Novel agents and opportunities beyond breast cancer. Pharmacol Ther. 2022 Nov;239:108296. doi: 10.1016/j.pharmthera.2022.108296. Epub 2022 Oct 5. Erratum in: Pharmacol Ther. 2023 Mar;243:108336. PMID: 36208791.

EP-0149

Low standardized uptake value of paraspinal muscle at L3 on FDG PET/CT as a Potent Prognostic Biomarker for Disease Progression in Older Women with Invasive Breast Cancer: A Retrospective Study

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Aim/Introduction: FDG PET/CT provides cancer metabolic status, increased FDG uptake at the tumor associated with a poor prognosis, including tumor proliferation and a high risk of metastasis. Tumor glucose metabolic conditions can be heterogeneous between the Warburg effect of glycolysis and the reverse Warburg effect related to the mitochondrial oxidative pathway. In breast cancer, mitochondrial dysfunction is linked to cancer progression, observed not only in cancerous tissues but also in normal tissues such as the heart and skeletal muscle. This study aimed to investigate whether clinical metabolic and baseline FDG PET/CT muscle parameters could predict disease progression (PD), including recurrence and distant metastasis, in women aged 50 years or older with invasive breast cancer. ***Materials and Methods:*** A total of 97 patients were enrolled, who underwent curative surgery between 2012 and 2020 at our hospital in Korea. Exclusion criteria included chronic medical illnesses. Their pathological stages are distributed as follows: pstage I (47.4%), pstage II (40.2%), and pstage III (12.3%). Cancer types included 58 luminal, 17 HER2, 10 triple-negative, and 12 luminal HER2. Histopathologic factors, clinical or serological factors (neutrophil-to-lymphocyte ratio [NLR], body mass index [BMI]), and FDG PET/CT muscle parameters including skeletal muscular index at L3 (SMI, area/height^2), L3 paraspinal muscle index (PSP MI, area/height^2), and L3 paraspinal muscle metabolism (SUVmean) were semi-automatically measured using the MIM workstation. ***Results:*** While as SUVmean at L3 PSP showed a significantly positive correlation with aging, the SUVmean at L3 PSP of the PD group (N=13) was significantly lower than that of the non-PD group (N=83). Univariate and multivariable logistic

regression analyses were performed to evaluate predictors of PD. Two significant independent predictors for PD were identified: lower SUVmean at L3 PSP (p=0.02, 95% confidence interval [CI] for estimate: -18.1, -1.9) and pathological staging (p=0.03, 95% CI: 0.25, 4.26 for pstage II; p=0.02, 95% CI: 0.42, 4.7 for pstage III). In the present study, the prediction model including SUVmean at L3 PSP and pathological staging showed a higher area under the curve (AUC) of the receiver operating characteristic (ROC) curve for PD compared to staging alone, 0.84 vs. 0.75 (p<0.05). ***Conclusion:*** Low L3 PSP uptake on FDG PET/CT may serve as a potent novel prognostic biomarker for recurrence or distant metastasis in peri- and postmenopausal women with breast cancer. ***References:*** 1. doi: 10.1053/j.seminoncol.2017.10.00422. 2. doi: 10.1038/cr.2017.15533. 3. doi: 10.1152/ajpcell.00264.2020.

EP-0150

Prognostic Value of Sentinel Lymph Node Biopsy after Neoadjuvant Chemotherapy in Advanced Stage Breast Cancer

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Aim/Introduction: Breast Cancer (BC) is considered a severe threat to women's physical and mental health worldwide. Under the premise of favorable results obtained by new therapeutic protocols, the next objective would be to reduce the extent of needed surgical procedures, such as axillary lymph node dissection, while improving patient's quality of life. Sentinel lymph node biopsy (SLNB) is advocated for patients in T1/T2N0 stages. Nevertheless, the role of SLNB after neoadjuvant chemotherapy (NAC) in more advanced initial stages, remains a subject of debate, mainly because of possible alterations of the anatomical conditions in breast and axilla, after treatment. This study aims to evaluate the prognostic value of radioisotopic mapping followed by SLNB in advanced stages of BC patients after NAC. ***Materials and Methods:*** We conducted a retrospective analysis involving 168 breast cancer patients who underwent NAC prior to lymphoscintigraphy mapping from January 2016 to January 2024. Inclusion criteria encompassed histologically confirmed BC, implementation of NAC before SLN mapping, use of 99mTc-albumin nanocolloid for SLN mapping and TNM staging before and after NAC. A total of 131 patients fulfilled these criteria, out of which 64 were cN0, respectively 67 cN1/2. Favorable clinical response to NAC preceded scintigraphic assessment of sentinel lymph nodes to facilitate conservative surgical planning. Each patient received 18-37 MBq of 99mTc-albumin nanocolloid via peritumoral injection guided by ultrasound. For patients achieving complete tumor remission under NAC, colloid injection surrounded the intratumorally placed metallic clip at core biopsy. SLN mapping occurred 18-20 hours preoperatively, employing planar scans 30 minutes to 2 hours after colloid administration; SPECT/CT scan was added in cases of non-axillary or multifocal drainage for precise lymph node localization. ***Results:*** The lymphoscintigraphy performed in our patients with advanced stage BC after the administration of NAC presented an identification rate (IR) of 94.7%. The IR for intraoperative SLNB was 96.2%, with a false-negative rate (FNR) of 6.78%. After a median follow-up of 28.87 months, we obtained a distant disease-free survival rate of 93.1%. Results reported in literature were similar to those of our study, presenting IR in the range 80.8-96.8%, with a generally accepted FNR of 10%. ***Conclusion:*** SLNB is a reliable and effective procedure in advanced breast cancer stages following NAC, providing a low false-negative rate (FNR) and prognostic value comparable to conventional guidelines, with a low recurrence rate within our study cohort.

EP-0151

SUVmax vs SUVpeak - the Race for Quantitative Supremacy of Bone Lesions Evaluation

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Aim/Introduction: Quantitative SPECT-CT has shown a growing importance in recent times in the management of oncological patients. Innovative technology and application development have offered the possibility to measure the same parameters used in PET-CT on SPECT-CT acquisition, thus getting the capabilities of the two methods closer. The most important clinical applications are represented by treatment response evaluation and patient follow-up. The purpose of our study was to compare the diagnostic accuracy of SUVmax and SUVpeak in differentiating metastatic from degenerative lesions in the management of breast cancer patients. ***Materials and Methods:*** The study included 119 female patients presenting metastatic breast cancer that had a bone SPECT-CT acquisition using [99mTc]-HDP from January 2021 to March 2024. The scanning was performed using the following protocol parameters: 60 views, 20 seconds per view, dual energy window with to energy peaks 140± 10 KeV and 120±5 KeV respectively. Several lesions, with a maximum of ten were evaluated (five degenerative and five metastatic lesions) . A total of 487 lesions were assessed and were characterized as degenerative or metastatic bone lesions based on their morphological appearance. Quantitative SPECT-CT parameters SUVmax and SUVpeak based on lean body mass were measured for each of the target lesions. The ROC curve for both SUVmax and SUVpeak were conducted and the AUC index, cut-off value, sensitivity and specificity were determined. ***Results:*** The mean SUVmax and SUVpeak for the metastatic lesions were 24.72±12.93 and 17.97±9.39, respectively. For the degenerative lesions, the mean SUVmax and SUVpeak values were 10.18±4.71 and 8.08±4.03. To assess the diagnostic accuracy capabilities of the quantitative parameters, receiver operating characteristic (ROC) curve analysis were performed resulting in an area under the curve index of 0.896 for SUVmax and 0.857 for SUVpeak. The cut-off value for SUVmax was 12.65 with a sensitivity and specificity of 85.5% and 76.6%, compared to 9.58, 81.7% and 70.2 % for the SUVpeak in discriminating between degenerative and metastatic lesions. ***Conclusion:*** In conclusion, quantitative parameters of the SPECT-CT data can provide additional information of the target lesions thus improving the diagnostic accuracy in discriminating degenerative from metastatic bone lesions. Furthermore, various quantitative parameters that are now available using the SPECT-CT data can have a significant contribution in patient follow up and treatment response evaluation. Extensive studies need to be conducted to assess their impact in clinical practice.

EP-0152

Detection of bone metastases in breast cancer: a systematic review and meta-analysis of diagnostic test accuracy studies on $^{[18F]}$FDG-PET/CT, $^{[18F]}$F-PET/CT, MRI, and contrast-enhanced CT

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Aim/Introduction: Bone metastasis is a common feature in breast cancer patients, significantly impacting patient management and prognosis. This systematic review and meta-analysis compared the diagnostic accuracy and bone metastases detection rate of [18F]FDG-PET/CT, [18F]F-PET/CT, MRI, and contrast-enhanced CT. ***Materials and Methods:*** Following PRISMA-DTA guidelines, we systematically reviewed studies assessing these imaging modalities for detecting bone metastases in breast cancer patients. A comprehensive search of MEDLINE/PubMed, Scopus, and Embase databases was conducted until February 2024. Inclusion criteria involved original studies using [18F]FDG-PET/CT, [18F]F-PET/CT, MRI, or contrast-enhanced CT for diagnosing bone metastases in breast cancer patients. Studies focusing on artificial intelligence or machine learning methods, primary breast cancer patients without metastases, mixed cancer types, pre-clinical studies, and lesion-based diagnostic accuracy were excluded. Preference was given to biopsy-confirmed cases or those confirmed through clinical and imaging follow-up. Risk of bias was assessed using the QUADAS-2 tool. Screening, bias assessment, and data extraction were performed independently by two researchers, with discrepancies resolved by a third senior researcher. A meta-analysis was conducted using bivariate random-effects models. ***Results:*** Forty studies were included, with thirty-one contributing to the meta-analysis. High heterogeneity was observed due to diverse study purposes, including initial staging and comparative accuracy assessments. Sensitivity and specificity for [18F]FDG-PET/CT (N=21) were 0.94 (95% CI: 0.89-0.96) and 0.99 (95% CI: 0.96-1.00), respectively, with MRI (N=5) showing similar diagnostic performance (sensitivity: 0.95, 95% CI: 0.88-0.98; specificity: 0.99, 95% CI: 0.90-1.00). While [18F]F-PET/CT (N=8) demonstrated comparable sensitivity (0.93, 95% CI: 0.83-0.97), it was less specific (0.93, 95% CI: 0.87-0.96). Contrast-enhanced CT (N=6) exhibited lower sensitivity (0.71, 95% CI: 0.62-0.77), but maintained high specificity (0.98, 95% CI: 0.96-0.99). Most included studies lacked a definitive reference standard as biopsies were not feasible in all cases; therefore, clinical follow-up and supplementary imaging served as reference standards. ***Conclusion:*** [18F]FDG-PET/CT and MRI demonstrate high and comparable accuracy for diagnosing bone metastases in patients with breast cancer. [18F]F-PET/CT shows similar sensitivity and marginally reduced specificity compared to [18F]FDG-PET/CT and MRI. However, contrast-enhanced CT significantly falls short in sensitivity, making it unsuitable as a standalone modality for ruling out bone metastases in these patients. The considerable heterogeneity observed across the studies included in our analysis underscores the need for further standardization and research in this field. Additionally, the lack of a definite reference standard for true-negative patients, necessitating clinical and imaging follow-up in many cases, further highlights these challenges.

EP-0153

Which subtypes of breast cancer are more likely to have osseous metastases on bone scintigraphy? A Study in a Hospital in Johannesburg

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Aim/Introduction: In South Africa, breast cancer is the most common cancer in females, comprising 23.25% of all cancers diagnosed in 2020 (1). Metastatic disease is closely associated with breast cancer related mortality, with bone being the most frequent site (2). Bone scintigraphy is effective for the identification of osteoblastic metastases in breast cancer. The immunohistochemical expression of hormone receptors are associated with different metastatic patterns. The hormone receptor subtypes include oestrogen receptor (ER) and progesterone receptor (PR). The other subtypes are human epidermal growth factor receptor 2 (HER2), and triple-negative (TNBC) breast cancer, which is characterized by the lack of expression of any of the above receptors. As metastases are rarely present in early-stage breast cancer, extensive imaging is not cost-efficient, especially in resource restraint settings. The ability to identify patients who are at higher risk of bone metastases may help to prioritize these patients. The aim of the study is to assess which histological subtypes breast cancer are more at risk to develop osseous metastases. ***Materials and Methods:*** A retrospective review of all female patients with breast cancer referred for bone scintigraphy over 4 years was performed to assess which histological subtypes of breast cancer are most common in patients with bone metastases. Patient data including age, subtype of breast cancer and bone scintigraphy findings were obtained from departmental records. ***Results:*** 684 bone scans performed from 2019-2023 were reviewed. The mean age of the patients was 53.26 ± 12.17 years. Bone metastases were present in 27% of patients, absent in 61% of patients and 12% of patients had findings requiring further investigations. Luminal B subtype had the highest prevalence of osseous metastases (34%) and 10% had suspicious findings. Conversely, TNBC had the lowest prevalence of bone metastases (12%). ***Conclusion:*** We confirm in this study that in our setting, Luminal B subtype breast cancer is associated with a higher rate of positive findings on bone scan. Such patients, especially when associated with raised tumour markers, ALP and clinical symptoms, should be prioritized for bone scan in resource constrained settings. ***References:*** 1. NICD. Summary statistics of cancer diagnosed histologically in 2020 female-all population groups combined. Available at: https://www.nicd.ac.za/wp-content/uploads/2023/04/The-National-Pathology-Cancer-Incidence-Report-2020.pdf 2. Yao YB, Zheng XE, Luo XB, Wu AM. Original Article Incidence, prognosis and nomograms of breast cancer with bone metastases at initial diagnosis: a large population-based study [Internet]. Vol. 13, Am J Transl Res. 2021. Available from: http://seer.cancer.gov/data.

EP-0154

Role of [^{99}m Tc] DTPA-bis(Choline) in Evaluation of Breast Cancer: A Prospective Pilot Study.

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Aim/Introduction: In 2020, breast cancer became the leading global cancer, comprising 11.7% of cases, underscoring the need for early detection. Scintimammography (SM), utilizing radionuclides, visualizes breast tumors. Elevated choline kinase (ChoK) expression and phosphocholine (PC) levels in tumors suggest ChoK's role in malignancy. ChoK activity is notably higher in tumor tissues. Hence, we employed [99mTc]DTPA-bis(Choline) imaging on breast lesions to evaluate choline uptake. Leveraging ChoK's involvement in malignant transformation, this

approach holds promise for enhancing breast cancer diagnosis and management, offering potential improvements in prognosis and patient care. ***Materials and Methods:*** 17 female patients (05 premenopausal and 12 postmenopausal) with a mean age of 49.7±8.7 years having mammography showing BIRADS 4C and 5 lesions underwent SM using [99mTc]DTPA-bis(Choline). 20 mCi of the radiotracer was injected intravenously followed by early and delayed imaging. Anterior and lateral spot images of the thorax along with whole-body images were acquired. Target to background ratio (T: B) was calculated by drawing the Region of interest (ROI) on the target lesion and the adjacent normal breast tissue taken as the background on the lateral images. Later the results were compared with the biopsy findings of the lesion taken as the gold standard. ***Results:*** All patients showed significantly increased tracer uptake at the tumour site with an average T:B ratio of 2.94±0.86. One patient had a bilateral breast tumour with the left breast having benign findings (BIRADS-2) showed a T:B ratio of only 1.4 whereas the contralateral right breast having BIRADS-5 lesion showed significant tracer uptake with a T: B ratio of 2.6. Later all the patients followed up with their biopsy reports showing Invasive carcinoma of no special type (NST) in 16 patients and 1 patient had ductal carcinoma in situ further validating our findings of significant tracer uptake in malignant breast tumours. ***Conclusion:*** This is the first time study done using a SPECT choline tracer for the evaluation of choline uptake in malignant breast tumours. In our study, there is a significant choline uptake in the malignant breast lesion. This makes it a promising SPECT tracer for evaluation, localization, and diagnosis of breast carcinoma. ***References:*** Jaswal AP, Hazari PP, Prakash S, Sethi P, Kaushik A, Roy BG, Kathait S, Singh B, Mishra AK. [99mTc] Tc-DTPA-Bis (cholineethylamine) as an oncologic tracer for the detection of choline transporter (ChT) and choline kinase (ChK) expression in cancer. ACS omega. 2022 Apr 8;7(15):12509-23.

EP-0155

Exploring the Potential of [68Ga]Ga-FAP-2286 in Metastatic Cancer Diagnosis and Therapy

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Aim/Introduction: Fibroblast activation protein (FAP) is a promising target for both diagnosis and treatment due to its high expression in the stromal areas of different cancerous growths. FAP-2286, using cyclic peptides with FAP-binding abilities, aims to enhance the retention of imaging agents within tumors, contrasting with small-molecule FAP inhibitors like FAPi-46. The main goal of this study was to measure the uptake of [68Ga]Ga-FAP-2286 in primary solid tumors, adjacent excised tissues, and metastatic sites. ***Materials and Methods:*** In this study, 57 patients with various types of remaining and metastatic cancers were included. Specifically, there were eleven patients with metastatic sarcoma, fifteen with breast cancer, eight with uterine and ovarian cancer, four with colorectal cancer, four with stomach cancer, four with thyroid cancer, two with lung adenocarcinoma, two with adrenal cancer, one with testicular cancer, one with squamous cell carcinoma, and one with urothelial carcinoma. The patients underwent a [68Ga]Ga-FAP-2286 PET/CT scan, followed by visual assessment and semi-quantification of the results. The study calculated the standardized uptake values (SUV)max of [68Ga] Ga-FAP-2286 in tumor lesions and the tumor-to-background ratio (TBR) for each patient. ***Results:*** The patients' vital signs, including heart rate, blood pressure, and temperature, were monitored before, during, and after the diagnostic procedure over the 4-hour follow-up period. All participants underwent [68Ga]Ga-FAP-2286 PET/CT scans without any observed drug-related pharmacological effects. The PET/CT scans showed significant uptake of [68Ga]Ga-FAP-2286 in tumor lesions in all patients, regardless of the tumors' origin (epithelial or mesothelium) or whether they presented with local recurrence, distant recurrence, or metastatic lesions. ***Conclusion:*** In summary, the findings from this study indicate that [68Ga]Ga-FAP-2286 shows promise as a derivative of FAP for the effective diagnosis of metastatic cancer. Furthermore, the compound is being evaluated as a potential therapeutic option for individuals with advanced metastatic cancers. These results highlight the potential of [68Ga]Ga-FAP-2286 in advancing both diagnostic and treatment strategies for patients with metastatic cancer.

EP-0156

Extending baseline ^{18}F-FDG PET/CT clinical relevance in early stage triple negative breast cancer (eTNBC)

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Aim/Introduction: Immune checkpoint inhibitors (ICI) have improved outcomes in patients with eTNBC. 18F-FDG-PET/CT scan is routinely performed for initial staging before neoadjuvant treatment with immunotherapy and chemotherapy (NACT-IO). However, clinical benefit versus risk of immune-related adverse events (irAEs) is a major concern in clinical practice. This study aimed to evaluate whether 18F-FDG-PET/CT features could predict pathological complete response (pCR) and/or the occurrence of irAE from NACT-IO in eTNBC. ***Materials and Methods:*** We conducted a single-center retrospective study on eTNBC patients treated with NACT and pembrolizumab, between April 2022 and April 2023. Adverse events were graded according to NCI-CTC-AE version 5. Extracted FDG-PET parameters included features related to the primary tumor and the metastatic loco-regional lymph nodes (SUVpeak/max, metabolic tumor volume-MTV, total lesion glycolysis, primary tumor necrosis), and features extracted from organs not involved by metastatic disease (SUVmean of liver, spleen, bone marrow, blood pool-BP, digestive organs, endocrine glands and breasts). Data cut-off date was November 2023. The association between PET features and pCR or irAE was explored using logistic regression. All analysis were performed using R software version 4.1.1. ***Results:*** Of 86 identified patients, 54 had baseline FDG-PET done at our institution and available toxicity data. 65% (35/54) of patients experienced any-grade irAEs, and 24% (13/54) severe irAEs (grade ≥3). SUVmax of primary lesions ranged between 2.7 and 38.0 (median: 14.4).

44% (24/54) of primary lesions had central necrosis. 57% (31/54) patients had FDG-avid locoregional lymph nodes. Among the FDG-PET parameters explored, BP, liver and spleen SUVmean were highly correlated (BP-liver: 0.87; BP-spleen: 0.68; spleen-liver: 0.74). The correlation between primary tumor SUVmax and MTV was negligible at 0.17. Primary tumor SUVmax and metastatic lymph node SUVmax were linearly associated (LN_SUVmax = 1.3 + 0.64 x Primary_SUVmax; p = 9.3e-5). Only the primary lesion SUVmax was associated with an increased risk of severe irAE (OR 1.10 IC95 [1.01-1.21]; per unit of SUV). Neither lymph node related features nor healthy organ basal uptake value were associated with severe toxicity, and none of the above parameters were predictor of pCR. ***Conclusion:*** Our findings suggest that lymph node uptake can be estimated from the primary tumor, and that the primary lesion baseline SUVmax is significantly associated with an increased risk of severe ICIs irAEs. If confirmed, baseline 18F-FDG-PET/CT may help nuclear physicians to discriminate between irrelevant and metastatic lymph nodes and support multidisciplinary work to personalized risk assessment of irAE in eTNBC.

EP-0157

Optimizing the ^{18}F-FESPET/CT SUVmax Threshold for Estrogen Receptor Status Evaluation in Breast Cancer Lesions: A Comprehensive Retrospective Analysis

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Aim/Introduction: Breast cancer is the most prevalent malignancy among women, representing a significant cause of cancer-related fatalities in this demographic. The evaluation of estrogen receptor (ER) status assumes paramount significance in the clinical management of breast cancer. Presently, there is a burgeoning adoption of 16α-18F-fluoro-17β-estradiol (18F-FES) PET/CT for assessing ER status in breast cancer patients. However, prevailing studies predominantly employ 18F-FES PET SUVmax=1.5 as the positivity threshold, without specific criteria for various lesion sites. ***Materials and Methods:*** This retrospective study included breast cancer patients presenting with first recurrent or metastatic disease and aged ≥18 years. Patients underwent immunohistochemical testing for ER expression in lesions and 18F-FES PET for SUVmax measurement. The optimal SUVmax threshold was determined using receiver operating characteristic (ROC) curves and the Jordon index. Spearman rank correlation coefficient evaluated the relationship between SUVmax and ER percentage in 18F-FES PET. Specificity, sensitivity, positive predictive value (PPV) and negative predictive value (NPV) were used as reference criteria for predicting ER immunohistochemistry status and confidence intervals were calculated using an adopted Wilson method. ***Results:*** The study comprised 152 patients with 156 biopsied lesions, with 24% classified as estrogen receptor-negative and 77% as estrogen receptor-positive. The AUC for all biopsied metastases was 91% (95% CI, 87-95). According to the Jordon index, the optimal SUVmax thresholds were: 2.0 for overall lesions, 2.1 for lymph node metastases, 2.3 for bone metastases, 1.1 for lung metastases, 1.5 for chest wall metastases, and 2.0 for breast metastases. Adjusting SUVmax thresholds to 2 for metastases in breast, lymph nodes, bone, and other sites (79%) yielded sensitivity of 82% (72-89), specificity of 97% (85-100), PPV of 99% (91-100), and NPV of 71% (57-82). Retaining the traditional SUVmax threshold of 1.5 slightly increased sensitivity (88%) but markedly reduced specificity (66%) and PPV (85%). For lung metastases (9%), the threshold was set at 1, with sensitivity of 90% (54-99), specificity of 50% (9-91), PPV of 82% (48-97), and NPV of 67% (13-98); for chest wall metastases (12%), the threshold was set at 1.5, with sensitivity of 94% (69-100), specificity of 100% (20-100), PPV of 100% (76-100), and NPV of 67% (13-98). ***Conclusion:*** This study underscores the accuracy of 18F-FES PET/CT in predicting ER expression in breast cancer lesions when utilizing distinct thresholds for varied lesion sites. Hence, this noninvasive approach presents a viable alternative to lesion biopsy for determining ER status in primary or metastatic breast cancer lesions.

EP-0158

Diagnostic value of ^{18}F-FDG PET-CT in staging of early-stage breast cancer -a retrospective institutional study

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Aim/Introduction: Breast cancer is the most common cancer worldwide and leading cause of cancer death among women making screening, diagnosis and staging vital for appropriate management as well as for prognostication. Mammography, ultra-sonography and MRI are commonly used imaging methods which show limited sensitivity for nodal staging as well as for distant metastasis. The WB-F^{18}-FDG-PETCT is a useful imaging modality used for tumour identification, staging, and follow-up. Furthermore, the hybrid PET/CT strategy can potentially alleviate the restricted specificity of PET, which is impacted by the elevated metabolic activity of some benign tumours and inflammatory tissue. In their clinical practice guidelines for breast cancer ASCO, ESMO, and the Royal College of Radiologists (UK) don't recommend routine imaging for the M-staging of asymptomatic patients with early-stage disease. Nonetheless, a number of studies have demonstrated the value of FDG PET-CT in the early stages of illness as well. ***Materials and Methods:*** Retrospective data of 720 patients were included with biopsy proven carcinoma breast, where 154 patients were referred for initial staging and were included in the study. The patients were categorised as T1 to T4 stage based on 8thedition AJCC staging system. The incidence of metastasis in each T stage was evaluated and displayed in percentage. ***Results:*** In this study 10(6.5%) patients had T1 disease, while 40(25.9%) had T2 disease, 4(2.6%) had T3 disease, 85(55.2%) had T4b disease and 15(9.7%) had T4c disease. Metastatic disease involvement was present in 10% T1stage while it was 27.5% in T2 stage of the total 154 patients. The available literature suggests, presence of metastatic disease in < 2% of T1 and T2 stage of breast cancer. However, in the present study, metastatic disease was present in significant higher number of patients. However, no significant correlation was found in the present study (p=0.121). ***Conclusion:*** The study evaluates the effectiveness of ^{18}F-FDG PET/CT in staging breast cancer, specifically in detecting distant metastases in early-stage T1 and T2 disease. Despite recommendations against routine imaging for M-staging in early stages, there's growing evidence supporting PET/CT's utility early on. This modality offers improved sensitivity and specificity, potentially helping identify hidden metastases missed by conventional methods. By evaluating PET/CT's clinical impact, the study aims to align existing guidelines with emerging evidence to enhance patient care through more precise staging and treatment planning.

EP-0159

Optimizing the Role of Thoracic SPECT in Bone Scintigraphy for Breast Cancer

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Aim/Introduction: Breast cancer most commonly metastasizes to the bone, playing an important role in prognosis establishment and disease staging. While bone scintigraphy (BS) is a standard imaging modality for breast cancer staging, the utilization of thoracic single-photon emission computed tomography (SPECT) is not standardized. This study aims to evaluate the complementary role of thoracic SPECT in lesion detection during breast cancer staging and restaging with whole-body (WB) planar BS. ***Materials and Methods:*** A retrospective study was conducted, including adult individuals with breast cancer who underwent WB-BS with [99mTc]Tc-HDP and thoracic SPECT for either staging or restaging of the disease between 2018 and 2023. Exclusion criteria comprised other bone-affecting diseases (metabolic, traumatic or other neoplasm). WB and SPECT images were reviewed to identify suspicious lesions, categorized into three groups (0, 1, or ≥2 lesions), and assessed for consistency in lesion count. Statistical analysis included Chi-square and Fisher's exact test, proportion comparison, and univariate binomial and multinomial logistic regressions. ***Results:*** A total of 230 individuals were included (99% women; mean age: 60.5±12.7 years), with 60% undergoing BS for initial staging. Performing thoracic SPECT resulted in a different number of suspicious lesions reported in 27% of cases compared to WB-BS, with significant differences observed (p<2.2e-16). Notably, cases with a single lesion on WB-BS significantly led to benign classification when evaluated with SPECT (p=0.04). The chances of SPECT reporting a different lesion count from WB-BS decreased by 53% during restaging compared to initial staging (OR=0.47; p=0.019). Importantly, when WB-BS is performed for restaging, SPECT did not significantly change the number of reported lesions (p<0.001). ***Conclusion:*** Thoracic SPECT offers valuable insights into lesion characterization during breast cancer staging, particularly when a single lesion is identified on WB-BS. These findings suggest that thoracic SPECT should be considered a crucial component of breast cancer staging protocols while it may not be warranted and could be omitted in restaging disease.

EP-0160

Value of HER2-PET/CT derived quantitative parameters in metastatic HER2+ breast cancer patients treated with T-DM1 (data from the ZEPHIR trial)

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Aim/Introduction: Response to Trastuzumab Emtansine (T-DM1) in breast cancer (BC) treatment requires HER2 expression. The ZEPHIR trial proposed HER2 molecular imaging as a non-invasive method to evaluate HER2 status across the total tumour burden which was found to successfully predict response to T-DM1 using a visual classification of HER2 expression. This study aims to assess whether HER2-PET quantitative parameters can also reflect T-DM1 response. ***Materials and Methods:*** The ZEPHIR trial included patients with metastatic HER2-positive BC who underwent a baseline Zirconium-89 Trastuzumab (HER2)-PET/CT and an FDG-PET/CT. Visual classification of HER2 distribution distinguished HER2+ from HER2- patients [1]. Patient-based RECIST1.1 and late metabolic response were assessed after three T-DM1 cycles. An automated workflow was used to segment the metabolic tumour volume (MTV) on baseline FDG-PET/CT, using PERCIST threshold. These volumes were then propagated on the HER2-PET/CT to assess the relation between HER2 quantitative parameters (SUVmax, SUVpeak and SUVmean) derived from the baseline MTV and patient-based response using Mann-Whitney test, and with time to treatment failure (TTF) using Cox proportional hazards regression analysis. Additionally, MTV in all patients and only HER2+ patients was correlated with TTF. P value <0.05 was considered significant. ***Results:*** 80 patients were analysed. All HER2 quantitative parameters were significantly associated with RECIST1.1 response: median SUVmax, SUVpeak and SUVmean of 7.1, 4.6 and 2.3 in non-responding patients compared to 17.9, 10.3 and 5.6 in responding patients, respectively (all having p<0.01). Furthermore, a similar association was found with late metabolic response. HER2 quantitative parameters however were not predictive of TTF. MTV was significantly associated with TTF in all patients (HR=1.30, 95%CI:10.9-1.55, p=0.004), with stronger association in the HER2+ group (HR=1.66, 95%CI:1.28-2.15, p=0.0001). Finally, HER2 quantitative parameters were in line with the previous patient-based HER2 visual classification (p<0.01). ***Conclusion:*** HER2 quantitative parameters can successfully predict response to T-DM1, similar to the previously established patient-based HER2 visual classification. Further investigation is required to examine the clinical utility and added value of quantitative parameters in HER2 positive BC. ***References:*** [1] M. Mileva et al. Molecular imaging predicts lack of T-DM1 response in advanced HER2-positive breast cancer (Final Results of ZEPHIR trial). NPJ Breast Cancer. 2024;10:4.

EP-0162

Dual FES/FDG PET/CT imaging to predict therapy response in patients with estrogen receptor-positive recurrent or metastatic breast cancer: Preliminary Results

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Aim/Introduction: ER expression is both prognostic and predictive biomarker that plays a main role in breast cancer oncogenesis. However, ER expression status may differ in primary and metastatic breast cancer lesions and over time. Moreover, ER positivity in tissue sample does not always reflect the functional status of the receptor. FDG, glucose analogue reflects the metabolic activity of tumor cell. Although SUV is a predictive prognostic factor, the success of FDG PET in evaluation of therapy response in hormone positive breast cancer is limited because it can not provide information about the function of ER. Our aim is to predict therapy response by using dual FES/FDG imaging in patients with estrogen receptor-positive metastatic or recurrent breast cancer. ***Materials and Methods:*** Thirty-one (22 invasive ductal, 9 invasive lobuler) ER+ metastatic or recurrent breast cancer patients prospectively underwent both FES and FDG PET imaging. Images were evaluated on 4 category (FES-FDG-, FES-FDG+, FES+FDG-, FES+FDG+) for whole lesions. FES- and FES+ groups were compared for therapy response under hormonotherapy or not. ***Results:*** While 22/31 patients had under hormonotherapy, remaining 9 patients not. In hormonotherapy

group, 16/22 patients had FES+ images and remaning 6 patients had FES- images. In this group, 6/16 (38%) patients with FES positive had progression, 1/6 (16%) patient with FES negative had progression. In hormonotherapy-off group, 7/9 patients had FES+ images and remaining 2 patients had FES- images. In this group, 3/7 (42%) patients with FES positive had progression, ½ (50%) patient with FES negative had progression ***Conclusion:*** FES positivity under hormonotherapy and FES negativity without hormonotherapy can be related with disease progression. Use of dual FES/FDG PET imaging may be guide to predict the therapy response and prognosis in the groups of hormonotherapy-on or off. Although no statistically significant difference could be found due to the limited number of patients, this preliminary results can be significant.

EP-0163

Correlation Between F^{18} FDG PET-CT SUVmax Values and Hormone Receptor Status -Ki67 Index in Breast Cancer Patients: A Single Centre Experience

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Aim/Introduction: To assess the correlation between F^{18} FDG PET-CT SUVmax values and hormone receptor status - Ki67 index in cancer patients, elucidate potential correlations that could contribute to prognosis and treatment planning. Hormone receptor status (estrogen, progesterone and Her2neu -ER, PR, HER2) and the Ki67 index are crucial determinants of tumor behavior and treatment response. The relationship between SUVmax and these molecular markers remains unclear. Understanding this correlation could offer valuable insights into tumor biology and guide personalized treatment strategies. ***Materials and Methods:*** 101 breast cancer patients (with invasive, lobular, metaplastic and mucinous carcinomas) who underwent staging F^{18} FDG PET-CT study and had available data on hormone receptor status and Ki67 index were retrospectively analysed. PET-CT images were analysed to determine SUVmax values. Hormone receptor status was assessed using immunohistochemistry, while the Ki67 index was calculated as the percentage of positively stained tumor cells. Statistical analysis, including correlation coefficients and regression models, was performed to evaluate the relationship between SUVmax, hormone receptor status, and Ki67 index. ***Results:*** Among the 101 breast cancer patients included in the study, 68.3%, 64% and 35.6% had positive hormone receptor status for ER, PR and Her2-neu respectively. 12% of patients had triple negative tumors. The mean and median SUVmax values in all patients was 8.888 and 6.15 respectively (Range=1.4-25.7). Among patients with triple negative tumors, the mean, median and range of SUVmax was 12.958, 12.45, and 1.7-20.6 respectively. Among patients with hormone positive tumors the mean, median and range of SUVmax was 10.241, 10.6 and 1.4-34 respectively.The median SUVmax was significantly higher in hormone receptor-negative tumors compared to hormone receptor-positive tumors ($p < 0.05$). Additionally, a positive but weak correlation was observed between SUVmax values and the Ki67 index (correlation coefficient [0.259]). ***Conclusion:*** Our analysis revealed a significant correlation between F^{18} FDG PET-CT SUVmax values and hormone receptor status. However, a positive but weak correlation between SUVmax and Ki67 index was noted. Hormone receptor-negative tumors exhibited higher SUVmax values, suggesting increased metabolic activity, while SUVmax values weakly correlated with the Ki67 index, indicating an association between tumor metabolism and proliferative activity. These findings highlight the potential of PET-CT SUVmax as a non-invasive imaging biomarker for prognostication and treatment planning in cancer patients. Further prospective studies are warranted to validate these observations and explore their clinical implications.

EP-09

e-Poster Area

B: Imaging Clinical Studies -> B1 Oncological Imaging Clinical Study -> B14 Lung (including Mesothelioma)

EP-0164

The Value of SUV-Based Parameters in a Large-Scale Retrospective Study on Lung Lesions

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Aim/Introduction: Although many well-known factors affect the maximum standardized uptake value (SUVmax), it remains the most requested and used parameter, especially among clinicians, despite other parameters such as the standardized uptake value corrected for lean body mass and the metabolic tumor volume proved to be less sensitive to the same factors, more robust, and eventually more informative. This study intends to provide robust evidence regarding the diagnostic and prognostic value of SUVmax in a large cohort of patients with suspected malignant lung nodules imaged by $^{[18F]}$FDG PET/CT. ***Materials and Methods:*** We performed a retrospective single-centre analysis of patients with suspected or confirmed primary lung tumours undergoing $^{[18F]}$FDG PET/CT within 180 days before surgery. The required sample size was 567 patients. Demographics, imaging data, surgical information, definitive histology, and follow-up data were collected. SUVmax values were analysed according to histology, TNM stage, scanner type, and outcome data. The impact on SUVmax and SUVmean values of different reconstruction protocols (clinical vs EARL) was assessed. All potential predictors of patients' outcome were assessed. The same analyses were also performed for SUVmean. ***Results:*** 91% of cases were histologically confirmed primary lung tumours. Lung benign nodules or metastases accounted for 5% and 4% of cases, respectively. The predominant primary lung tumour histotype was adenocarcinoma (70%) and most patients presented with stage I disease (51%). 144 patients relapsed during post-surgical follow-up, and 55 patients died. SUVmax failed to effectively differentiate benign lesions from primary tumours or metastases. Stage I patients presented lower SUVmax values. SUVmax significantly correlated with patient weight, injected $^{[18F]}$FDG activity, and lesion size. SUV values differed between clinical and EARL reconstructions. The same results were confirmed for SUVmean. Survival analyses revealed no

independent prognostic significance for SUVmax in progression-free after adjusting for other variables. SUVmax correlated with overall survival, alongside disease stage and tumour histotype. ***Conclusion:*** Our study confirms that SUVmax, though widely employed, present relevant limitations in discriminating between benign lesion and lung cancer, in classifying cancer histotypes, and in predicting patient outcomes independently. Known influencing factors such as patient's weight and reconstruction protocols significantly impact SUVmax and SUVmean values. While SUV-derived parameters remain valuable, their interpretation should be cautious, emphasising the need for comprehensive clinical and imaging assessments.

EP-0165

Clinical Impact of [18F]FDG PET-CT in the Staging of Stage III Non-Small-Cell Lung Cancer

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Aim/Introduction: Stage III non-small cell lung carcinoma (NSCLC) is associated with low survival rates despite curative treatment with chemoradiotherapy and/or surgery. Our aim is to evaluate the clinical impact of [18F]FDG PET-CT in the staging of stage III non-small cell lung carcinoma (NSCLC) by conventional imaging. ***Materials and Methods:*** Prospective study of 52 patients diagnosed with stage III NSCLC by computed tomography (CT) between January 2023 and January 2024, who underwent [18F]FDG PET-CT in the first 3 weeks after CT. We analysed variables such as sex, age, histology, staging (TNM) by CT and PET-CT, sensitivity and specificity of these two tests by assessing their concordance with pathological anatomy (endobronchial ultrasound-guided transbronchial needle aspiration (EBUS-TBNA) and/or mediastinoscopy), change of staging and therapy administered. ***Results:*** 80% of the patients were male. Median age was 68 years (50-86 years). Histologically 31 were squamous and 21 adenocarcinomas. Regarding CT staging 15 were IIIA, 29 IIIB and 8 IIIC. After PET-CT, 25 patients had a new staging: 1 IA2 (previous IIIB), 1 IA3 (previous IIIA), 3 IIB (previous IIIB-C), 9 IVA (previous IIIA-C), 11 IVB (previous IIIA-C). In 44% of patients who remained stage III, a different nodal staging (N) was observed on PET-CT (11 confirmed by pathological anatomy). CT had a sensitivity of 66% and a specificity of 74%, while PET-CT had 100% and 92%, respectively. The inclusion of PET-CT modified the disease stage in 48% (25/52), leading to a therapeutic change: 5 patients to a lower stage (2 IA2-3 and 3 IIB, candidates for surgery) and 20 to a higher stage (IVA-B, candidates for immunotherapy +/- chemotherapy). ***Conclusion:*** [18F]FDG PET-CT is not only essential in the staging of patients with potentially curable NSCLC, but also in stage III as it can lead to a major change in the therapeutic approach. Therefore, its inclusion could avoid irradiation toxicity in patients reclassified at a higher stage and increase cure rates by surgery in those reclassified at a lower stage.

EP-0166

Diagnostic Accuracy of Lymph Node Staging in Stage III NSCLC using $^{[18F]}$FDG digital PET-CT and its Correlation with Metabolic Quantification Parameters

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Aim/Introduction: Our aim is to assess the diagnostic accuracy of [18F]FDG digital PET-CT for nodal staging in stage III non-small cell lung carcinoma (NSCLC) and its correlation with metabolic parameters. ***Materials and Methods:*** Prospective study of 52 patients diagnosed with stage III NSCLC between January 2023 and January 2024, who underwent [18F]FDG digital PET-CT. Variables such as sex, age, lymph node staging on PET and CT and their concordance with pathological anatomy (endobronchial ultrasound-guided transbronchial needle aspiration (EBUS-TBNA) and/or mediastinoscopy) were analysed to assess sensitivity, specificity and predictive values of both tests. In addition, the results of the pathological anatomy (PA) were correlated with metabolic quantification parameters: SUVmax tumour (T), SUVmax most hypermetabolic lymph node (N), SUVratio N/hepatic and SUVratio N/T. ***Results:*** 80% were men. Median age was 68 years (50-86 years). Of the 43 N+ patients in PET-CT, 39 were confirmed in PA (PPV 91%; S 100%); while of the 47 N+ in CT only 37 were N+ in PA (PPV 79%; S 95%). In PET-CT all patients classified as N0 (9/9) were truly N0 in PA (NPV 100%; S 69%). On CT 2 of the patients considered as N0 had nodal involvement (N+) in PA (NPV 60%; S 23%). Of the 13 N0 patients in PA, 4 were classified as N+ in PET-CT. Analysing the quantitative parameters, 3 had similar nodal uptake to the liver (SUVratio N/hepatic 1.19-1.35) and 1 had double the nodal uptake compared to the primary tumour (SUVratio N/T 1.92; anthracotic nodes). Of the 39 N+ patients in PA (all of them N+ in PET-CT), nodal uptake was higher than hepatic uptake in al lof them (SUVratio N/hepatic 1.42-12.53). Up to 87% (34/39) had nodal uptake lower or similar to tumour (SUVratio N/T 0.26-1.26). ***Conclusion:*** [18F]FDG digital PET-CT has a higher diagnostic accuracy than CT for nodal staging in stage III NSCLC. In patients where nodal staging may be difficult to assess, quantitative assessment of nodal metabolism with respect to tumour or liver uptake could be a helpful complementary tool. Thus, if lymph node uptake is higher than liver uptake and/or similar to the primary tumour uptake, we can accurately consider that the lymph node is pathological (SUVratio N/hepatic >1 and/or SUVratio N/T ≈ 1).

EP-0167

Predictive Value of Heterogeneity Index in Evaluating Treatment Response with F^{18}-FDG PET CT in Locally Advanced and Advanced Lung Cancer

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Aim/Introduction: We aimed to evaluate the response to treatment(chemoradiotherapy) and progressive or regressive disease course in locally advanced and advanced lung cancer cases(stage 3,stage 4) with the heterogeneity index and show the predictive value of the heterogeneity index. ***Materials and Methods:*** The images of diagnosed lung cancer patients who applied to our clinic for oncological F^{18} FDG PET-CT examination between 2018 and 2023 were retrospectively examined.A total of 44 patients with Stage 3 and Stage 4 small cell and non-small cell lung cancer,whose first PET-CT was performed in our clinic and whose follow-up images were not found missing,were included in the study.The regressive patient group that was responsive to treatment consisted of 19 cases (43.2%),and the progressive patient group that was unresponsive to treatment consisted of 25 cases (56.8%).Heterogeneity index,SUVmax,SUVmean,MTV,TLG calculations were made based on the first PET-CT imaging. Metabolic tumor volumes(MTV) calculated according to the

treshold values(40%,60%,80%) determined by examining the patients' images at the workstation were used to create a curve on the graph in Microsoft Excel.The slope of this curve was calculated with the linear regression method.The heterogeneity index was determined as the negative value of this slope value. The predictive values of the calculated heterogeneity index with SUVmax,SUVmean,MTV,TLG for response to treatment were compared.ROC(Receiver Operating Characteristic) analysis was performed to determine the diagnostic performance and cut-off point of MTV and heterogeneity index parameters in distinguishing the development of progression.Multivariable logistic regression analysis was performed to identify risk factors independently associated with progression in patients.Data analysis was done with IBM SPSS 23.0. P values <0.05 were considered statistically significant. ***Results:*** There was no significant difference in the median values of SUVmax and SUVmean of the two groups(p=0.740 and p=0.981).The median MTV value was calculated as 55.84 in patients with progression and 36.28 in patients with regression. Median MTV value was found to be statistically higher in patients with progression(p=0.047).The heterogeneity index median value was found to be 1.28 in patients with progression and 0.85 in patients with regression.Heterogeneity index values were significantly higher in patients with progression(p=0.040). Although TLG values were higher in the progression group,this difference was not statistically significant(p=0.139).The optimal cut-off point for MTV with Youden index was found to be >22.3(Sensitivity: 92%,Selectivity: 47.37%) and >0.45 for heterogeneity index(Sensitivity:96%,Selectivity:47.37%). ***Conclusion:*** The heterogeneity index has been found to be superior in predicting response to treatment and the progressive or regressive course of the disease.

EP-0168

The value of a joint model based on clinical features and PET/CT radiomics features in predicting the growth trend of pulmonary nodules

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Aim/Introduction: To construct a joint model based on clinical features and PET/CT radiomics features to predict the growth trend of pulmonary nodules and evaluate its predictive performance. ***Materials and Methods:*** A retrospective study was conducted on chest PET/CT images and clinical data of 300 patients with a one-year follow-up period in our hospital from January 2019 to January 2023. All patients were divided into a progression group of 124 cases and a non progression group of 176 cases. Progressive nodules are defined as nodules whose diameter increases by ≥ 2mm within one year. All patients were divided into a training group of 240 cases and a validation group of 60 cases through 8:2 stratified sampling. Based on the Region of Interest (ROI), radiomics features of lung nodules were obtained, and the optimal radiomics parameters were selected through dimensionality reduction to obtain the radiomics feature parameter score (Rad score). By incorporating clinical data and radiomics feature scores of patients, logistic regression was used to establish clinical models, radiomics feature models, and joint models, respectively, to obtain a column chart of the joint model. Draw ROC curves separately to evaluate the predictive performance of clinical feature models, radiomics feature models, and joint models on lung nodule growth. ***Results:*** There was a statistically significant difference in the history of lung cancer among first-degree relatives. The 8 optimal radiomics characteristic parameters have statistical differences. The AUC values of the clinical feature model, radiomics feature model, and joint model training sets were 0.687 (95% CI: 0.539~0.701), 0.865 (95% CI: 0.774~0.893), and 0.885 (95% CI: 0.798~0.924), respectively. The AUC values of the validation set were 0.698 (95% CI: 0.578~0.798), 0.783 (95% CI: 0.701~0.876), and 0.886 (95% CI: 0.697~0.897). ***Conclusion:*** The joint model based on clinical features and PET/CT radiomics feature scores is superior to the clinical and radiomics feature models, and has good clinical application value in predicting the growth trend of solid pulmonary nodules.

EP-0169

The utility of ^{18}F-FDG PET in discriminating between local recurrence and inflammatory changes following SABR in primary lung cancer patients

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Aim/Introduction: Stereotactic ablative radiotherapy (SABR) achieves good cancer control and is indicated in patients with early-stage Non- Small Cell Lung Cancer (NSCLC) who are not fit for surgery or who decline surgery1,2. Patients are followed up using Computed Tomography (CT) surveillance scans, although these scans are frequently difficult to interpret due to the radiation-induced inflammatory and fibrotic changes which can be indistinguishable from a recurring mass3. If there is suspicion of recurrence on CT, FDG PET-CT is often used for further investigation. The aim of this study was to investigate the utility of FDG PET in detecting recurrence in patients with suspicious CT findings. ***Materials and Methods:*** 236 patients underwent SABR for a lung lesion at our institution between 2012 and 2023. Patients who underwent FDG PET for suspected recurrence on CT findings were included. Patients who had SABR for oligometastatic disease and patients who had less than 5 months follow-up after PET scan were excluded from this retrospective study. SUVmax, reported impression of nuclear medicine physicians reporting the scan and patient outcome were studied in these patients. ***Results:*** Out of 27 included patients, 4 patients had local recurrence and 23 did not have recurrence. The SUVmax of the lung lesions post-SABR was significantly higher in patients who had recurrent tumour (median 7.1) compared to those who did not (median 3.4) (p=0.0025). There was overlap in SUVmax values between recurrence and post-SABR changes. The PPV and NPV of FDG PET were 75% and 95%, respectively. There was increased uncertainty associated with patients whose primary tumours demonstrated low FDG avidity. ***Conclusion:*** FDG PET is very useful in guiding management of patients with suspected recurrence in patients after SABR, particularly in cases where the primary tumour is FDG avid. However, no absolute threshold can be used to indicate recurrence, as there is overlap between the SUVmax values of recurrent tumours and fibrotic changes. More research is needed to understand the utility of FDG PET in detecting recurrence of low FDG avid tumours. ***References:*** 1.NICE. Lung cancer: diagnosis and management. 2.Matsuo Y, Nakamoto Y, Nagata Y, et al. Characterization of FDG-PET images after stereotactic body radiation therapy for lung cancer. Radiotherapy and Oncology. 2010;97(2):200-204. doi:10.1016/j.radonc.2010.04.011 3.Matsuo Y, Nagata Y, Mizowaki T, et al. Evaluation of mass-like consolidation after stereotactic body radiation therapy for lung tumors. Int J Clin Oncol. 2007;12(5). doi:10.1007/s10147-007-0691-9.

EP-0170

Diagnostic Utility of Metabolic Parameters in Preoperative ^{18}F-FDG PET/CT to Predict Nodal Metastatic Involvement in Patients with Non-Small Cell Lung Cancer.

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Aim/Introduction: To evaluate the diagnostic utility of metabolic parameters from positron emission tomography-computed tomography with ^{18}F-fluorodeoxyglucose (18F-FDG PET/CT) in predicting regional lymph node(LN) involvement(N1 and N2) in patients with non-small cell lung cancer(NSCLC). ***Materials and Methods:*** Descriptive-retrospective study of 70 patients(mean age:65 years,11 females and 59 males) diagnosed with NSCLC and who underwent surgery between January-December 2016, staged using ^{18}F-FDG PET/CT. Histology:adenocarcinoma 50%;squamous cell carcinoma 36%;other 14%. Pathological lymph node status(pN):N0:76%,N1:13% and N2:13%.We compared clinical-pathological characteristics and metabolic parameters with the gold standard(pN yes/no). The assessment of nodal involvement based on PET/CT uptake was qualitative. We collected: maximum standardized uptake value(SUVmax) of the tumor(T) and lymph nodes(LN), metabolic tumor volume(MTV), and LN to primary tumor ratio of SUVmax(LPR). Differences between groups were compared using the t-Student test. ROC analysis was performed, and the area under the curve(AUC) was calculated to evaluate the diagnostic performance of metabolic parameters to identify nodal involvement, obtaining the optimal cutoff value according to the Youden index. Multivariable logistic regression analysis was performed to identify predictors of nodal involvement. It is important to note that for ROC analysis and logistic regression, each lymph node station(N1 and N2) was considered as a single observation and each patient as a group of observations. ***Results:*** Out of 70 patients,19(27%) had suspected nodal involvement according to PET/CT, histologically confirmed in 9 cases. Sensitivity(S),specificity(E),positive predictive value(PPV) and negative predictive value(NPV) were 50%,80.77%,47.37% and 82.35%, respectively. False positives were mainly due to inflammatory causes, while false negatives were due to subcentimeter metastatic lymph nodes.Metabolic tumor volume(MTV) was significantly higher in patients with nodal involvement, while SUVmax of the primary tumor(T) showed no significant differences. In ROC analysis, the AUC of MTV[AUC, 0.75; 95% CI(0.678-0.822)] was higher than SUVmax T[AUC, 0.656; 95% CI(0.577-0.735)]. The AUC of LPR[AUC, 0.712; 95% CI(0.636-0.782)] was slightly higher, though not significantly, than AUC SUVmax LN[AUC, 0.707; 95% CI(0.632-0.782)], with cutoff values of 0.37 and 3.56, respectively. In multivariate analysis, we found that LPR value≥0.37 to predict N2 was not significant(p=0.07). MTV was an independent predictor for N2 nodal involvement in adenocarcinoma with a cutoff value of 7.6(p<0.05). ***Conclusion:*** The findings suggest that MTV and LPR could enhance the accuracy in identifying N2 nodal involvement in NSCLC, particularly MTV in adenocarcinoma, although limited by the small sample size. Prospective studies are needed to validate the results and evaluate the effect of metabolic parameters on therapeutic strategy.

EP-0171

Predicting Cachexia Status in Lung Cancer Patients Using PET Radiomics

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Aim/Introduction: Approximately half of lung cancer patients are at risk of developing cachexia (1). Given the poor prognosis associated with advanced cachexia, early recognition of cachexia status is of paramount importance (1, 2). The aim of this study is to investigate the ability of PET radiomics in early prediction of cachexia in lung cancer patients undergoing [18F]fluoro-2-deoxy-D-glucose ([18F]-FDG) positron emission tomography (PET)/computed tomography (CT) scans. ***Materials and Methods:*** Lung cancer patients who underwent [18F]-FDG PET/CT scans from October 2017 to October 2020 were included in the analysis, with detailed weight data available for the six months preceding and following the PET/CT scan. According to the definition of cancer-associated cachexia, it is necessary to ascertain that the weight change in patients six months prior to the PET/CT scan did not reach the severity of cachexia. Radiomic features were extracted, and a model was developed using the FeAture Explorer Pro (FAE, Ver. 0.5.3) software, analyzing PET scans that included regions of interest such as the liver, pancreas, visceral and subcutaneous fat, as well as the psoas and sacrospinal muscles. When constructing the radiomics model, we applied methods such as Pearson correlation analysis, recursive feature elimination, and auto-encoder. The area under the curve (AUC) was utilized to measure the predictive performance of the radiomics model. ***Results:*** Eighty-nine lung cancer patients were included, with 63 in the training cohort and 26 in the testing cohort. Among the training cohort, 36 were cachectic and 27 were non-cachectic, while in the testing cohort, 15 were cachectic and 11 were non-cachectic. The radiomics model included a total of three radiomic features, with two originating from the pancreas and one from subcutaneous fat. The AUC values of the radiomics model for predicting cachexia status in the training and testing cohorts of lung cancer were 0.775 and 0.727, respectively. ***Conclusion:*** The PET radiomics model can effectively aid in early identification of lung cancer patients at higher risk of developing cachexia. ***References:*** (1) Baracos VE, Martin L, Korc M, Guttridge DC, Fearon KCH. Cancer-associated cachexia. Nat Rev Dis Primers. 2018 Jan 18;4:17105.(2) Fearon K, Strasser F, Anker SD, Bosaeus I, Bruera E, Fainsinger RL, Jatoi A, Loprinzi C, MacDonald N, Mantovani G, Davis M, Muscaritoli M, Ottery F, Radbruch L, Ravasco P, Walsh D, Wilcock A, Kaasa S, Baracos VE. Definition and classification of cancer cachexia: an international consensus. Lancet Oncol. 2011 May;12(5):489-95.

EP-0172

Dual time point imaging ^{18}F FDG PET/CT: Is there any clinical impact on enhancing the diagnostic accuracy of SUV in small Solitary Pulmonary Nodules?

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Aim/Introduction: The characterization of solitary pulmonary nodules (SPNs) still remains a complex process. The differential diagnosis based on PET/CT is not always feasible due to the ^{18}F FDG overlap uptake in malignant and inflammatory cells. An SUV≥2.5 is used as a criterion of malignancy. Moreover, well differentiated

malignancies exhibit only minimal increased activity and more recent semiquantitative parameters are investigated. The aim of this study was to evaluate the clinical impact of dual time point imaging based on changes of SUV values in the accurate definition of the nature of SPNs. ***Materials and Methods:*** One hundred forty PET/CT scans from 70 patients with small SPNs ≤ 10mm found on previous CT, were included in this prospective analysis between May 2023 and March 2024. Dual point imaging ^{18}F FDG PETCT, early phase image acquisition 1hr (PET1) and delayed phase images after 2hrs p.i (PET2), were performed on a digital PETCT scanner. Regions of interest (ROIs) were drawn around the lesion on both PET images. A semiquantitative analysis was followed by using the parameter Standardized Uptake Value, SUV1 for early and SUV2 for delayed images. Patients were classified in 3 groups: group 1 malignant (primary or metastatic), group 2 benign and group 3 indeterminate (without differences) lesions based on the difference of SUV1 and SUV2 values. The final diagnosis was based on CT or EBUS guided biopsy and on clinical follow up for more than 6 months. The reference standard in characterizing SPNs was SUV≥2.5 value, comparing early and dual time point imaging and the clinical outcome ***Results:*** CT/EBUS guided biopsy results in 57/70 pts showed 40 malignant nodules (29 adenocarcinomas, 8 squamous cell carcinomas and 3 bronchoalveolar) and 17 benign (inflammatory granulomas, infection). In 13 pts biopsy was not diagnostic and the reference standard was the clinical outcome. The sensitivity, specificity, accuracy, PPV and NPV of the SUV1 in characterizing the nature of SPNs were 64%, 41%,54%,60%,45% respectively. Among the malignant nodules with SUV<2.5 at the early phase 9/12 malignant lesions showed higher values at the delayed phase. Dual point images achieved 96%,46%,78%,75%,87%. Moreover in 16 cases there was no SUV difference (indeterminate) ***Conclusion:*** Dual time point imaging ^{18}F FDG PET/CT has higher sensitivity, specificity, accuracy, PPV and NPV and is recommended mostly for SPNs with SUVvalues <2.5.

EP-0173

A prospective comparison of SUV, MTV and TLG volumetric parameters changes between early and delayed FDG PET/CT in the accurate assessmentof small solitary pulmonary nodules.

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Aim/Introduction: The differentiation of solitary pulmonary nodules (SPNs) into benign and malignant continues to challenge thoracic oncology, given the multitude of potential causes including benign-inflammatory, metastatic lesions, and primary malignant tumors. Positron Emission Computerized Tomography (PET/CT) using the Standardized Uptake Value (SUVmax) parameter has become essential, exploiting the differential glucose metabolism between cancerous and non-cancerous cells. Due to SUV uncertainties and errors, newer parameters, Metabolic Tumor Volume (MTV) and Total Lesion Glycolysis (TLG) have been introduced. The aim of this study was to investigate the correlation of changes in these parameters over time in pts with SPNs with the presence of malignancy, aiming to identify which of these parameters is the most accurate. ***Materials and Methods:*** One hundred sixteen PET/CT scans from 58 patients with small SPNs ≤ 10mm (median lesion size 7mm) found on previous CT were included in this prospective analysis, between May 2023 and March 2024. Early 1hr (PET1) and delayed images 2hrs p.i (PET2) were performed on a digital PETCT scanner. Standardized Uptake Value (SUVmax), Metabolic Tumor Volume (MTV) and Total lesion glycolysis (TLG) for PET1 (SUV1, MTV1, TLG1), for PET2 (SUV2, MTV2 and TLG2)and their percentage changes between PET studies (ΔSUVmax,ΔMTV, ΔTLG) were evaluated. Patients were classified in 3 groups: group 1 malignant lesion (primary or metastatic), group 2 benign lesion and group 3 equivalent (without difference) based on the difference of SUV, MTV and TLG of PET1 and PET2 scans. The final diagnosis was based on CT or EBUS guided biopsy. ***Results:*** Histoapthological findings showed: malignancy in 35/58 and benign lesion in 23/58 patients. On PET 1/PET2, the average ΔSUVmax was (1.17-14.18 vs 1.2-22.4), of ΔMTV (1,25-40,53 vs 1,25-28,97) and of ΔTLG (2,3-38 vs 2,1-32). The sensitivity, specificity, accuracy, PPV and NPV were for SUV (91%, 53%, 78%, 72%, 80%), for MTV (55%, 95%,72%,94%,60%) and for TLG (85%,100%,92%,100%,75%) respectively. Multivariate regerssion analysis showed pvalue<0,05 for MTV 0,001 and for TLG 0,000. ***Conclusion:*** This ongoing study suggests that TLG parameter is the driving factor for the best management of pts with SPNs improving the accuracy.

EP-0174

Integrating PET/CT Imaging and Machine Learning to Enhance Early Diagnosis of Solitary Pulmonary Nodules

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Aim/Introduction: Differentiating solitary pulmonary nodules (SPNs) as benign or malignant poses a significant challenge in oncology. Traditional ^{18}F FDG PET/CT metrics such as Standardized Uptake Value (SUV), Metabolic Tumor Volume (MTV), and Tumor Lesion Glycolysis (TLG) provide limited diagnostic accuracy and lack a universal diagnostic threshold applicable to all cases. This study aims to enhance the diagnostic precision of SPNs by integrating these metrics with high-level features extracted with advanced machine learning methods directly from the imaging exams, providing critical insights ahead of biopsy results. ***Materials and Methods:*** In addition to the SUV, MTV and TLG metrics, and demographic data our dataset comprises PET/CT images, analyzed using a GE digital PET/CT Discovery MI 4R system. We employ advanced image processing techniques on the images to precisely detect regions of interest and localize nodules within them. Furthermore, we leverage the capabilities of Convolutional Neural Networks (CNNs) through a pre-trained VGG16 model loaded with ImageNet-trained weights and adapted to extract high-level features, ensuring a robust feature set tailored to SPNs. The high-level image-extracted features are then integrated with the measurements of SUV, MTV, and TLG obtained from both initial and delayed imaging sessions (two hours post-radiopharmaceutical administration) to construct a comprehensive dataset that forms the basis for our predictive modeling.An advanced explainable ensemble decision tree framework like the XGBoost model, is employed to analyze and predict the malignancy of SPNs with enhanced accuracy, harnessing both traditional radiological metrics and novel image-derived features. ***Results:*** Our results demonstrate that by integrating high-level image-extracted features with TLG, SUV, and MTV and demographic data into explainable tree-based ensemble models, we significantly increase the predictability of SPNs among the provided data. Specifically, we find accuracy of

the order of 80% through random tree ensemble analysis while the inclusion of direct image information in the data set increases substantially this figure. This study underscores the potential of AI-enhanced radiomics to reduce false diagnostic rates and improve the early accuracy of diagnoses. ***Conclusion:*** Integrating AI with PET/CT imaging presents a promising avenue for advancing diagnostic procedures for SPNs. The utilization of explainable ensemble tree-based models, along with traditional and novel imaging metrics, supports more effective and earlier clinical decision-making. This approach accelerates the preliminary diagnostic timeline, potentially reducing the time to intervention and optimizing treatment planning.

EP-0175

Development, validation and comparison of PET/CT diagnostic model based on radiomics and deep learning in differentiating benign and malignant pulmonary persistent ground-glass nodules

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Aim/Introduction: To develop PET, CT and PET/CT diagnostic models based on radiomics and deep learning, verify and compare their differential diagnostic efficacy in differentiating benign from malignant pulmonary persistent GGNs, elucidate the application value of each model. ***Materials and Methods:*** 173 patients with pulmonary persistent GGNs who underwent ^{18}F-FDG PET/CT, breath-hold chest CT, and surgery at three PET/CT centers were retrospectively analyzed, 184 pulmonary persistent GGNs (43 benign nodules and 141 malignant nodules) were included in the study, Based on conventional image parameters, radiomics, and deep learning algorithms to extract and screen PET, CT, and PET/CT image characteristics, corresponding diagnostic models were developed to verify and compare the performance of each model in differentiating benign from malignant lung GGNs. ***Results:*** In the test set, AUCs were higher in the CT radiomics (AUC = 0.889) and PET radiomics (AUC = 0.903) models than in the reference model (AUC = 0.869); in the external validation set, AUCs were higher in the CT-VGG19 (AUC = 0.851), PET radiomics (AUC = 0.833), and PET-ResNet50 (AUC = 0.884) models than in the reference model (AUC = 0.824).In addition, the CT-ResNet50 model had a slightly better AUC on the test set than the CT-VGG19 model in models built based on deep learning features (AUC = 0.821 vs. 0.793), but the CT-VGG19 model performed better in the external validation set (0.851 vs. 0.551); the AUC of the PET-ResNet50 model was better than that of the PET-VGG19 model in both the test set and the external validation set (AUC = 0.838, 0.884 vs. 0.814, 0.767). To further improve the differential efficacy of benign and malignant lung GGNs, a combined model (PET/CT radiomics and PET-ResNet50/CT-VGG19) was constructed based on dual-modality radiomics or deep learning characteristics. Because the CT omics feature eventually did not enter the PET/CT omics model (equivalent to the streamlined PET radiomics model), it had a better AUC on the test set than the combined deep learning model (AUC = 0.906 vs. 0.810), but the deep learning combined model had a better AUC in the external validation set (AUC = 0.927 vs. 0.849). ***Conclusion:*** The combined PET/CT diagnostic model developed based on deep learning has higher performance in differentiating benign from malignant pulmonary persistent GGNs and better generalization performance and can be used for the precise management of patients with pulmonary persistent GGNs.

EP-0176

Identifying PET/CT-based biomarkers in lung cancer patients using unsupervised machine learning.

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Aim/Introduction: Lung cancer holds the highest position among cancer types affecting Indian males aged 40-64 and 65+, constituting 10.6% of all cancer cases in this population (1). With progressively worsening risk factors of smoking and air pollution, there is an urgent need for population specific risk assessment to guide targeted treatment approach. Extracting radiomics features from PET/CT can define predictive and prognostic image markers, potentially limiting treatment failures and costs. Machine learning aids pattern recognition, however requiring extensive annotated datasets. Here, we aim to address this by utilising a publicly accessible PET/CT dataset (n = 103 patients) to train our ML model (2), with an independent patient cohort for testing. ***Materials and Methods:*** Radiomics features of first, second, and third-order types were extracted from publicly available PET/CT images utilising the Pyradiomics. An unsupervised Deep Embedded Multi-View Clustering (DEMVC) network was trained using these features. For testing, we used a dataset consisting of initial staging PET-CT scans of 28 lung cancer patients, with their survival outcomes observed over the past three years. The top five features were ranked by an extra tree classifier and identified clustered on the test set. Finally, the robustness and generalisability of the model were assessed through its validation based on overall survival. ***Results:*** Three clusters were identified based on the training data. All top five features are wavelet transformed, where the first two, glszm_GrayLevelVariance and glrlm_RunEntropy, correspond with the HLL filter. The third feature was generated using an HLH filtered glcm_SumSquares. The fourth and fifth features were first order LLH_RootMeanSquared and LLL_RobustMeanAbsoluteDeviation. We found that cluster 2 dominates with alive patients (62.5%), and cluster 3 dominates with dead patients (74%). The feature values in the notched box plot also had a distinct separation for both clusters. ***Conclusion:*** We identified population specific PET/CT radiomics features based on overall survival. Our findings suggest the potential of initial staging PET/CT scan to guide more efficient clinical decision-making processes in future. ***References:*** 1. Sathishkumar K, Chaturvedi M, Das P, Stephen S, Mathur P. Cancer incidence estimates for 2022 & projection for 2025: result from National Cancer Registry Programme, India. Indian Journal of Medical Research. 2022 Oct 1;156(4&5):598-607. 2. Gatidis S, Hepp T, Früh M, La Fougère C, Nikolaou K, Pfannenberg C, Schölkopf B, Küstner T, Cyran C, Rubin D. A whole-body fdg-pet/ct dataset with manually annotated tumor lesions. Scientific Data. 2022 Oct 4;9(1):601.

EP-0177

Which parameters with F^{18} FDG PET/CT are valuable in predicting contralateral lung parenchymal metastasis?

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Aim/Introduction: The etiology underlying contralateral lung metastasis in cases of lung cancer and the determinants contributing to the metastatic process, remain yet to be comprehensively elucidated. We aimed to investigate the additional value of FDG PET/CT to determining contralateral

lung parenchyma metastasis (CLM), its causes and predictive factors in lung cancer. ***Materials and Methods:*** Lung cancer patients who underwent PET/CT between 2009 and 2021 were analyzed. Postoperative histopathological data, follow up data and FDG PET/CT findings including primary tumor lobe, segment, size, pleural effusion, pleural involvement, mediastinal invasion/thorax wall involvement and additional metastasis were recorded. Relationships between these factors and PET/CT parameters were statistically analyzed. Survival analyses were performed. ***Results:*** 125 patients with contralateral lung parenchymal metastases and 100 patients with distant metastasis who chosen randomly were compared. Among them, 81 patient had contralateral metastasis in diagnosis and 44 patients developed CLM in follow up. While there was no difference between the two groups between the primary tumors metabolic parameters such as SUVmax, SUVmean and MTV values; presence of satellite nodules and metastatic nodules in other lobes in the same lung were found to be significantly higher in CLM group (p=0,007; p<0,001). Pleural metastasis and effusion were more common in CLM group rather than control group based on PET/CT findings (p=0,003 and p=0,036). In statistical analyses, satellite nodules in the same lobe raise the probability of CLM by fourfold (p = 0,012; R = -0,2752; 95% CI: 0,082-0,767), and the absence of necrosis in the initial tumor raises the probability of metastasis to the contralateral lung by 3,326 times during follow-up (p = 0,015; R = 0,2656; 95% CI: 1,236-8,950). ***Conclusion:*** PET/CT provide a simple yet potent way to investigate and predict characteristics related to contralateral parenchymal metastases in lung cancer such as ipsilateral nodules, pleural effusion and metastasis. It also contributes to the determination of primary tumor characteristics such as the presence of necrotic tissue and their effect on metastasis to the contralateral lung. ***References:*** 1-Onuigbo WI: Anomalous lung cancer cell carriage: a historical review with present prospects. Int J Surg 2014, 12(7):734-736.2-Onuigbo WI: Contralateral pulmonary metastases in lung cancer. Thorax 1974, 29(1):132-133.3- Rashidi B, Moossa AR, Hoffman RM: Specific route mapping visualized with GFP of single-file streaming contralateral and systemic metastasis of Lewis lung carcinoma cells beginning within hours of orthotopic implantation [correction of implantion]. J Cell Biochem 2013, 114(8):1738-1743.

EP-0178

Maximum Standard Uptake Lean Body Mass (SULmax) [18F] FDG PET/CT and Cell-Free DNA to Predict Adjuvant Therapy requirements in Resectable Non-Small Cell Lung Cancer (NSCLC)

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Aim/Introduction: The NSCLC represents 80% of newly diagnosed lung cancers. Accurate staging is critical for prognosis. (SUL) is a volumetric parameter more objective for metabolic quantitative analysis and treatment response evaluation of lung cancer. Increased levels of circulating cell-free DNA (cfDNA) are detected in cancer patients due to various mechanisms, including tumor cell necrosis, apoptosis, and macrophage digestion, with subsequent release of tumor DNA fragments into the bloodstream. The purpose of this study was to evaluate the relationship between SUL and cfDNA concentration to predict adjuvant therapy requirements in patients with early-stage, resectable NSCLC. ***Materials and Methods:*** Prospective cohort study including patients with resectable NSCLC and baseline preoperative [18F] FDG PET/CT between 2021 and 2023. Images were acquired using a GE Discovery™ MI PET/CT after the injection 1.5 MBq/kg of [18F] FDG. Prior to surgery, blood was collected in Streck Cell-Free DNA blood collection tubes. DNA was extracted from plasma using the QIAamp Circulating Nucleic Acid Kit and was measured using the Qubit™ dsDNA HS Assay Kit. The relationship between SULmax, cfDNA and clinical variables was evaluated with Wilcoxon test or Dunn test. A Leave-One-Out Cross Validation (LOOCV) multivariate logistic regression was generated. Model performance was evaluated based on accuracy, which was considered statistically significant by a one-sample t-test if it exceeded the percentage of non-adjuvant cases. ***Results:*** Ninety patients (37 females and 53 males), mean age 65.2±6.81 with stage I (56.66%), II (26.66%) and III (16.66%) were included. The histology were adenocarcinoma (50), squamous (22), large cell (14) and others (4). The squamous presented the mayor SULmax with a median of 10.63 (interquartile range, IQR:6.05). 30% of patients received adjuvant chemotherapy after surgery. Analysis of SULmax revealed significant differences (p<0.05) with respect to tobacco consumption, type of surgery, histology, stage and adjuvant therapy. The concentration of cfDNA was significantly associated with the type of surgery, stage and need for postoperative therapy (p<0.05). There was no correlation (Spearman R<0.10) between cfDNA concentration and SULmax. Logistic regression models showed that stage alone could not predict the need for an adjuvant therapy. However, moderate predictive capacity was observed after adding SULmax and cfDNA concentration (accuracy=0.78, p=0.04) ***Conclusion:*** Combining different clinical characteristics could predict which patients will have the greatest benefit from postoperative therapies. Different but simple combinations, such as SULmax with cfDNA and stage, may help to improve adjuvant therapy decision making.

EP-0179

Detectability of lung lesions on ^{18}F-FDG PET/CT obtained from decimated and CNN-based denoised scan: An observer-based study for lung cancer screening

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Aim/Introduction: 18F-FDG is a key imaging in characterization of undetermined lung lesion (LL). We investigated LL detectability in perspective of lung cancer screening conditions by simulating low-dose and denoised 18F-FDG PET/CT. ***Materials and Methods:*** We retrospectively analyzed full statistics and decimated (30%, 10%, 5%, 2%, 1%) 18F-FDG PET/CT simulating different levels of injected activity in 49 patients presenting at least one LL. Full statistics 18F-FDG PET were acquired on digital PET Biograph Vision 600 and retrospectively reconstructed with different decimation levels. Denoising algorithm based on a convolutional neural network (CNN) was trained to reproduce full statistics PET from the decimated reconstruction and was applied on full and reduced statistics. LL detectability was assessed by three readers on a Likert scale varying from score 0 (negative), 1 (probably negative), 2 (probably positive) to 3 (positive) on a total of 12 randomized reconstructions per subject (6 with denoising, 6 without). SUVmax was normalized to the decimation level. Resulting LL detectability score were dichotomized into positive (1 for LL score=2-3) or negative (0 for LL score=0-1) malignancy score. LL detectability score distribution and quantitative measurements were compared between full statistics and the different decimation levels with and without denoising, respectively. The scores were

also analysed according to lung nodule size. ***Results:*** We analyzed 141 LL (diameter 12±12mm, range 4-30mm) across 588 (12×49) reconstructions. SUVmax was 8.3±9.9g/mL without denoising and 4.7±5.9g/mL with denoising. Compared to the full statistics (100%), LL detectability score distribution differed significantly at 2% and 1% decimation without denoising ($p<0.001$) and 5%, 2% and 1% with denoising ($p<0.001$). The dichotomized LL malignancy score was significantly lower on 10%, 5%, 2% and 1% without denoising ($p<0.029$) and on 5%, 2% and 1% decimation with denoising ($p<0.001$). The results were similar across different lung nodule sizes. Comparing LL scores at same decimation levels with or without denoising, they differed significantly at 10%, 2% and 1% decimation ($p<0.019$), the dichotomized score were similar. Overall, the proportion of LL scores with high diagnostic confidence (3 and 0) were significantly increased on denoised PET ($p<0.038$). ***Conclusion:*** Simulating reduced levels of injected activity, we found similar LL detectability supporting the feasibility of low-dose 18F-FDG PET/CT for lung cancer screening. Moreover, CNN-denoising enhanced LL detectability and diagnostic confidence on the very low-statistics datasets (≤10%).

EP-0180

Utility of Ga68 DOTANOC PET/CT in baseline staging of small cell lung cancer in treatment naive patients

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Aim/Introduction: Identify utility of Ga68-DOTANOC-PET/CT for initial staging in treatment naïve patients of Small Cell Lung Cancer and to compare its findings with F^{18}-FDG-PET/CT ***Materials and Methods:*** prospective study done at tertiary care apex medical institute in COVID 19 era for 2 years including 22 patients with histopathologically proven small cell lung cancer. Patients with history of prior treatment for lung cancer were excluded. All patients underwent baseline imaging with Ga68-DOTANOC PET/CT & F^{18}-FDG-PET/CT with in interval of 2 weeks before starting first line treatment. Written and informed consent were taken from all the subjects included in the study with approval from the Institute. AJCC 8th TNM staging was utilized to stage the disease. Imaging data was reported & obtained by two separate qualified nuclear medicine physicians trained experienced in reporting PET/CT & analysed by using statistical software SPSS/strata. Association between categorical data was assessed by chi square/fisher exact test. Quantitative data was compared by independent t test/ rank sum as appropriate. P=0.05 is considered as statistically significant. ***Results:*** : Ga68-DOTANOC-PET/CT had detected all primary lesions & loco regional lymph nodes at par with F^{18}-FDG-PET/CT but their uptake values (described in terms of SUV) differ. It also identified maximum metastatic lesions in all patients as par F^{18}-FDG-PET/CT except in two patients. Ga68-DOTANOC-PET/CT detected additional brain metastases in 1 patient compared to F^{18}-FDG-PET/CT. Ga68-DOTANOC-PET/CT has shown similar M stage on scan findings in 20 patients. 2 patients had different M stage on Ga68-DOTANOC-PET/CT compared to ^{18}F-FDG-PET/CT. One patient got down staged (M1c to M1a) while 01 patient got up staged (M1a to M1b).Both sensitivity & specificity of Ga68-DOTANOC-PET/CT were high (>90%) as compare to F^{18}-FDG PET/CT but the p value >0.05 demonstrated no significant difference between F^{18}-FDG PET/CT & 68-Ga-DOTANOC PET/CT in staging. ***Conclusion:*** Ga68-DOTANOC-PET/CT can detect the primary lesion, locoregional lymph nodes & metastases in small cell lung cancer especially in cases of brain metastases which were better visualized on Ga68-DOTANOC-PET/CT due to very less background uptake of radiotracer in brain cells. Ga68-DOTANOC-PET/CT can stage primary lesion, locoregional lymph nodes & majority of metastatic lesions correctly at par with ^{18}F-FDG-PET/CT. Ga68-DOTANOC-PET/CT was superior to F^{18}-FDG PET/CT in 1 patient & inferior to F^{18}-FDG-PET/CT in another patient to detect metastatic lesions. The SUVmax of Ga68-DOTANOC-PET/CT were less than SUVmax of F^{18}-FDG-PET/CT but lesion to background ratio (SUVr) were higher for Ga68-DOTANOC PET/CT, possibly due to less background activity in Ga68-DOTANOC-PET/CT.

EP-0181

Assessment of risk factors for recurrence of primary lung tumors treated with stereotactic body radiotherapy (SBRT).

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Aim/Introduction: To determine which factors (T, histology subtype, radiotherapy dose, lung location, SULmax in baseline PET-CT and at 3 months post-radiotherapy PET-CT) are associated with a higher risk of recurrence in primary lung nodules N0M0 treated with SBRT. ***Materials and Methods:*** We perform a retrospective study of 104 patients (11 women and 93 men) with average age of 76 years, between 2013 and 2023. Follow-up was carried out by PET-CT three months after completing radiotherapy treatment and subsequently every 6 months until 2-3 years post-radiotherapy. The mean follow-up was 22 months. We defined recurrence as new-appearing pathological uptakes that were confirmed in successive PET-CT during follow-up. The patients were divided into two groups: with recurrence and without recurrence (control). ***Results:*** 33 patients presented recurrence during follow-up (17 local, 4 regional and 12 distant recurrence), 21 tumors were non-small cell carcinomas (10 squamous cell carcinoma, 10 adenocarcinoma and 1 unspecified carcinoma) and 12 did not present histology subtype. 29 of 33 were staged as T1 and 4 as T2. 24 nodules were located in the upper lobes, 8 in the lower lobes and 1 in the medial lobe. 22 of 33 were treated with 60 Gray of radiotherapy dose and 11 with <60 Gray.The SULmax mean at the baseline PET-CT and at 3-month PET-CT were 5.67 and 2.82, respectively. 71 patients did not have recurrence during follow-up. 30 were adenocarcinomas, 11 squamous cell carcinoma and 30 did not have histology diagnosis. 59 of 71 were staged as T1, 8 as T2, 3 as T3 and 1 as T4. 46 nodules were located in the upper lobes, 21 in the lower lobes and 4 in the medial lobe.54 of 71 were treated with 60 Gray of radiotherapy dose and 16 with <60 Gray. The SULmax mean at the baseline PET-CT and at 3 month PET-CT were 4.91 and 3.31, respectively. We did not observe significant differences ($p>0.05$) between both groups in the variables of T, histology subtype, radiotherapy dose, pulmonary location, SULmax mean at baseline PET-CT and SULmax mean at 3 months PET-CT. ***Conclusion:*** PET-CT is a useful tool in the early detection of recurrence of primary lung neoplasms treated with SBRT.We did not find a statistical correlation of the variables studied with post-radiotherapy tumor recurrence.

EP-0182

The prognostic and diagnostic significance of conventional PET parameters in NSCLC

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Aim/Introduction: Lung cancer is the most common cancer globally and has the highest mortality rate among adults. Accurate prognosis prediction is paramount. Recent literature has explored the diagnostic and prognostic value of imaging parameters derived from pretreatment FDG-PET/CT scans in NSCLC, yielding promising results. Our aim was to evaluate the significance of conventional PET parameters extracted from primary lung nodules (pre-surgery) in our NSCLC patient cohort retrospectively. ***Materials and Methods:*** Pre-treatment FDG-PET/CT scans (Mediso) from 79 patients with suspected lung cancer were analyzed. Scans were conducted at the University of Pecs, Department of Medical Imaging. Following surgery, histopathological confirmation was obtained for all cases: squamous cell carcinoma (23 patients) and adenocarcinoma (56 patients). We investigated significant differences in imaging parameters among groups: partial, complete response, and stable disease (25 patients) versus progression (32 patients), based on RECIST; metastases present at the time of diagnosis or within a 2-year follow-up versus no metastases within 2 years; TNM stage IIA or lower (33 patients) versus higher stage than IIA (46 patients); and PD-L1-positive (18 patients) histology versus PD-L1 negativity (13 patients). Suspected primary tumors were delineated, and conventional PET radiomics were extracted (ROVER software). Parameters assessed included standardized uptake values (SUVmax, mean, peak), metabolic tumor volume (MTV), total lesion glycolysis (TLG), tumor-to-liver uptake ratio (TLR), and first-order parameters such as coefficient of variation (COV), kurtosis, skewness, entropy, and maximal tumor diameter. Group comparisons were performed using non-parametric statistical tests (Mann-Whitney U test). ***Results:*** SUVmax (p=0.049), SUVmean (p=0.033), and TLR (p=0.022) exhibited statistically significant differences between adenocarcinoma and squamous cell carcinoma groups. Regarding PD-L1 expression, SUVmean (p=0.04), TLG (p=0.04), ASP (p=0.02), and TLR (p=0.02) displayed significant differences. TLG (p=0.032) and MTV (p=0.029) showed statistically significant differences between progression and response groups. Significant differences were observed between metastasis and non-metastasis groups, and among stage groups in the following parameters (p<0.001): SUVmax, SUVmean, SUVpeak, MTV, TLG, ASP, TLR, Entropy and max diameter. No significant differences were found in COV, kurtosis, and skewness. ***Conclusion:*** Our analysis suggests that conventional FDG-PET/CT parameters hold promise for prognosis prediction and diagnostic estimation. Further analysis and data collection are warranted to strengthen our findings. ***References:*** Project no. TKP2021-EGA-10 has been implemented with the support provided from the National Research, Development and Innovation Fund of Hungary, financed under the TKP2021-EGA funding scheme.

EP-0183

FDG PET/CT Response Evaluation of Multimodality Treatments in NSCLC

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Aim/Introduction: 18F-FDG PET/CT is an important imaging tool to evaluate early treatment response accurately in solid tumors in order to optimize cancer treatment and patient management. Our aim was to evaluate the role of 18F-FDG PET/CT in assessing post-therapy response of patients with Non Small Cell Lung Carcinoma (NSCLC) who underwent treatment with multiple modalities. ***Materials and Methods:*** We performed baseline and post treatment follow up 18F-FDG PET/CT in 36 patients (24 males,12 females),age: 45-84 years with primary Non Small Cell Lung Carcinoma (NSCLC).All of them were referred to our department for initial staging and assessing response following treatment after an interval of 6-18 months.5 patients had surgery,9 patients had chemotherapy,1 patient had radiotherapy,7 patients had targeted molecular therapy,2 patients had immunotherapy,3 patients had surgery and chemotherapy,2 patients had surgery and radiotherapy,3 patients had chemotherapy and immunotherapy,2 patients had surgery, chemotherapy and radiation therapy,1 patient had chemotherapy and immunotherapy and 1 patient had radiotherapy, chemotherapy and immunotherapy. We performed baseline and post treatment 18F-FDG PET/CT from vertex to mid-thigh in all the patients with a 64 slice,16cms axial FOV (field of view) PET/CT camera (GE 710) 60 minutes after injecting a standard dose of 0.06mci/kg of 18F-FDG.The images were reconstructed on an Advantage (GE) work station and analyzed on a Hermes system by four independent PET/CT readers. ***Results:*** Baseline FDG PET/CT showed disease restricted to lung in 15 patients, loco-regional lymph node metastasis in 11 patients, locally invasive disease in 3 patients and distant metastasis in 7 patients. Following treatment FDG PET/CT PERCIST 1 criteria showed CMR (complete metabolic response) in 8 patients (post treatment changes were observed in 2 patients),PMR (partial metabolic response) in 5 patients, SMD (stable metabolic disease) in 8 patients and PMD (progressive metabolic disease) in 15 patients. ***Conclusion:*** Our study shows that 18F-FDG PET/CT can identify responders and non-responders in patients with NSCLC treated with multiple modalities including targeted molecular therapy and immunotherapy. This may help in designing new treatment options and continue existing ones to improve prognostic outlook in these patients. ***References:*** 1. The value of FDG PET/CT in Treatment Response Assessment, Follow-Up and Surveillance of Lung Cancer. S.Sheikhbahaei, et al. AJR 2017; 208:420-433. 2. FDG PET/CT for Evaluation of Immunotherapy Response in Lung Cancer patients.Marc.Andre. Leger,et al. Semin Nucl Med 2022 Nov;52(6):707-19. 3. 18F-FDG PET/CT criteria for treatment response assessment.EORTC and beyond. A. Miceli, etal. Clinical and Translational Imaging (2023) 11:421-437.

EP-0184

Dual-Tracer PET/CT in Non-Small Cell Lung Cancer: A Case Series Analysis Using $^{[18F]}$FDG and $^{[18F]}$F-PSMA-1007

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Aim/Introduction: Prostate-specific membrane antigen (PSMA) tracer, used for prostate cancer evaluation, has emerged as a marker of neoangiogenesis, exhibiting accumulation in various

neoplasms with potential theranostic capability. Despite the high sensitivity of FDG-PET/CT for non-small cell lung cancer (NSCLC) detection, it remains uncertain whether PSMA-PET/CT can detect additional lesions. This study aims to compare the uptake patterns of [18F]FDG and [18F]F-PSMA-1007 in primary and metastatic lesions of NSCLC. ***Materials and Methods:*** Five patients diagnosed with NSCLC (4 male), 56-71 years-old were studied. FDG-PET/CT and PSMA-PET/CT scans (respectively performed 60 minutes after intravenous administration of 0.1mCi/kg of [18F]FDG or 90 minutes after 0.1mCi/kg of [18F]F-PSMA-1007) were carried out with a time interval of 1-8 days between them. The imaging data were analyzed by two nuclear medicine physicians and one radiologist. The maximum standardized uptake value (SUVmax) of each lesion was measured for both radiotracers in the primary tumor and metastatic sites identified through visual analysis. Lesions were considered positive if their SUVs exceeded those of the cardiac blood pool, with inflammatory sites being excluded. ***Results:*** A total of 105 lesions were detected, 87 identified using [18F]FDG and 96 using [18F]F-PSMA. Nine lesions were exclusively detected by [18F]FDG (6 lung, 2 adrenal, and 1 lymph node metastases), while 14 were only identified by [18F]-PSMA (11 lymph node, 1 brain, 1 bone, and 1 lung metastases). The median SUVmax of lesions detected by [18F]FDG and [18F]F-PSMA images was 5.2 (1.7-25.0) and 3.7 (0.7-12.4), respectively. Brain lesions were more readily identified on [18F]PSMA images, whereas liver lesions were more notable on [18F]FDG images due to the intense physiological uptake of [18F]FDG and [18F]F-PSMA in the brain and liver, respectively. The uptake intensity and intratumoral distribution of the two tracers varied among different lesions. ***Conclusion:*** Both [18F]FDG-PET/CT and [18F]F-PSMA-1007-PET/CT identify most lesions of NSCLC. Due to ethical considerations, biopsies of all lesions were not feasible, precluding the exclusion of false positive results for both tracers. Although [18F]F-PSMA-1007 images detected a greater number of lesions, the uptake intensity generally appears higher with [18F]FDG. These findings suggest that the two radiopharmaceuticals may have complementary roles in NSCLC, independently detecting lesions with either higher glycolytic activity or greater neoangiogenesis. This potential could lead to a more personalized approach in managing these patients. Additionally, the results hint at a possible theranostic approach in selected patients with high PSMA uptake. Further investigations are essential to validate these findings.

EP-0185

Predicting Major Pathological Response to Neoadjuvant Immunochemotherapy in Non-small Cell Lung Cancer Using Multi-organ ^{18}F-FDG PET Metabolic Parameters: A Preliminary Study

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Aim/Introduction: Neoadjuvant immunochemotherapy (NAIC) has shown promise in improving the prognosis of non-small cell lung cancer (NSCLC). However, a significant portion of NSCLC patients fail to achieve major pathological response (MPR) with this treatment, experiencing rapid disease progression or severe immune-related adverse events. Various FDG PET metabolic parameters of organs like bone marrow, skeletal muscle, and colon have been linked to the prognosis of NSCLC. This study aims to investigate the efficacy of multi-organ parameters on 18F-fluorodeoxyglucose (FDG) positron emission tomography (PET) in predicting MPR to neoadjuvant immunochemotherapy in NSCLC patients. ***Materials and Methods:*** We retrospectively reviewed a consecutive cohort of 26 eligible NSCLC patients who underwent baseline ^{18}F-FDG PET/CT followed by neoadjuvant immunochemotherapy. Ten organs (spleen, kidney, pancreas, liver, colon, heart, aorta, lung, spine, and iliopsoas) were automatically delineated from PET/CT images, and five metabolic PET parameters (SUVmax, SUVmean, SUVpeak, metabolic tumor volume [MTV], total lesion glycolysis [TLG]) were measured. Spearman correlation and gradient boosting decision tree (GBDT) algorithms were used to select discriminative parameters. Logistic regression was employed to construct a prediction model, evaluated using metrics such as the area under the receiver operating characteristic curve (AUC), calibration plots, and decision curve analysis (DCA). ***Results:*** In our study cohort, 13 out of 26 patients achieved MPR following NAIC. Baseline clinical characteristics showed no significant difference between the MPR group and non-MPR groups. Spearman correlation and GBDT algorithms identified six key parameters (Spleen_SUVmax, Kidney_SUVmean, Pancreas_SUVmax, Colon_SUVpeak, Iliopsoas_SUVmean, Iliopsoas_SUVmax). Our logistic model, integrating these parameters with the SUVmean of the primary tumor, demonstrated significant stronger performance than SUVmean alone (AUC 0.92 [95% CI 0.81-1.00] vs 0.65 [95% CI 0.42-0.89], $p<0.05$). It displayed good calibration, and provided a notably higher net benefit in DCA. ***Conclusion:*** The predictive model, combining multi-organ ^{18}F-FDG PET parameters and the SUVmean of the primary tumor, delivered impressive results in predicting MPR to neoadjuvant immunochemotherapy in NSCLC patients. This model holds the potential to serve as a valuable biomarker for enhancing patient selection in future NAIC applications. However, larger sample size and multicenter studies are necessary to confirm our results and explore their clinical implications further.

EP-0186

IMSD in the differential diagnois between lung tumors side effects after chest radiotherapy

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Aim/Introduction: After Radiotherapy (RT) phlogosis can persist for 12 weeks and fibrosis even longer, interfering with relapses diagnosis. With this retrospective analysis we aimed to evaluate ^{18}FDG-PET/CT qualitative pattern and semiquantitative parameters, both automatic and proceeded by physicians, in interpreting lung lesions in the RT irradiation field. ***Materials and Methods:*** 94 patients (pts) submitted to RT (3 months before) for lung cancer with Computed Tomography (CT) doubtful lung lesion in the RT field were included (mean age 68 years old, range 49-84). ^{18}FDG uptake pattern was distinguished in: focal/wide, deep/shade, homogeneous/inhomogeneous. Semiquantitative parameters were: global SUVmax (gSUVmax), MTV and Intratumoral-Metabolic-Spatial-Distribution (IMSD= proximalSUVmax/distal SUVmax). ^{18}FDG-PET/CT was related to pts's outcome (biopsy and/or clinical-instrumental follow up): positive for lung relapse, negative if phlogistic. Chi-squared test for qualitative variables and t-Student for semiquantitative values were applied ($p<0.05$ for statistical significant). ***Results:*** In 76/94 (80.8%) pts, ^{18}FDG uptake was higher compared to the background;

in 18/94 (19.2%) no higher ^{18}FDG uptake were detected. Outcome was positive for lung relapse in 49/94 pts and negative in 45/94, with disease prevalence of 52.13% (95%CI=41.57%-62.54%). In the 18/94 pts without higher ^{18}FDG uptake, outcome was negative for lung relapse. In 49/76 pts with higher ^{18}FDG uptake the outcome confirmed the presence of relapse, while in 27/76 the lesion was phlogistic. Results about the Sensitivity, Specificity, Accuracy, Positive and Negative Predictive Values (95%CI) were respectively: 100% (92.75%-100%), 40% (25.7%-55.67%), 71.28% (61.02%-80.14%), 64.47% (58.84%-69.73%) and 100% (81.47%-100%). Chi-square test showed difference statistical significant between the positive and negative outcome for patterns focal/wide (p=0.02) and deep/shade (p<0.00001). 35/49 (71.4%) pts with lung relapse had focal lesion and 15/27 (55.6%) with phlogosis had wide pattern. 34/49 (69.4%) pts with lung relapse had deep pattern and 25/27 (92.6%) with lung phlogosis had the shade one. Significant difference was observed in evaluation the 3 patterns (p=0.00007), with prevalence of "focal/deep/homogeneous" patterns in lung relapse and "wide/shade/inhomogeneous" in phlogosis. gSUVmax, MTV and IMSD were: in the 76 pts, 5.63 (1.4-24.7), 42.49 (4.94-193) and 3.61 (1-5.54); in the 49/76 true positive pts, 6.93 (1.5-24.7), 35.28 (4.94-85.99) and 3.30 (1.05-5.54); in the 27/76 false positive pts, 3.27 (1.4-19.2), 38.37 (4.94-193) and 1.57 (1-2.13). The difference was statistically significant only for IMSD (t=2.779; p=0.0069). ***Conclusion:*** Physician confidence in evaluating ^{18}FDG-PET/CT lung lesions after RT can be improved evaluating qualitative pattern of uptake and IMSD, especially for differential diagnosis between relapse and RT side effects.

EP-0187

Baseline ^{18}FDG PET/CT derived MTV and TLG as predictors of progression free and overall survival in patients with malignant mesothelioma under first line dual immunocheckpoint inhibition

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Aim/Introduction: Recent guidelines recommend dual immunocheckpoint inhibition (dICI) with ipilimumab and nivolumab as preferred first-line therapy in non-resectable malignant mesothelioma (MM). 18FDG PET/CT is the state-of-the-art imaging method for staging and response assessment in MM. Aim of this study is to evaluate metabolic parameters derived from baseline 18FDG PET/CT at initial staging for prediction of progression free survival (PSF) and overall survival (OS) in MM under first-line dICI. ***Materials and Methods:*** Baseline 18FDG PET/CT data of patients suffering from non-resectable MM before initiation of first-line dICI were collected retrospectively. SUVmax, SUVpeak, MTV and TLG were estimated (SUV cutoffs for MTV and TLG were defined in relation to liver uptake according to PERCIST). Additionally, dICI-related PFS and OS were collected. Spearman's Rho correlation coefficients and Kaplan-Meyer curves were calculated to estimate the significance of the metabolic 18FDG parameters in predicting PFS and OS. ***Results:*** Up to now 31 patients (female n=8, male n=23) were included (histology: n=19 epitheloid, n=4 sarcomatoid, n=8 biphasic). Of those, n=26 were of pleural and n=5 of peritoneal origin. Median PFS was 5.6 months while median OS was 10.8 months. SUVmax and SUVpeak do not significantly correlate with the survival parameters. However, MTV and TLG correlate negatively with PFS (MTV Spearman's Rho: -0.44, p=0.016; TLG: Spearman's Rho: -0.44, p=0.018) but failed to correlate with OS (MTV Spearman's Rho: -0.22, p=0.25; TLG: Spearman's Rho: -0.20, p=0.29). Kaplan-Meyer plots indicate significantly prolonged PFS when MTV was less than 47.5 ml (p=0.0029) or TLG under 293.5 SUVmax*ml (p=0.0034). ***Conclusion:*** Baseline 18FDG PET/CT derived MTV and TLG are feasible metrics to predict prolonged PFS under first-line dICI with ipilimumab und nivolumab. However, it appears that these metabolically derived tumor volumes are not suitable to estimate OS without considering additional parameters. Second-/ third-line chemotherapies, re-challenges with immunotherapies and other patient-related factors might also contribute to the variance in individual OS.

EP-0188

Metabolic aberrations in lung cancer patients as detected with a normative whole-body $^{[18F]}$FDG-PET/CT database

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Aim/Introduction: Normative databases (NormDB) have long been established in neuroimaging, with MRI and PET NormDB serving as references to identify metabolic and structural aberrations in neurological examinations. We apply this concept to study whole-body metabolic, voxel-based aberrations. We aimed to identify metabolic aberrations in lung cancer patients from a Japanese cohort by comparing whole-body $^{[18F]}$FDG-PET/CT image data against that of a healthy cohort. ***Materials and Methods:*** This study included 49 healthy controls (8F/41M, 69±13 kg) and 10 lung cancer (1F/9M, 56±15 kg) patients at different tumor stages. We curated 28/49 healthy controls to build a normative template image for male subjects with a BMI of 20 to 25. This template image was created by aligning the subjects' PET/CT images with an affine transformation to create an initial template. This was followed by an iterative deformable registration that used an updated reference image for each iteration. The PET and CT images from the 9 male (matched to the sex representing the NormDB) cancer patients were then compared by first segmenting [1] and then aligning, constrained by the segmentation, each organ with its counterpart in the normative template image. Once spatially aligned, a voxel-based aberration map was computed for each organ, thereby normalizing each voxel to its deviation from the NormDB, represented as a z-score. The created aberration images were reviewed by trained physicians regarding aberrations that were initially unrelated to a diagnosis by comparing the aberration images to the initial reports. ***Results:*** The aberration images revealed metabolic aberrations from the norm in all clinically reported lesions across the nine male patients. Observed aberrations in these regions reached z-scores up to 26.4. Additional highlighted aberrations included sites not evident when reviewing the SUV PET images exclusively. Notably, increased $^{[18F]}$-FDG uptake was detected at resection sites of lung

lesions, showing z-scores of up to 18. Additional areas suggesting inflammation, such as in joints and sore muscles, were also identified as aberrations. These findings were confirmed by the investigating physicians upon reviewing the initial clinical reports. ***Conclusion:*** The created aberration images successfully highlighted the targeted primary lesions. Additionally, secondary, subtle metabolic abnormalities that were not initially the focus were highlighted. This capability to detect subtle abnormalities could enhance diagnostic precision and reduce overlooked pathologies, marking a promising development in an oncological setting. ***References:*** [1] Sundar LKS, Yu J, Muzik O, et al. J Nucl Med. 2022; doi:10.2967/ jnumed.122.264063. Online ahead of print.

EP-0189

The utilization of a normative [18F]FDG-PET/CT database to highlight metabolic aberrations in cachectic lung cancer patients

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Aim/Introduction: Cachexia as a multi-organ syndrome is often associated with lung cancer patients (LCP). Patients experience rapid weight loss and, eventually, reduced quality of life and poor survival. In contrast to common organ-based analysis, we employ a voxel-wise analysis of whole-body [18F]FDG-PET/CT images to study metabolic differences between cachectic and non-cachectic patients in relation to healthy controls. ***Materials and Methods:*** In this multi-centre study, a cohort of 19 healthy controls (10M/9F) was used to create two (male and female) normative [18F]FDG-PET/CT images: first, all CT images underwent affine registration and averaging, followed by iterative deformable registration using the averaged image as a template, with updates and refining in each iteration. All alignments and averaging steps were applied to the corresponding PET images. This resulted in a normative PET and CT template image pair and a standard deviation (STD) image depicting normal metabolic ranges for each voxel. Three LCPs, each with or without cancer cachexia (2M/1F, in tumor stage I, II, and IV with either adenocarcinoma or squamous cell carcinoma histology, respectively), were compared with the established normative template. Cachexia status was defined by the body mass index adjusted weight loss grading system (WLGS): non-cachectic (WLGS-0/1) and cachectic (WLGS-3/4). Metabolic aberrations in the patient's SUV PET image were measured on a voxel-by-voxel basis as z-scores by computing each voxel's distance to the corresponding normative voxel in the SUV PET template image and normalizing this by their STD. ***Results:*** Aberrations in target lung lesions were 2.31-fold more severe, expressing a higher distance to the norm in the cachectic (z-score of 95) than in non-cachectic LCP (z-score of 41). Subclavicular adipose tissue regions were of particular interest, as they expressed aberrations up to 15-fold higher in cachectic (z-score of 18) than in non-cachectic LCP (z-score of 1.2). More generally, despite homogenous Hounsfield values in the CT images, subtle differences in the patient SUV PET images were highlighted in the aberration images for both cohorts. ***Conclusion:*** Analyzing data by organ may diminish individual voxel impacts, simplifying aberrations into a single value. However, voxel-wise analysis allows for identifying regional metabolic changes potentially associated with higher tumor burden and cachexia. Subclavicular adipose tissue regions expressing higher SUV might be suggestive of activated brown adipose tissue and could be associated with the onset of cachexia in LCP. The presented voxel-wise comparison approach could be utilized for detecting significant metabolic changes in LCP, suspected for cachexia.

EP-0190

Baseline ^{18}F-FDG PET/CT for prediction of early response to immunotherapy plus chemotherapy in patients with extensive-stage small-cell lung cancer: preliminary results from an ongoing prospective observational study

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Aim/Introduction: Small-cell lung cancer (SCLC) is a highly-aggressive tumour. Immunotherapy with PD-L1/PD1 checkpoint-inhibitors, combined with chemotherapy, was recently approved as first-line treatment in extensive-stage SCLC (ES-SCLC) patients, providing an opportunity to improve disease control and survival. However, only a few SCLC patients benefit of chemo-immunotherapy. Predictive biomarkers of treatment efficacy are lacking, with no reports investigating on 18F-FDG PET/CT for treatment response prediction. Thus, we aimed to explore the value of baseline 18F-FDG PET/CT as potential predictor of chemo-immunotherapy response in an ES-SCLC population. ***Materials and Methods:*** We analysed baseline 18F-FDG PET/CT performed in 13 consecutive ES-SCLC patients (8M; 70.7±6.1years) enrolled in an ongoing prospective, observational study and treated with chemo-immunotherapy. From whole-body dynamic 18F-FDG PET/CT (lasting 71 minutes; fully-automated multiparametric PET suite for kinetic analysis), the following PET parameters were evaluated: 1) number of visually PET-positive lesions; 2) activity of primary tumour (T), loco-regional nodal lesions (N; measuring the two most active) and distant metastases (M; measuring up to 5 lesions for patient, the 2 most active for each involved organ) in terms of SUVmax, SUVmean, SUVpeak and influx rate constants (Kimax, Kimean, Kipeak, expressing 18F-FDG consumption rate); 3) intra-lesional metabolic heterogeneity expressed by differences between SUVpeak and SUVmean, and between Kipeak and Kimean values (Delta-SUV, Delta-Ki). PET/CT performance for predicting early treatment response (after 4 chemo-immunotherapy cycles) was assessed by ROC curve analysis (MedCalc Statistical Software; statistical significance: $p<0.05$), using response evaluation by contrast-enhanced CT (RECIST criteria 1.1) as reference standard. ***Results:*** At baseline PET/CT: 13/13 patients presented nodal involvement; 10/13 additional distant metastases. A mean of 6 target lesions was measured for each patient. After 4 chemo-immunotherapy cycles, 10/13 patients were classified as responders (partial response),

3/13 no-responders (stable/progressive disease). At ROC analysis, PET parameters showing better performance for predicting treatment response were: number of PET-positive lesions (cut-off:20; Sensitivity=100%; Specificity=80%; AUC=0.90; p<0.0001), T-SUVmax and T-SUVpeak (cut-offs:13.7 and 12.3; Sensitivity=100%; Specificity=80% and 70%; AUC=0.87; p=0.001), tumour Delta-SUV (cut-off:4.4; Sensitivity=100%; Specificity=90%; AUC=0.93; p<0.0001), nodal Delta-SUV (cut-off:3.11; Sensitivity=100%; Specificity=71%; AUC=0.81; p=0.046). ***Conclusion:*** Baseline 18F-FDG PET/CT parameters may represent potential predictors of treatment efficacy in an ES-SCLC population candidate to chemo-immunotherapy, especially in terms of metabolic tumour burden, primary tumour activity and intra-lesional metabolic heterogeneity. From our preliminary results, kinetic analysis does not seem to provide additional predictive information and further analyses from ongoing prospective study are in progress, also on the role of post-treatment PET/CT for predicting prognosis.

EP-0192

[18F]FDG parametric PET imaging in non-small lung cancer patients with abbreviated dynamic scan protocols in a LAFOV PET/CT scanner: a clinical perspective

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Aim/Introduction: [18F]FDG PET/CT is essential in the management of lung cancer. Standard semi-quantitative analysis of malignant lesions relies on SUV, representing a composite of metabolic processes. Conversely, dynamic PET acquisitions provide robust radiotracer kinetics but present well-known practical challenges. Abbreviated dynamic scans exploiting the high sensitivity of long axial field-of-view (LAFOV) PET/CT scanners may offer a viable solution. ***Materials and Methods:*** Twenty treatment-naive patients with diagnosed non-small cell lung cancer (NSLC) underwent [18F]FDG PET/CT in a LAFOV PET/CT scanner. After injection of 3.0 MBq/kg/BW [18F]FDG, a 20-min PET scan was performed at 45 min p.i, following a validated abbreviated dynamic scan protocol grounded on a population-based input function (PBIF). Parametric images in terms of net influx rate of Ki [mL/min/100ml]and Distribution Volume (DV) [%] were obtained by integration of Patlak modeling directly into the image reconstruction. Two nuclear medicine physicians evaluated standard static PET (60-65 min p.i), Ki, and DV images. Primary tumors (n=20) and metastatic lesions (n=20) were segmented with a VOI isocountour of 41% of max SUV in static PET images. Reference VOIs were then overlayed in Ki and DV images for comparability, with adjustments made as necessary. Mean, max, and peak values of SUV, Ki, and DV were recorded. Pearson´s correlation coefficient was conducted to evaluate the linear association between quantification parameters, and paired Student's t-tests were employed to assess differences between variables. ***Results:*** There were no missed lesions between static and parametric PET images. The mean SUVmean, Ki mean, and DVmean for primary tumors were 7.0±4.0, 3.3±1.6, and 188±124, respectively. Paired t-tests between primary tumors and metastatic lesions revealed no statistically significant differences in SUVmean (p=0.3020), Kimean(p=0.3119), and DVmean(p=0.6848) values. Strong positive correlations were found between SUVmean/Ki mean ($r = 0.91$, $p < 0.0001$) and SUVmean/DVmean ($r = 0.67$, $p = 0.0056$) in primary tumors, as well as in metastatic lesions ($r = 0.94$, $p = 0.0167$; $r = 0.98$, $p = 0.0002$, respectively). ***Conclusion:*** Parametric quantitative values show a strong positive correlation with the generally used SUV and no statistically significant differences between primary and metastases. Therefore, by potentially finding different correlations in inconclusive findings such as inflammation, parametric analysis could enable better differentiation by PET alone. Additionally, abbreviated dynamic scan protocols using PBIFs facilitate data acquisition and implementation into the daily clinical routine. Concluding analysis with histopathology will provide the correlation to assess the additional utility of parametric data in NSCLC.

EP-0193

The Role of the Nuclear Medicine Specialist in the Multidisciplinary Tumor Board for Lung Cancer Treatment

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Aim/Introduction: The interdisciplinary approach to the menagement of oncology patients has became the standard of care in order to achieve the best treatment outcomes. The aim of this study was to assess the impact of nuclear medicine physicians or nuclear medicine procedures, such as fluorine-18 fluorodeoxyglucose positron emission tomography with computed tomography (18F FDG PET/CT), on the menagement of lung cancer patients discussed at multidisciplinary (MDT) meetings for thoracic neoplasms at our institutions. ***Materials and Methods:*** We retrospectively analyzed patients referred for ^{18}F FDG PET/CT scan, after discussion on weekly MDT meetings over the period form January 2023 to January 2024, for assessing the highly suspicious lung nodules, staging of already confirmed malignancy and for monitoring therapy of previously treated disease. Tissue biopsy, endobronchial ultrasound mediastinal lymph node biopsy, thoracic surgery and subsequent PET/CT or CT scans were performed for evidencing or ruling out the malignancy. ***Results:*** Among the 676 patients presented at the MDTs, 135 individuals were selected for ^{18}F FDG PET/CT. Out of those 135 patients, 58 (43%) were referred for the evaluation of lung nodules metabolic activity, 62 (45.9%) for staging of newly diagnosed lung malignancy, and 15 (11.1%) for therapy monitoring or suspected recurrence of previously treated disease. After the ^{18}F FDG PET/CT, in total subset of 135 patients, 47 (34.8%) exhibited an altered treatment plan, while for remaining 88 (65.2%) patients therapy course hadn't changed. Within the group of 47 patients whose treatment course changed after ^{18}F FDG PET/CT, there were 31 patients (66%) who experienced disease stage progression, due to the solitary or combined findings of positive mediastinal lymph nodes, metabolically active lung and suprarenal lesions as well as detection of occult brain or bone metastases. In contrast, 16 patients (34%) have had lower stage of the disease than previously anticipated by ruling out the malignancy in the non-metabolic or inflammatory lung lesions, mediastinal lymph nodes or suspect suprarenal or bone dissemination. ***Conclusion:***

Due to the substantial proportion of patients for whom ^{18}F FDG PET/CT altered the treatment course, we consider that it is essential to involve the nuclear medicine physicians in MDT discussions whenever feasible. Their inclusion is crucial not only for optimizing and organizing patient care, but also for deepening of clinical understanding among nuclear medicine physicians, supporting advancements in nuclear medicine research, as well as improvement of patients outcomes.

EP-10

e-Poster Area

B: Imaging Clinical Studies -> B1 Oncological Imaging Clinical Study -> B15 Gastro-Intestinal (including Liver and Non-Endocrine Pancreas)

EP-0194

Role of 68Ga FAPI PET-CT in the Evaluation of Gastric Cancer (GC): Comparison with ^{18}F-FDG PET-CT

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Aim/Introduction: ^{18}F-FDG PET-CT is often used for staging and preoperative evaluation of GC but it has been reported to have a low detection rate especially in some histological types, such as signetring cell, mucinous and poorly differentiated adenocarcinoma and moreover specificity is relatively low. Therefore other more sensitive radiopharmaceutical IS needed in the evaluation of GC. Recently radiolabeled inhibitors of fibroblast activation protein, such as 68Ga FAPI were used to visualize FAP-expressing tumors. The role of 68Ga FAPI PET-CT in patients with GC is now under evaluation in few reports. The aim of the study was to evaluate the role of 68Ga FAPI PET-CT in GS for staging and restaging and to compare the results with ^{18}F FDG PET-CT. ***Materials and Methods:*** Twenty eigh patients-Pts (18 men and 10 women, aged 38-71, in the stages between T3-4 N1-3 and M0-1) with histologically proven gastric cancer, were recruited for the investigation within the period 2021-2023. They underwent 68GaFAPI PET-CT (2MBq/kg) for staging- in 9 of them and for restaging in 19 with as a whole 50 investigations. In 16/28 of the patients ^{18}F-FDG PET-CT (2MBq/kg) was also performed with as a whole of 21 investigations. ***Results:*** Normal result, without evidence of metastases was registered in 10 of the patients after surgery/chemotherapy/immunotherapy and in 18 Pts-metastases were found in regional and/ or distant lymph nodes, liver, peritoneum or lung. In 7/18 of the Pts (37.5% of the cases) investigated with both radiopharmaveuticals, more lesions were found with 68GaFAPI PET-CT, mostly in peritoneum and abdominal lymph nodes, as in 5 of them histological type of the tumors was mucinous or signet ring cell. There was a better contrast with 68GaFAPI, with SUVmax of the primary tumor of 13.5 and 7.9 of the metastases, compared with SUVmax of 2.8 of the metastases with ^{18}F-FDG /without focal activity of the primary tumor/. ***Conclusion:*** According to our preliminary data, we consider that 68GaFAPI PET-CT is a very promising tool for evaluation of patients with advance GC, more sensitive than ^{18}F-FDG PET-CT and could be recommended as a method of choice for staging and restaging in order to plan the most appropriate therapy.

EP-0195

Prognostic value of metabolic and volumetric parameters obtained from pre-treatment F^{18} FDG PET/CT images in patients with Pancreatic Ductal Adenocarcinoma

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Aim/Introduction: The 5-year survival rate for advanced stage Pancreatic ductal adenocarcinoma (PDAC) is 2% and effective methods are needed to prevent unnecessary surgery and predict prognosis. The aim of this study was to evaluate the prognostic value of metabolic and volumetric parameters measured from F^{18} fluorodeoxyglucose (F^{18} FDG) positron emission tomography (PET)/computed tomography (CT) in patients with PDAC. ***Materials and Methods:*** Between January 2010 and December 2021, patients with PDAC who underwent F^{18} FDG PET/CT only in our department for pre-treatment staging were retrospectively evaluated . SUVmax, SUVmean, Metabolic Tumor Volume (MTV) and Total Lesion Glycolysis (TLG) values of the primary pancreatic lesion were calculated. Clinicopathological and demographic data, radiological progression and death dates of the patients were obtained from the hospital information system. The prognostic values of the FDG-PET parameters for recurrence-free survival (RFS) and overall survival (OS) were assessed by Kaplan-Meier and COX regression analysis. Ethics committee was approved. ***Results:*** A total of 44 PDAC patients, 24 men and 20 women, aged between 33 and 79 years (mean 61.5 years) were included in the study. At the time of evaluation, 41 patients had died and 3 patients were still alive. The mean SUVmax measured from the pancreatic tumour was 7.69 ± 3.42 (range 2.57-16.58), the mean SUVmean was 4.93±1.9 (range 2.57-10.43), the MTV value was 20.39 ± 43.02 (range 0.04 - 265.53) and TLG value was 100.16 ± 178.71 (range 0.1- 963.87) was detected. Tumour size was found to be associated with SUVmax (p=0.02), SUVmean (p=0.04), MTV (P=0.001), TLG (p=0.001) and CEA (p=0.04). Median OS was 11.07 (95% CI: 7.99-14.14) months, and there was no relationship between SUVmax (p=0.25), SUVmean (p=0.38), MTV (p=0.62) values. There was also no relationship between OS and tumour size and intra-pancreatic localization of the tumour (head/tail). While the relationship between OS and CEA levels was significant (p=0.017), its relationship with CA19-9 (p=0.155) was not significant. Median PFS was measured as 7.37 (95% CI: 4.68-10.05) months; No significant relationship was found between PFS and SUVmax (p=0.24), SUVmean (p=0.28) and MTV (p=0.39). No relationship was observed between PFS and CA19-9 (p=0.74) and CEA (p=0.27) levels. ***Conclusion:*** In conclusion; pre-treatment CEA values may be a prognostic marker for OS in patients with PDAC. We could not detect a role of SUV-based parameters obtained from F-FDG PET/CT images in predicting PFS and OS in patients with PDAC.

EP-0196

Role of ^{18}F-FDG PET-CT in the Pretreatment Evaluation & Prognostication of Gall Bladder Cancer

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Aim/Introduction: Through this retrospective study we evaluate and establish the role of whole body ^{18}F-FDG PET-CT as a tool for imaging and prognostication of patients of non-metastatic and metastatic gall bladder cancer. ***Materials and Methods:***

41 patients with confirmed adenocarcinoma of gall bladder were included in our analysis. The findings pertaining to the local disease, lymph node status and metastasis along with other parameters such as SUVmax of the primary and metastatic lesions, dimensions of the lesions, level of differentiation of the primary tumor & liver function test results were included. Descriptive statistics along with Spearman correlation coefficients and linear regression analysis were conducted. ***Results:*** The mean age was 58.4±13.1 yrs, primary tumor size: 4.8±2.8 cm, long axis diameter (LAD) of metastatic lymph node: 2.2±0.8 cm, primary tumor SUVmax: 8.7±3.1, distant mets SUVmax: 7.2±3.1, serum albumin: 3.2±0.8 mg/dl, total protein: 6.6±0.9 mg/dl, ALT: 122.5±119.7 IU/L, AST: 69.2±98.4 IU/L, total bilirubin: 3.9±3.6 mg/dl & direct bilirubin: 2.4±2.0 mg/dl. 17% were male, 83% female; 27% had no metastasis, 73% had metastasis; 46% were well-differentiated, 39% moderately- differentiated, 15% poorly differentiated. Spearman's correlation coefficients were calculated for the variables mentioned above, which demonstrated a significant correlation between primary tumor SUVmax & total protein (ρ= -0.324, p=0.042), primary tumor SUVmax & total bilirubin (ρ=0.550, p<0.001), primary tumor SUVmax & direct bilirubin (ρ=0.366, p=0.022), primary tumor SUVmax & distant metastasis SUVmax (ρ=0.431, p=0.017), long axis diameter (LAD) of metastatic lymph node & distant metastasis SUVmax (ρ=0.622, p<0.001), primary tumor size & metastatic lymph node LAD (ρ= -0.537, p=0.002), primary tumor size & distant metastasis SUVmax (ρ= -0.388, p=0.034). Linear regression analysis of the relation between primary SUVmax & total bilirubin gave us a regression equation of: total bilirubin=0.382(SUVmax)+0.644 (R2=0.112, p=0.038). Similar regression equations were generated for various other variable pairs, such as the following: lymph node LAD & distant metastasis SUVmax: distant mets SUVmax =2.438(LN LAD)+2.474 (R2=0.384, p<0.001); primary tumor size & metastatic LN LAD: metastatic LN LAD= -0.202(primary tumor size)+2.99 (R2=0.284, p=0.002) and distant mets SUVmax & primary tumor size: distant mets SUVmax= -0.471(primary tumor size)+9.305 (R2=0.178, p=0.02). ***Conclusion:*** We have demonstrated that FDG PET-CT helps play a prognostic role in predicting the aggressiveness of gall bladder cancer, derangement in liver function and thus help predict patient outcome.

EP-0197

Interim Analysis of a Phase 2 Trial using ^{18}F-PSMA PET/CT Imaging in Patients with Hepatocellular Carcinoma

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Aim/Introduction: While prostate specific membrane antigen (PSMA) is overexpressed in prostate cancer cells, it's also expressed in the tumor neo-vasculature of other cancer cell types, including hepatocellular carcinoma (HCC). Currently, functional imaging agents are limited for assessing HCC, which make diagnosis and re-staging following local therapies difficult. This study aimed to evaluate the feasibility of using ^{18}F-PSMA(DCFPyL)-PET/CT to detect sites of HCC before and after treatment in comparison with CT/MRI and FDG-PET/CT. ***Materials and Methods:*** This is a phase 2, multi-site, prospective IRB-approved trial planned to enroll 50 patients. We included a cohort of 6 patients with suspected HCC eligible for standard local/locoregional treatment. Participants underwent ^{18}F-DCFPyL, ^{18}F-FDG and diagnostic CT/MRI at baseline and within 4-8 weeks post-treatment, and histopathologic assessment. Volumes Of Interest (VOIs) were drawn on the PMSA-PET positive lesions (i.e. focal uptake greater than background with CT abnormality). Maximum Standardized Uptake Value (SUVmax) and tumor volume (TV) burden were calculated. ***Results:*** All six patients (males, 71±10.7 years) had at least one lesion deemed to be HCC by an expert radiologist using Liver Imaging Reporting & Data System (LIRADS, LR). Three patients were treated with ablation (LR-5), two with stereotactic body radiotherapy (LR-4 and LR-5), and one underwent surgical resection (LR-5). All patients (6/6) had at least one PSMA positive lesion(s), which were biopsy-confirmed to represent HCC and 2 out of 6 patients exhibited lesions positive on FDG. At the lesion-based level, 13 liver lesions were seen on CT/MRI, 8 of 13 were PMSA positive (61.5%) whereas 3 of 13 showed FDG-avidity (23.1%). One extrahepatic lesion was positive on all modalities. Lesion(s) PSMA SUVmax ranged from 6.7 to 14.3, mean 10.7; average TV of 8.7 ml (range: 0.9-13.6 ml). Five of the 6 patients underwent post-treatment PSMA-PET/CT, and all five demonstrated decreasing uptake values and tumor volumes in the treated lesions compared to baseline. ***Conclusion:*** In this interim analysis, we confirm the feasibility of using ^{18}F-PSMA-PET/CT to detect tumor sites and assess local treatment response in HCC patients. Results from this completed trial may help determine whether PSMA-selective radiopharmaceutical therapies may be beneficial for patients with HCC. Patient accrual is ongoing for this trial and additional results may be available at the time of the presentation. ***References:*** Hirmas N et al. 68Ga-PSMA-11-PET/CT Improves Tumor Detection and Impacts Management in Patients with Hepatocellular Carcinoma. JNM.2021. Sep;62(9):1235-1241. Nyakale N et al. Uptake on PET-Radiopharmaceuticals for Imaging Hepatocellular Carcinoma. Cancers.2023 Mar;15(7):1975.

EP-0198

^{68}Ga-FAPI PET/MRI may not be superior to contrast-enhanced CT in the N-staging of gastric cancer: a head-to-head retrospective study comparing with pathology by D2 lymphadenectomy

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Aim/Introduction: 68Ga-FAPI PET has been proven to perform well in the diagnosis and staging of diverse solid malignant tumors, including gastric cancer. However, the value of 68Ga-FAPI PET for gastric cancer N staging remains uncertain. Contrast-enhanced CT(CECT) is recommended by NCCN guidelines as conventional imaging for gastric cancer staging. This study aimed to evaluate the performance of 68Ga-DOTA-FAPI-04 (68Ga-FAPI) PET/MRI for the diagnosis of regional lymph node metastasis in patients with gastric carcinomas, utilizing histopathology as the reference standard, and to compare with CECT. ***Materials and Methods:*** Patients with gastric cancer who underwent 68Ga-FAPI PET/MRI from June 2020 to June 2023 were retrospectively collected. Inclusion criteria: (1) histologically

proven gastric carcinomas; (2) underwent radical surgery and D2 lymphadenectomy without neoadjuvant therapy; (3) underwent CECT within 1 month; (4) no anti-tumor treatment before 68Ga-FAPI PET/MRI or CECT and between the two modalities. Exclusion criteria: (1) histologically proven non epithelial gastric malignancies including gastric lymphoma, etc.; (2) suffering from other malignancies; (3) lack of clinical data or histopathological examination of lymph nodes. The diagnostic performance of 68Ga-FAPI PET/MRI for regional lymph node metastasis of the patients received D2 lymphadenectomy was assessed and compared with CECT. Histopathology served as the standard for the final diagnosis. The McNemar's test and chi-squared test were applied to compare the detection efficiency of two modalities. ***Results:*** Eighteen patients with histologically proven gastric carcinomas (median age: 58 y; range: 25-77 y) were enrolled, including 14 men and 4 women. Thirteen patients were diagnosed with regional lymph node metastasis. 68Ga-FAPI PET/MRI correctly diagnosed 13 cases and misdiagnosed 5 cases. CECT correctly diagnosed 12 cases and misdiagnosed 6 cases. 68Ga-FAPI PET/MRI correctly staged 7 cases and underestimated 11 cases. CECT correctly staged 6 cases, underestimated 10 cases, and overestimated 2 cases. A total of 532 lymph nodes were removed for pathological examination. The sensitivity, specificity and accuracy of 68Ga-FAPI PET/MRI for regional lymph node metastases were comparable to CECT (28.3% [28/99] vs. 23.2% [23/99], 99.8% [432/433] vs. 99.3% [430/433], 86.5% [460/532] vs. 85.2% [453/532], all P > 0.05). ***Conclusion:*** In patients with gastric carcinomas who received D2 lymphadenectomy, as confirmed by histopathology, 68Ga-FAPI PET exhibited limited sensitivity in detecting regional lymph node metastasis due to false negatives. 68Ga-FAPI PET/MRI had no advantage over CECT in the evaluation of regional lymph nodes. More large sample multi-center prospective head-to-head comparisons are needed for further validation.

EP-0199

The Significance of SUVmax in ^{18}F-FDG PET-CT for Staging Esophageal Cancer: Understanding Metastatic Influence

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Aim/Introduction: The prognostic value of SUVmax in esophageal cancer shows discordant results in the literature, generally due to heterogeneity of the samples and the reduced representation of patients with metastatic involvement. We aim to analyse the prognostic value of SUVmax of the esophageal lesion according to the presence of metastases at diagnosis. ***Materials and Methods:*** Retrospective cohort study (2016-2022) of 118 patients with suspected esophageal cancer attending for staging by ^{18}F-FDG/PET-CT. We excluded tumors of the gastro-esophageal junction (32), atypical/not clearly malignant histologies (10) and those without the possibility of measuring SUVmax (13), obtaining a final sample of 63 patients. We collected predictor variables and tumor-caused mortality as an event. In the multivariate analysis (Cox regression) we added an interaction term between SUVmax and the presence of metastases. ***Results:*** The mean age was 69.1±13.1 years; 84.1% were male, with epidermoid being the most frequent subtype (61.9%). Twenty-four patients (38.1%) had metastases at diagnosis. Median follow-up was 12.2 months (IQR 5.6-25.1), with 50 patients (79.4%) dying. SUVmax was related to mortality in univariate analysis (HR 1.03; CI 95%: 1.00-1.07; p=0.028). In multivariate analysis the interaction between SUVmax and the presence of metastases was significant (p=0.017), so that SUVmax was related to mortality in patients without metastases (HR 1.06; CI 95%: 1.02-1.10; p=0.001), but not in those with metastases at diagnosis (HR 0.99; CI 95%: 0.94-1.03; p=0.593). Other variables related to mortality in multivariate analysis were chemotherapy treatment (HR 0.37; CI 95%: 0.17-0.79, p=0.011) and surgical resection (HR 0.26; CI 95%: 0.11-0.61, p=0.002). ***Conclusion:*** SUVmax of the esophageal lesion is related to mortality in patients without metastases at diagnosis. On the other hand, the prognosis of patients with disseminated disease is independent of SUVmax of the primary lesion.

EP-0200

Exploring the Prognostic Value of ^{18}F-FDG PET-CT Metabolic Parameters in Esophagogastric Junction Tumors

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Aim/Introduction: Esophagogastric junction (EGJ) tumors present an important limitation as a tumor entity composed of two different natures (esophageal tumors and gastric tumors). We aim to assess the prognostic utility of metabolic parameters in ^{18}F-FDG/PET-CT staging of patients with EGJ tumors. ***Materials and Methods:*** Retrospective cohort study (2016-2022) of 37 patients attending for staging EGJ cancer by ^{18}F-FDG/PET-CT. SUVmax and metabolic tumor volume (MTV) of the primary lesion were measured in all but two patients, obtaining a final sample of 35. A logarithmic transformation of both variables was performed to approximate normality. We collected predictor variables and tumor-caused mortality as an event. Uni/multivariate analysis was performed using Cox regression to search for predictors of events. Survival curves were compared using the Log-Rank test. ***Results:*** The mean age of the patients was 68.9±10.8 years and 85.7% were male. The majority histological subtype was adenocarcinoma (91.4%). Sixteen patients (47.1%) were considered resectable (only one of them had metastatic disease). In univariate analysis, neither logSUVmax (HR 0.95; CI 95%: 0.55-1.64; p=0.862) nor logVMT (HR 0.95; CI 95%: 0.67-1.33; p=0.749) predicted mortality. Univariate predictors of mortality were the presence of metastases (HR 4.32; CI 95%: 1.83-10.22; p=0.001) and tumor resectability (HR 0.12; CI 95%: 0.05-0.32; p<0.001). In multivariate analysis only tumor resectability remained as an independent predictor (HR 0.08; CI 95%: 0.03-0.24; p<0.001). Median survival in operated patients was 58.1 months, compared to 7.4 in those not operated (p<0.001). ***Conclusion:*** Metabolic parameters of ^{18}F-FDG/PET-CT were not able to predict mortality of patients with EGJ cancer in our sample, mortality is primarily determined by tumor unresectability.

EP-0202

Value of SUV based cellularity measuring FDG uptake for predictions of patient prognosis in Preoperative Carbon-ion Radiotherapy for Pancreatic Cancer

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Aim/Introduction: Various parameters are used for measuring tumor glucose metabolic activity with 18F-FDG PET including measuring the single maximum pixel value within the slice with highest radioactivity concentration(SUVmax) or the mean value of 1.0 mL spherical VOI centered on SUVmax(SUVpeak) within a tumor. The SUV(SUVmax and SUVpeak) are commonly used in FDG-PET to predict patient prognosis. We tried to measure not only glucose metabolism but also tumor cell density using FDG-PET. The results of pathological findings can help prediction of patient prognosis with cancer. We compared the pathology results and the 18F-FDG-PET with the SUVs, as a prognostic factor in pancreatic cancer. ***Materials and Methods:*** Seventeen patients(10males, 7females; mean age, 67±7y) with pancreas cancer underwent 18F-FDG PET/CT scan before carbon ion radiotherapy at a total dose of 35.2-36.8GyE followed by surgery for pancreatic cancer. We think the difference between SUVmax and SUVpeak could mean the tumor cellularity in cancer cells. We evaluated the glucose metabolism by SUVmax and SUVpeak, and evaluated the tumor cellularity by SUVcell. SUVcell was calculated by the following equation: SUVcell = [SUVpeak] / [SUVmax] × 100 We compared these results with the pathological findings according to the 7th of Japanese General Rules for the study of pancreatic cancer. 18F-FDG accumulates in tumor cells but does not accumulate so much in the other cells. The high cellularity tumor may be high SUVmax and high SUVpeak, so SUVcell may be high. The low cellularity tumor may be high SUVmax and low SUVpeak, so SUVcell may be low. The overall survival was calculated using the Kaplan-Meier method by evaluating the results of the glucose metabolism and tumor cellularity using a statistical analysis software R. The SUVs were statistically compared with the pathological findings using the Mann-Whitney's U test with the R. ***Results:*** A Kaplan-Meier analysis showed that patients with a median value of SUVcell≤ 88.0 had a much better overall survival(OS) rate than the patients with a median value of SUV>88.0(p<0.05). There were no statistically significant differences between OS rate and SUVmax, and SUVpeak. Statistically-significant difference was observed between SUVmax and and SUVpeak between pN(+) and pN(-) in regional lymph node metastasis each other(p<0.05). Statistically-significant difference was observed between SUVmax and SUVpeak between pRP(+) and pRP(-) in retroperitoneal tissue(p<0.05). ***Conclusion:*** We think SUVcell could estimate the tumor cellularity using FDG-PET/CT, and the tumor cellularity might be useful for predicting prognosis of the patients with pancreatic cancer.

EP-0203

Is incidental focal F^{18} FDG uptake in gallbladder of oncologic patients worrisome? : Preliminary study

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Aim/Introduction: This retrospective study aimed to assess the clinical implications of incidental focal gallbladder F^{18} FDG uptake in non-gallbladder cancer patients. ***Materials and Methods:*** We retrospectively reviewed F^{18} FDG PET/CT reports from March 2017 to August 2023 in non-gallbladder cancer patients. When incidental suspicious focal gallbladder uptakes were identified, then corresponding histopathological reports were retrieved if available. Twenty patients were eligible, encompassing various primary cancers; five lymphoma, three breast, two lung, two gastric, and eight others. Focal gallbladder uptakes were categorised as malignant, benign, or unconfirmed. Maximum standardized uptake value (SUVmax) of each uptake was measured and compared between malignant and benign lesions. Statistical significance was set at $p < 0.05$. ***Results:*** Among the twenty incidental gallbladder FDG uptakes, five were malignant, eight benign, and seven unconfirmed. Malignant lesions accounted for 25.0% of the focal uptakes. SUVmax failed to differentiate between malignant (mean ± SD: 4.6 ± 1.7) and benign (mostly inflammatory, 4.4 ± 2.0) lesions ($p > 0.5$). Unconfirmed lesions exhibited an SUVmax of 4.3 ± 0.4, with no statistical difference observed among the three groups. ***Conclusion:*** In light of the substantial influence of gallbladder cancer metastasis on 5-year relative survival rates, the imperative for early detection cannot be overstated. Notably, approximately one quarter of incidentally observed focal gallbladder FDG uptakes in cancer patients proved to be malignant. We should underscore the importance of closely monitoring unexpected gallbladder FDG uptake, as relying solely on SUVmax may not yield sufficient accuracy in distinguishing malignant from benign lesions. Further studies with larger cohorts and histopathological confirmation are warranted to elucidate the role of SUV in this context.

EP-0204

PSMA-PET/CT can differentiate between CCC and HCC

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Aim/Introduction: Differentiating hepatocellular carcinoma (HCC) from cholangiocellular carcinoma (CCC) by non-invasive imaging poses a diagnostic challenge. In the present Phase II study, we aimed to separate between those hepatic tumor subtypes based on PSMA-directed PET (NCT). ***Materials and Methods:*** We included 13 patients affected with liver tumor (CCC in 5/13 (38.4%), HCC in 8/13 (61.6%)). All patients were treatment-naïve and underwent a PSMA-directed PET/CT using [^{18F}]PSMA-1007 and liver magnetic resonance imaging (MRI) upon initial staging. We revealed the diagnostic performance of PSMA-PET/CT on a patient- and lesion-based level and conducted quantification of uptake in sites of disease. ***Results:*** All 13 patients (100%) were rated positive for tumor infiltration on MRI. On a lesion-based level, all HCC tumors showed an elevated PSMA uptake whereas the CCC tumors showed no significant uptake on PSMA-directed PET. The SUVmean for HCC was 17.4±6.2 (CCC, 4.3±2.4) and SUVmax was 31.3±12.2 (CCC, 7.1±3.5; P=0.001, respectively). Indicative for improved contrast, tumor-to-background ratios were also elevated for the HCC in comparison to CCC on PSMA-PET (27.0±19.3 vs 4.3±0.9; P=0.02). ***Conclusion:*** HCC tumors show a significantly increased PSMA expression, while CCC revealed no relevant uptake. As such, PSMA-targeted PET/CT may be used to differentiate non-invasively between those tumor subtypes.

EP-0205

^{18}FDG PET/CT Hepatic Superscan caused by colon adenocarcinoma

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Aim/Introduction: "Hepatic Superscan" describes a diffuse increased ^{18}FDG hepatic uptake. It is a rare but interesting finding in daily clinical practice using ^{18}FDG PET/CT. This pattern can be seen coupled with strikingly low cerebral and cardiac FDG uptake and it is associated with an extensive and diffuse involvement by a malignant disease such as primary hepatic lymphoma, diffuse angiosarcoma of the liver, secondary lymphomatous or leukemic involvement, HCC or metastases(1), etc. There are less frequent causes of diffuse increase in hepatic FDG uptake described in the literature, mostly infectious. Our aim is to report this pattern in solid tumors that is not easy to find. ***Materials and Methods:*** This is a retrospective observational study, lasting two years. From March 2022 to March 2024. We performed 1173 ^{18}FDG PET/CT studies and found 2 patients with diffuse increased hepatic uptake confirmed by biopsy to be generated by secondary compromise. ***Results:*** The diagnoses were, colon adenocarcinoma in both patients. The increased hepatic uptake was diffuse, with no clear correlation on CT images, in one case it was clearly diagnosed pre surgery; in the other on it was seen during surgery, the SUV max in one patient was 4,82 and in the other 3,99. When reporting oncologist patients, it is important to keep in mind the normal HEPATIC SUVmax according to the body mass index (2,58±0,33)(2). There are some published cases related to breast carcinoma and lymphoma, but no related to Colon Adenocarcinoma, where the most common pattern is multiple focal metastases. There are also some reported cases of diffuse hepatitis seen as diffuse increased uptake. ***Conclusion:*** There is an increasing incidence of typical and atypical forms of diffuse liver involvement. This unusual finding was an indicator of extensive liver involvement caused by colon carcinoma, and gives us an idea of the importance of the finding and how it could change the staging and treatment of the patient. ***References:*** (1) Kaneko, Koichiro et al. "A case of diffuse-type primary hepatic lymphoma mimicking diffuse hepatocellular carcinoma." Annals of nuclear medicine vol. 25,4 (2011): 303-7. doi:10.1007/s12149-010-0460-0 (2) Mahmud, Mohd & Nordin, Abdul Jalil & A S, Fathinul Fikri & Azman, Ahmad Zaid Fattah. (2015). Impacts of biological and procedural factors on semiquantification uptake value of liver in fluorine-18 fluorodeoxyglucose positron emission tomography/computed tomography imaging. Quantitative imaging in medicine and surgery. 5. 700-7. 10.3978/j.issn.2223-4292.2015.05.02.

EP-0206

Role of PET Radiomic features in characterizing Esophageal Carcinoma

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Aim/Introduction: Radiomics has recognized itself as a promising tool in classification and detection of malignancy as well as metastases. Esophageal cancer is one of the most common malignancy with significant morbidity. The squamous subtype is most common in Asia, however the adenocarcinoma is associated with worse prognosis. This study aims to evaluate the role of non-invasive radiomic features of PET to predict the histological subtype of this malignancy. ***Materials and Methods:*** This is a retrospective study conducted in patients with histopathologically proven carcinoma esophagus. The study group consisted of Squamous cell carcinoma and Adenocarcinoma. The PET parameters of tumoral SUVmax, Metabolic ratio of tumor to liver (SUR), Metabolic Tumor Volume (MTV) and Total Lesion Glycolysis (TLG) were calculated and compared between the two groups using Mann-Whitney U test. ***Results:*** Out of 59 patients (M:F=33:26) included in the study, 19 had Adenocarcinoma and 40 had Squamous subtype. Median age was 57 years (Range: 30-83). The median SUVmax, SUR, MTV and TLG of both the groups were 12.99, 5.34, 11.52 cc and 77 g/ml. The median SUVmax, SUR, MTV and TLG of Adenocarcinoma group were 10.89, 3.86, 9.98 cc and 55.8 g/ml, and of Squamous group were 13.88, 5.6, 13.52 cc and 108.4 g/ml respectively. There was significant difference noted in the tumoral SUVmax (p=0.043), SUR (p= 0.019) and TLG (p= 0.032) between the two groups, with higher metabolic values observed in the Squamous group. MTV (p=0.224) between the two groups was insignificant. ***Conclusion:*** The radiomics analysis using metabolic parameters can serve as a non-invasive tool to differentiate the pathological subtypes, and hence the prognosis of esophageal malignancy.

EP-0207

Role of DOTANOC PET/CT in the Management of Gastrointestinal Stromal Tumors

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Aim/Introduction: Gastrointestinal stromal tumors (GISTs) represent a subset of mesenchymal neoplasms characterized by their distinctive molecular profile, particularly mutations in the KIT or PDGFRA genes. The management of GISTs poses significant challenges due to their heterogeneity and potential for metastasis. Accurate staging and surveillance are crucial for determining appropriate therapeutic strategies and assessing treatment response. In recent years, positron emission tomography/computed tomography (PET/CT) imaging using radiotracers such as 68Ga-DOTA NOC peptides has emerged as a promising modality for the evaluation of GISTs. ***Materials and Methods:*** 18 cases of GISTs referred to our center for DOTANOC PET/CT were evaluated on the basis of our imaging reports and final biopsy reports. Acquisition of DOTANOC PET/CT was performed on dedicated PET/CT scanners (Biograph mCT, Siemens Inc and Discovery PET/CT, GE) 45-60 minutes after administration of 2-3 mCi of radiotracer intravenously. All the scans were interpreted by two experienced nuclear medicine physicians. ***Results:*** A total of 18 patients with diagnosed GISTs were included in the study. All patients underwent DOTANOC PET/CT imaging at baseline and 3 patients had follow-up after receiving standard treatment regimens. The mean age was 48.3 ± 8.4 years , with a male-to-female ratio of 4:5. Of the 3 patients who had respone assesment scan, 2 patients had stable disease and 1 showed partial response. 7 patients had only primary disease, 8 patients had metastatic disease and for 3 patients DOTANOC PET/CT was not able to detect any lesions. In patients with metastatic diseases the most common site for metastases were lymph nodes followed by liver. ***Conclusion:*** DOTANOC PET/CT represents a valuable imaging tool in the multidisciplinary management of GISTs. Its high sensitivity, specificity, and ability to provide functional information make it a promising adjunct to conventional imaging modalities. Further prospective studies are warranted to validate its role in treatment decision-making, patient monitoring, and prognostic assessment in GISTs. Integration of DOTANOC PET/CT into routine clinical practice has the potential to optimize patient outcomes and enhance personalized medicine approaches in this challenging disease setting.

EP-0208

Head-to-head comparison of ^{11}C-choline and ^{18}F-FDG PET/CT in the differentiation of benign and malignant liver lesions

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Aim/Introduction: The limitations of 18F-FDG in the diagnosis of hepatic focal lesions are due to the low expression of glucose transporter proteins on the cell membranes of hepatocellular carcinoma (HCC), resulting in low uptake in many primary hepatic lesions. This study aimed to compare the efficacy of 11C-choline and 18F-FDG PET/CT in distinguishing between benign and malignant liver lesions. ***Materials and Methods:*** Forty-seven patients with liver lesions were prospectively enrolled. All patients underwent abdominal three-phase 11C-choline PET/CT and whole-body 18F-FDG PET/CT within one week. Histopathological diagnosis or clinical and regular medical imaging at 6-months follow-up served as the gold standard. All lesions showing higher tracer uptake than normal liver were considered positive for HCC. Average SUVmax of the abdominal aorta (B) served as background reference. The SUVmax of the lesion (T) were measured in both scans, with the average SUVmax of normal liver tissue (L) as reference. T/L and T/B ratios were calculated for both methods. ***Results:*** Among 47 enrolled patients, 30 of them were diagnosed with malignant lesions, and 17 of them were benign lesions. 11C-choline exhibited superior sensitivity (86.2% vs. 83.3%) and specificity (94.4% vs. 42%) compared to 18F-FDG PET/CT. For malignant lesions, T/L and T/B in 11C-choline were significantly higher than in 18F-FDG PET/CT (T/L:1.39 ± 0.55 vs. 0.84 ± 0.32, $P < 0.05$;T/B:6.20 ± 3.25 vs. 1.56± 0.66, $P < 0.001$). There was no significant difference in T/L and T/B between 11C-choline and 18F-FDG PET/CT imaging for benign lesions. In addition, malignant lesions in 11C-choline PET/CT showed a 65.2% (21/30) gradual decrease in T/L from early phase to delayed phase, with average T/L of 1.38 ± 0.6 (early phase), 1.18 ± 0.39 (regular phase), and 1.02 ± 0.33 (delayed phase). Benign lesions in 11C-choline PET/CT maintained stable T/L across all phases, with average T/L of 0.61 ± 0.24 (early phase), 0.66 ± 0.35 (regular phase), and 0.68 ± 0.35 (delayed phase). Changes in T/B across the three phases of 11C-choline PET/CT imaging showed no significant differences for benign or malignant lesions. ***Conclusion:*** 11C-choline outperforms 18F-FDG PET/CT in differentiating between benign and malignant liver lesions, particularly demonstrating higher sensitivity for malignancy. Our study revealed that the trend of T/L in three-phase 11C-choline PET/CT imaging may be a superior predictor of hepatic focal benign and malignant lesions. Therefore, 11C-choline PET/CT imaging is more accurate than 18F-FDG PET/CT for the differentiation of benign and malignant liver lesions.

EP-11

e-Poster Area

B: Imaging Clinical Studies -> B1 Oncological Imaging Clinical Study -> B16 Neuroendocrine (Pancreatic and Others)

EP-0209

The value of ^{18}F-FDG PET/MR radiomic features in predicting the malignant degree of pancreatic intraductal papillary mucinous tumors(IPMN)

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Aim/Introduction: The malignancy degree of pancreatic IPMN determines its surgical methods and whether to continue other treatments after surgery.The purpose of this study is to explore the value of ^{18}F-FDG PET/MR radiomics features in predicting malignant degree of pancreatic IPMN,thereby providing guidance for clinical treatment. ***Materials and Methods:*** The clinical and PET/MR imaging data of 189 patients with IPMN were collected, including 76 cases of Benign, 55 cases of borderline and 58 cases of malignant. Pathological and clinical diagnosis results serve as the gold standard for diagnosis. We used AK software to extract the most relevant imageomics features for tumor classification, and randomly divided the two groups of images into training set (70%) and test set (30%). The maximum correlation and minimum redundancy (mRMR) and minimum absolute shrinkage and selection operator (LASSO) methods were used to select features from 1800 features extracted from MR and PET, and finally 9 best features were retained. Multivariate logistic regression analysis was performed using the radiomics features and clinical variables to establish the prediction model. The receiver operating characteristic (ROC) analysis is used to evaluate the prediction model. ***Results:*** The established PET/MR imaging features have good prediction efficiency for distinguishing malignant degree of pancreatic IPMN($P<0.05$). The AUC of the training group and the validation group were 0.945 (95% CI: 0.787-0.956), 0.934 (95% CI: 0.776 - 0.945).The calibration curve showed that the nomogram of radiomics had goodness of fit, and DCA proved that the nomogram of radiomics was useful in clinical practice. ***Conclusion:*** The prediction model of PET/MR radiomics features can be used as an auxiliary method to predict the malignant degree of pancreatic IPMN. It can also provide objective basis for clinical diagnosis and individualized treatment, and may has guiding significance for clinical treatment.

EP-0210

^{68}Ga-PSMA PET/CT Imaging in Metastatic Medullary Thyroid Cancer: Preliminary Results of a Prospective Study

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Aim/Introduction: Expression of the prostate-specific membrane antigen (PSMA) has been demonstrated in various malignancies, including medullary thyroid cancer (MTC), beyond prostate cancer. The detection of metastatic lesion with 68Ga-PSMA could offer an alternative radioligand treatment option for patients diagnosed with metastatic MTC with limited treatment choices. This study aims to investigate the feasibility of 68Ga-PSMA in patients diagnosed with metastatic MTC by comparing 68Ga-DOTATATE with 68Ga-PSMA positron emission tomography/computed tomography (PET/CT) imaging. ***Materials and Methods:*** This single-center prospective study included adult patients with metastatic MTC diagnosed due to pathological uptake (higher than background) in lesions on 68Ga-DOTATATE PET/CT within the last 9 months. Eligible patients underwent 68Ga-PSMA PET/CT imaging. Two radiopharmaceuticals were compared in terms

of the number and uptake patterns of the lesions. ***Results:*** A total of 6 patients, including 3 females with an average age of 56.5 ± 10.21, were included in the study. Eighty lesions, including 49 lymph nodes, 25 bones, 5 lungs, and 1 liver metastasis, were evaluated. Out of 80 lesions, 79 showed DOTATATE uptake (98.7%), while 71 showed PSMA uptake (88.7%). The median SUVmax values for DOTATATE and PSMA were 2.8 (0.73-17.6) and 3.04 (0.97-31.65), respectively. When comparing the two imaging methods, it was observed that the activity uptake of lesions showed a heterogeneous distribution among patients and within the same patient in three cases. In 4 patients, out of 49 detected lymph nodes, 6 (12.2%) showed no PSMA uptake, while 29 (59.2%) showed similar or lower levels compared to DOTATATE, and 14 lymph nodes (28.6%) showed higher levels of PSMA uptake than DOTATATE. Out of 25 bone metastases detected in 68Ga-DOTATATE PET, 3 (12%) showed no PSMA uptake, while 6 (24%) showed similar or lower levels, and 16 lesions (64%) showed higher levels of PSMA uptake than DOTATATE. In a patient with lung metastases, a total of 5 lesions showed similar or lower levels of PSMA uptake compared to DOTATATE. In one patient, a liver lesion that did not show uptake in DOTATATE PET showed intense PSMA uptake. ***Conclusion:*** This study suggests that the concurrent evaluation of 68Ga-DOTATATE and 68Ga-PSMA PET, due to the presence of metastatic lesions showing heterogeneous distribution among and within the same patients, could contribute to the personalized management of metastatic medullary thyroid cancer. Further studies with larger sample sizes are required to validate these results.

EP-0211

^{18}F-NOTATATE PET/CT non-invasive evaluation of SSTR2 expression in pediatric neuroblastoma

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Aim/Introduction: This study clarifies the feasibility of using 18F-NOTATATE positron emission tomography/computed tomography (PET/CT) to assess somatostatin receptors2(SSTR2)expression in patients with neuroblastoma (NB) by analyzing the correlation between 18F-NOTATATE PET/CT imaging parameters and immunohistochemistry(IHC) scores. ***Materials and Methods:*** Retrospective data were collected from patients with initial or treated NB who underwent 18F-NOTATATE PET/CT scans at Shandong Cancer Hospital between June 2021 and March 2023. Imaging and clinical data were collected, and lesions that were pathologically validated and accurately localized on PET/CT images were selected. uptake of the imaging agent in lesions was assessed using the Krenning score, maximum standardized uptake value (SUVmax), and mean standardized uptake value (SUVmean). Tumor tissue expression of SSTR2 was evaluated using the HER2, IRS, H, and Volante scores. Spearman's correlation test was used to analyze the correlation between the imaging parameters and SSTR2 expression. ***Results:*** A total of 71 lesions from 53 patients were analyzed, comprising 51 NB lesions, 9 lesions converted to ganglioneuroblastoma (GNB) after treatment, and 11 ganglioneuroma (GN) lesions. The SSTR2 scores and uptake of 18F-NOTATATE imaging agent were significantly higher in NB lesions compared to GNB and GN lesions. In both the overall cohort and NB subgroup, the Krenning score, SUVmax, and SUVmean were positively correlated with the four IHC scores ($p < 0.05$), with higher correlations observed with the HER2, IRS, and H scores (Rho ranged from 0.451 to 0.703). However, in the GNB and GN subgroups, no correlation was found between 18F-NOTATATE PET/CT imaging parameters and pathological scores ($p > 0.05$). ***Conclusion:*** 18F-NOTATATE PET/CT imaging can assess SSTR2 expression in newly diagnosed NB lesions or those remaining NB after treatment, serving as a valuable substitute for pathological scoring and providing molecular evidence for future follow-up and guidance for NB treatment.

EP-0212

Preliminary study on the related factors of diffuse nonspecific ^{68}Ga-FAPI uptake of pancreas in patients with gastrointestinal tumors

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Aim/Introduction: In previous 68Ga-FAPI imaging studies, high heterogeneity of diffuse uptake of FAPI tracer in the pancreas of patients with gastrointestinal tumors was observed. The purpose of this study was to explore the related factors affecting pancreatic diffuse68Ga-FAPI tracer uptake in patients with gastrointestinal tumors. ***Materials and Methods:*** In this retrospective study, 68Ga-FAPI PET/CT images and patient records of 169 patients with gastrointestinal tumors with diffuse uptake pattern of pancreas were investigated for the correlation between the SUVmax, Pancreas-to-Liver ratio (PLR) values of pancreatic 68Ga-FAPI uptake and characteristics and outcome. ***Results:*** We observed that PLR was negatively correlated with body weight (R=-0.159, P=0.027), BMI (R=-0.161, P=0.016) and myocardial uptake (R=-0.21, P=0.003), while SUVmax was positively correlated with serum CA125(R=0.196, P=0.007) and PCT (R=0.328, P=0.002). In addition, the univariate analysis of SUVmax (7.07±4.57 vs.5.67±3.61, P=0.023) and PLR (4.91±3.40 vs.3.93±3.13, P=0.039) by t-test showed that operation was the influencing factor, while Chemotherapy (6.44±4.23vs.7.06±4.53, P= 0.338;4.48±3.23vs.4.86±3.60, P=0.452) and immunotherapy (7.59±4.45vs. 6.97±4.34, P=0.344;5.42±3.59vs.4.99±3.15, P=0.90) were not. Among them, there was a significant difference in the uptake whether it is surgery with impaired pancreatic structure (such as Whipple operation,14.37±6.57 vs.6.56±3.75,P<0.001) or surgery with impaired pancreatic function (radical distal gastrectomy or total gastrectomy,14.37±6.57 vs.6.51±3.8,P= 0.001;8.37±4.28vs.6.54±3.91,P=0.032), but whether proximal gastrectomy and colorectal surgery were performed or not will not cause the difference in uptake. There was a low negative correlation between SUVmax and operation interval (R=-0.15, P=0.043),PLR and the internal time of immunotherapy(R=-0.20,P=0.046). In addition, we found that there were differences in the factors affecting SUVmax and PLR at different cut-off values (4,5,6). ***Conclusion:*** Pancreatic diffuse 68Ga-FAPI uptake in patients with gastrointestinal tumors is negatively correlated with body weight and positively correlated with serum CA125 and PCT levels. The operating mode is an imaging factor that affects pancreatic uptake, especially pancreatic function and structural destruction. This provides a possible explanation for the diffuse nonspecific uptake of 68Ga-FAPI in the pancreas.

EP-0213

Assessing the long-term efficacy of PRRT on metastatic NET: application of a radiomics-based model on DOTA-peptide PET and contrast-enhanced CT

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Aim/Introduction: Peptide-receptor radiotherapy (PRRT) can treat liver metastases from differentiated neuroendocrine tumours (NET). Amenability to PRRT is evaluated with [68Ga] Ga-DOTA-peptide positron-emission tomography (DOTA-PET), yet tools to assess the long-term efficacy of PRRT in disease stabilisation are lacking. The characteristics of the tumour (such as the proliferation index Ki67%) and heterogeneity in tracer distribution across the metastatic lesions could influence the PRRT efficacy. We tested the effectiveness of clinical-radiomics models in predicting the time-to-progression (TTP) in a cohort of NET patients. ***Materials and Methods:*** All NET patients with liver metastases treated with PRRT at our institution (2013-2019) with at least 3 years of follow-up were reviewed. Radiomics features were extracted from up to five liver metastases per patient on the DOTA-PET and co-registered portal venous phase enhanced CT (pvCT) images, using LifeX® V. 6.3; to account for the presence of multiple lesions per patient, their standard deviation value was used. Feature reduction was then performed via recursive elimination; sequential models were constructed via a random forest machine learning algorithm using the clinical parameter and then adding the selected PET and CT features (clinical; clinical+PET; clinical+PET+CT). Cox regression was used to evaluate the impact of the features on TTP. The performance of the models was measured by evaluating their area-under-the-curve (AUC); the hazard ratio (HR) and the significance (p) of the single features were also computed. ***Results:*** Forty-nine patients (243 lesions) were included. Median TTP was 38 months (range 5-93). The clinical model had an average performance (AUC=65); its most significant variables were Ki67% (p=0.03) and Chromogranin A (CgA; p=0.007). The clinical+PET model performed better than the clinical one (AUC=71); other than the clinical parameters, GLZLM_SZE (HR: 1.57, p=0.034), SUV_Skewness (HR: 2.52, p=0.022), and GLZLM_LZLGE (HR: 1.54, p=0.052) were associated with TTP. Adding the pvCT features led to a further improvement (AUC=0.77); particularly, HUmax was associated with progression risk reduction (HR:0.42, p=0.003). ***Conclusion:*** Radiomics analysis significantly improves the prediction of disease progression in patients with NET liver metastases. Features from both DOTA-PET and pvCT appear synergic with the clinical indices. Particularly, PET patterns indicating high uptake variability and large areas of lower uptake (as in intratumoral necrosis) were associated with risk increase, while high CT density (such as in increased vascularisation) proved protective. These data suggest that radiomics and machine learning can improve metastatic NET patients' prognostic evaluation.

EP-0214

Assessment of Gastroenteropancreatic Neuroendocrine Tumors Using SSTR-RADS 1.0 Criteria.

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Aim/Introduction: To determine the correlation between SSTR-RADS 1.0 criteria for 68Ga-DOTATOC PET-CT and definitive diagnosis in gastroenteropancreatic neuroendocrine tumors (GEP-NET). ***Materials and Methods:*** Retrospective analysis of patients who underwent 68Ga-DOTATOC PET-CT with i.v. iodinated contrast agent by GEP-NET between August/2019 and December/2023. Two nuclear medicine physicians with >15 years of experience determined SSTR-RADS (1-5) and uptake score (1-3) (Werner et al, J Nucl Med 2018;59:1085-91). Categories 4/5 were considered positive for NET, 1/2 negative for NET. Category 3 was the most controversial of the different subcategories and required further individualised analysis. Histopathological examination (HE) or clinical follow-up (CFU) was considered the gold standard. SP, E, PPV and NPV were calculated. A χ^2 test and logistic regression were performed. ***Results:*** 77 patients (45 males), mean age 63.5 (25-87 years), with suspected or diagnosed GEP-NET. The gold standard was HE (n=28) or CFU (n=49; mean 19.16 months). In 11 cases of suspected neoplasia, GEP-NET was not confirmed by imaging or CF. Of the 66 patients with NET, 38 had stage III-IV disease. Most of the NETs were located in the pancreas (n=33) and small intestine (n=31), 4 were MEN-1. Of the 66 GEP-NET: G1 (n=47), G2 (n=17) and G3 (n=2). The most common metastatic sites were regional lymph nodes (28.6%) and liver (29.9%). SP=100%, E=76%, PPV=90%, NPV=100%. An association was found between SSTR-RADS 1.0 classification and NET diagnosis (χ^2=58.625, p-value<0.001). Logistic regression showed a capacity for correct SSTR-RADS classification of 85.7%. In categories 4 and 5, 100% (n=47) showed tumor. In category 3 (n=13) only 38.5% (2/2 labelled as 3A and 3/9 of 3D) showed NET. In 3C, none (n=2) corresponded to NET. In category 1 (n=17) 17.6% had NET. ***Conclusion:*** The SSTR-RADS 1.0 criteria allow the correct diagnosis of NET in a high percentage of patients. Category 3, especially 3D, requires further confirmation. ***References:*** Werner et al, J Nucl Med 2018;59:1085-91

EP-0215

Head to head comparison of [18F]SiTATE versus [18F]DOPA-PET in patients with neuroendocrine tumors

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Aim/Introduction: In neuroendocrine tumors molecular imaging methods play a key role, either targeting the somatostatin receptor (SSTR) or catecholamine pathways. [18F]SiTATE is a novel SSTR-targeting peptide that uses silicon fluoride acceptor (SiFA) radiochemistry, overcoming disadvantages of Gallium-68 labelled DOTA compounds. Here we present the first prospective data of [18F]SiTATE compared to [18F]DOPA-PET in NET patients. ***Materials and Methods:*** 38 patients with suspected NET were prospectively included. All patients underwent both [18F]DOPA-PET and [18F]SiTATE-PET. The diagnostic performances were compared on a per-patient and per-lesion basis. ***Results:*** 22 of 38 patients did not show [18F]DOPA- or [18F]SiTATE-PET positive disease. [18F] DOPA-PET was rated as the more accurate imaging modality in three cases and [18F]SiTATE-PET in four cases. [18F]SiTATE-PET showed a significantly higher sensitivity on a per lesion basis compared to [18F]DOPA-PET (n=143; sensitivity [18F]SiTATE: 86.7%; [18F]DOPA: 73.4%; p = 0.016). Relative quantitative uptake values were not significantly different ([18F]SiTATE median TBRmax: 8.2; [18F]DOPA TBRmax: 6.5; p=0.247) ***Conclusion:*** In this first prospective study,

[18F]SiTATE-PET provides high tumor to background ratios in the majority of NET patients with complementary results to [18F]DOPA-PET. ***References:*** Ilhan H, Lindner S, Todica A, et al. Biodistribution and first clinical results of 18F-SiFAlin-TATE PET: a novel 18F-labeled somatostatin analog for imaging of neuroendocrine tumors. Eur J Nucl Med Mol Imaging. 2020;47:870-880. Goffin K. Al18F-NOTA-octreotide and 18F-SiFAlin-TATE: two "new kids on the block" in somatostatin receptor imaging. Eur J Nucl Med Mol Imaging. 2019;46:2225-2227. Bozkurt MF, Virgolini I, Balogova S, et al. Guideline for PET/CT imaging of neuroendocrine neoplasms with 68Ga-DOTA-conjugated somatostatin receptor targeting peptides and 18F-DOPA. Eur J Nucl Med Mol Imaging. 2017;44:1588-1601.

EP-0216

[68Ga]Ga-DOTANOC PET/CT-Derived Functional Parameters to Predict Response to PRRT: Preliminary Results

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Aim/Introduction: To define predictive parameters of PRRT (Peptide Receptor Radionuclide Therapy) response is a current unmet need. Aim is to study potential predictive [68Ga]Ga-DOTANOC-PET/CT-derived parameters in a monocentric cohort of NET patients who underwent PET/CT before/after a full course of PRRT (4 cycles of [177Lu]Lu-DOTATATE PRRT) according to standard practice. ***Materials and Methods:*** Among the NET patients treated with a full course of PRRT at our Institution (July2019-April2023), we included those studied with [68Ga]Ga-DOTANOC PET/CT within 4 months of the PRRT and clinical follow-up of at least one year. PET parameters measured before/after PRRT included: lesionSUVmax, lesionSUVmean, lesionSUVmax/lesionSUVmean, liverSUVmax, liverSUVmean, lesionSUVmax/liverSUVmean, RTV (receptor tumour volume), TLA (total lesion activity=SUVmean x RTV), pTC-HU (hottest lesion's HU pre-PRRT on non-diagnostic-CT) and percentage variations of pHU, RTV and of TLA. RTV/SUVmean pre-PRRT was also calculated. ROC-curves were used to search for the best PET cut-off values. Log-rank test was applied to compare TTP (timeframe between baseline PET/CT and disease progression) survival curves.In the patients with a diagnostic-CT performed at our center within 4 months of PRRT, disease status was assessed according to RECIST 1.1 and compared to other response criteria (Choi, EORTC). Additionally, since NET lesions are generally better appreciated in the arterial phase, modified-Choi criteria (mChoi, assessed on the arterial phase) were also employed. ***Results:*** 34 patients were included (G1:G2=10:24; primary tumour site=19/34 ileum, 11/34 pancreas, 2/34 rectum, 1/34 duodenum, 1/34 primary of unknown origin). When survival curves (Kaplan-meyer) were created using the best cut-off values as threshold, patients with values lower than the cut-off showed significantly longer TTP: lesionSUVmax/lesionSUVmean pre-PRRT (<1.74; p=0.0098), RTVpost-RTVpre (<6.6cm3; p<0.0001), TLApost-TLApre (<24.8; p<0.0001), percentage variation of pHU (<28%; p=0.018), percentage variation of RTV (<12%; p<0.0001) and of TLA (<7.5%; p=0.00015), RTV/SUVmean pre-PRRT (<5.2; p=0.0028). Univariate analysis showed a significant association between shorter TTP and higher values of lesionSUVmax/lesionSUVmean pre-PRRT (p=0.016), RTV/SUVmean pre-PRRT (p=0.006) and percentage variation of RTV (p=0.025) and of TLA (p=0.0027). Disease status categorised as SD, PR, PD was: according to RECIST 1.1 12/24, 5/24, 7/24; to EORTC 6/24, 15/24, 3/24; to Choi 6/24, 9/24, 9/24; to mChoi 6/22, 8/22, 8/22 (mChoi was not available in 2/24). Concordance rate with standard RECIST 1.1 criteria was 29% (7/24) for EORTC, 67% (16/24) for Choi and 72% (16/22) for mChoi. ***Conclusion:*** Our data show that response evaluation varies significantly using different response criteria. Some [68Ga]Ga-DOTANOC PET/CT-derived parameters can be used to predict patients'TTP.

EP-0217

Comparison of FDOPA PET/CT and MRI for the diagnosis and follow-up of pheochromocytomas and paragangliomas

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Aim/Introduction: Pheochromocytomas (PCC) and paragangliomas (PGL) are rare neuroendocrine tumors derived from adrenal or extra-adrenal neural crest chromaffin cells. Nuclear medicine imaging plays an important role in the diagnosis, staging, and follow-up of these patients. Precise imaging follow-up is essential, given the high risk of tumor recurrence in these patients. The aim of this study is to determine whether 6-I-[18F]-fluoro-3,4-dihydroxyphenylalanine PET/CT (FDOPA PET/CT) is an accurate technique for the diagnosis and follow-up of these patients. ***Materials and Methods:*** Retrospective study including 57 patients (18 male, 39 female; age range 18-85 years) (24 with known disease, 33 with no medical history of PCC/PGL), who underwent FDOPA PET/CT study between January/2021-December/2023. MRI and FDOPA PET/CT qualitative and semi-quantitative findings were studied. ***Results:*** 63 FDOPAPET/CT studies were performed, in which pathological findings were seen in 31/63: 5 PCC, 24 PGL and 2 PCC/PGL (18 carotid body, 6 jugulotympanic, 6 tympanic, 5 jugular, 1 bladder wall and 1 pericardial PGL). Mean SUVmax for PCC and PGL was 12.98 and 10.38, respectively. Follow-up FDOPAPET/CT studies were performed (2 patients with SDH gene mutations with no PCC/PGL history, and 21 with PCC/PGL history, out of which 12 had SDH gene mutations). The remaining studies were performed to evaluate extension and multicentricity (14 SDH gene mutation screening, 9 incidentalomas and 17 due to clinical symptoms or high metanephrines/catecholamines). 24 patients underwent MRI study at the time of FDOPA PET/CT evaluation. In our series, MRI and FDOPA PET/CT results were discordant in 5/24 patients, leading to a change in therapeutic management in 2. FDOPA PET/CT study ruled out PCC/PGL in 3 patients with positive MRI findings (2 laterocervical nodes and 1 lesion compatible with vagal PGL surgical remains). 1 PGL (1 post-surgical disease) and 1 PCC were diagnosed in patients with normal MRI. 3 patients presented with progression during FDOPA PET/CT follow-up. ***Conclusion:*** Our results demonstrate that FDOPA PET/CT should be alongside with the MRI, an imaging technique of choice for both diagnosis and

follow-up of these patients. FDOPA PET/CT provides an accurate diagnostic method for whole-body evaluation and metabolic response assessment with high accuracy and changes patient outcome.

EP-0218

Comparing ^{18}F-DOPA and 68Ga-DOTATOC PET/CT imaging performance and its impact on 177 Lu-DOTATATE outcome in midgut neuroendocrine tumors

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Aim/Introduction: ^{18}F-DOPA PET/CT is a useful diagnostic tool to evaluate tumor burden in midgut neuroendocrine tumor (NET). On the other hand, 68Ga-DOTATOC is the diagnostic counterpart of 177 Lu-DOTATATE (Lutathera) and necessary for patient selection. The aim was to evaluate if ^{18}F-DOPA imaging is associated with 177 Lu-DOTATATE outcome in patients with positive pre-treatment 68Ga-DOTATOC. ***Materials and Methods:*** All patients with midgut NET that performed ^{18} F-DOPA and 68 Ga-DOTATOC PET before 177 Lu-DOTATATE were retrospectively evaluated. Only patients with both imaging performed within one year before treatment were included. The tumor burden from DOPA and DOTATOC PET was visually compared and patients were classified in 2 groups: Group 1 (G1): DOPA ≥ DOTATOC, Group 2 (G2) : DOPA < DOTATOC. The response was defined according to RECIST1.1 after C2 (n=16/18 patients) and after C4 (n=13/18 patients) of 177 Lu-DOTATATE. Follow-up duration was calculated using first treatment as the starting point. Statistics were computed using R version 4.3.2. ***Results:*** Among 35 evaluated patients, 18 patients treated between 2015-2023 fulfilled inclusion criteria and were analyzed. 61.1% of patients were female (n=11) and the median age was 69 (IQR [56, 74]). Median Ki67 of the tumor was 2% (IQR [1-5]). Patients received a median of 4 treatments of 177 Lu-DOTATATE (range: 1-8). In 77.8% of the cases, 18FDOPA was equal or better than 68GaDOTATOC (n=14/18, IC95 [51.9-92.6], p=0.031). In the remaining 4/18 68GaDOTATOC was superior compared to 18F DOPA. In G1, 2/9 (22.2%), 6/9 (66.7%) and 1/9 (11.1%) presented respectively partial response (PR), stable disease (SD) and progressive disease (PD) at C4. In G2, 1/4 (25%), 1/4 (25%) and 2/4 (50%) presented respectively PR, SD and PD. Median SUVmax of the most intense lesion at 68GaDOTATOC was 30.90 [20.47, 35.60]. Median Follow up after treatment was 25 months. At the end of follow up (n = 3 - 16,7%) patients died. No association were found between DOPA findings and survival, nor between DOTATOC SUVmax of the most intense lesion and survival (respectively p=1 and p=0.98). ***Conclusion:*** DOPA was superior to DOTATOC imaging for lesion mapping in most of patients with metastatic midgut NET treated with 177 Lu-DOTATATE and not associated with response or survival outcome. Larger studies are warranted to better evaluate the potential prognostic value of ^{18}F DOPA PET and impact of lesion mismatch in such patients.

EP-0219

Combined Prognostic Value of Tumor Dissemination (Dmax) and Coefficient of Variation Derived from 68Ga-DOTATOC PET/CT in Patients With Neuroendocrine Tumors

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Aim/Introduction: The aim of the present study was to test whether the largest distance between two 68Ga-DOTATOC avid lesions (Dmax) and other quantitative imaging parameters may predict overall survival in patients with neuroendocrine tumors (NET). ***Materials and Methods:*** Forty-three NET patients (30 men, 13 women) who had undergone 68Ga-DOTATOC PET/CT scan showing at least two positive lesions were included in the study. All lesions were segmented using an automated contouring program. The largest distance between two 68Ga-DOTATOC avid lesions (Dmax) in each patient was measured. Then the targeted lesion with the highest SUVmax value was selected and SUVmean, Coefficient of variation (CoV), Receptor Expressing Tumor Volume (RETV) and Total Lesion Receptor Expression (TLRE) were determined along with total RETV (RETVTOT) and whole-body TLRE (TLREWB) from all malignant lesions. Univariate analysis of clinical and imaging variables was performed using Cox proportional hazards regression whereas Kaplan-Meier method and log-rank tests were used for survival analysis. Patients were subjected to a mean follow-up period of 29 months (range 1-59 months). ***Results:*** A total of 236 lesions were segmented and mean Dmax value was 22.52±21.62 cm. In 43 targeted lesions, average values of SUVmax, SUVmean, CoV, RETV and TLRE were 40.22±30.69, 13.21±10.80, 0.57±0.24, 51.96±65.48 mL and 643.58±868.19 g, respectively, whereas mean values of RETVTOT and TLREWB were 170.07±186.59 ml and 2365±4060.43 g, respectively. Univariate analysis was performed including age, gender, grading, Dmax, RETVTOT, TLREWB and imaging parameters derived from targeted lesions. Overall survival (OS) was predicted by age (p<0.0001), grading (p=0.0064) and Dmax (p=0.0168) as well as by SUVmax (p=0.0011), SUVmean (p=0.0087) and CoV (p=0.0005) of targeted lesions. By Kaplan-Meier analysis, patients with Dmax ≤ 19.4 cm had significantly better OS as compared to patients with Dmax > 19.4 cm (p=0.0137). Moreover, patients with CoV of targeted lesions > 0.57 had a better prognosis compared to those with CoV ≤ 0.57 (p=0.0019). When we combined these two parameters in all possible arrangements, a statistically significant difference was found among the four survival curves (p=0.0022). In particular, patients with Dmax > 19.4 cm and CoV of targeted lesions ≤ 0.57 had the worst prognosis. ***Conclusion:*** Dmax, by reflecting tumor dissemination, and CoV of targeted lesions, by revealing heterogeneity of somatostatin receptor expression, can predict overall survival in NET patients.

EP-12

e-Poster Area

B: Imaging Clinical Studies -> B1 Oncological Imaging Clinical Study -> B17 Colorectal

EP-0220

Dual-Time-Point ^{18}F-FDG PET/CT Imaging in the Assessment of Advanced Colorectal Neoplasms in Patients with Focal Colorectal ^{18}F-FDG Uptake

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Aim/Introduction: This study aims to investigate the diagnostic efficacy of dual-time-point 18F-FDG PET/CT in detecting advanced colorectal neoplasms in patients with focal colorectal 18F-FDG uptake. ***Materials and Methods:*** A retrospective analysis was conducted on patients who underwent dual-time-point 18F-FDG PET/CT scans between January 2019 and December 2023. Patients showing focal colorectal 18F-FDG uptake in both early and delayed scans, and subsequently undergoing colonoscopy within one month, were included in the study. Advanced colorectal neoplasm was defined as an adenomatous polyp larger than 10 mm in diameter and/or with villous histology and/or presenting with high-grade dysplasia or adenocarcinoma. The maximum standardized uptake value (SUVmax) in the early and delayed scans, as well as the retention index, were compared between advanced colorectal neoplasms and non-advanced lesions. Predictive factors for advanced colorectal neoplasms were identified by uni- and multivariable analysis. ***Results:*** A total of 122 patients were enrolled in this study. A total of 141 lesions was studied, 80 (56.7%) of which were diagnosed as advanced colorectal neoplasms. When compared with non-advanced lesions, advanced colorectal neoplasms had higher SUVmax in delayed scan (25.1±14.2 vs 14.5±7.5, P<0.001), and higher retention index (32.9%±25.4% vs 7.8%±28.4%, P<0.001) in dual-time-point PET/CT. SUVmax in delayed scan (odds ratio [OR],1.084; 95% confidence interval [CI]: 1.037, 1.134; P<0.001) and retention index (OR, 20.120; 95% CI: 4.068, 99.516; P<0.001) were identified as independent predictors for advanced colorectal neoplasms by multivariable logistic regression analysis. When combining the SUVmax in the delayed scan with the retention index, the sensitivity and specificity for predicting advanced colorectal neoplasms were found to be 65.0% and 80.3%, respectively. Based on the threshold values of SUVmax in the delayed scan and retention index, we observed prediction rates of 13.9% (5 out of 36), 58.6% (34 out of 58), and 87.2% (41 out of 47) for advanced colorectal neoplasms in the low-, moderate-, and high-risk subgroups, respectively. ***Conclusion:*** Dual-time-point PET/CT aids in distinguishing lesions with focal colorectal 18F-FDG uptake. Higher SUVmax in delayed scan and higher retention index are predictive factors for advanced colorectal neoplasms.

EP-0221

The Role of PET/MRI Parameters of Primary Tumor in Predicting Pathological Response and Recurrent Disease after Neoadjuvant Therapy in Rectal Cancer

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Aim/Introduction: Neoadjuvant treatment (NAT) in rectal cancer reduces the risk of recurrence and prolongs survival in locally advanced stage patients. PET/MRI is emerging as an important tool in response evaluation with its multiparametric evaluation opportunities. This study aimed to evaluate the role of quantitative parameters and radiomic features of primary tumor obtained from FDG PET/MRI in rectal cancer for predicting pathological response and recurrent disease after surgery. ***Materials and Methods:*** The data of 33 patients with rectal cancer who underwent FDG PET/MRI for primary staging and treatment response evaluation after NAT, and subsequent surgical resection were evaluated retrospectively. SUVmax, SULpeak, MTV, TLG and ADCmin values of primary tumors and the percentage changes between two images were obtained from staging and response evaluation PET/MR images. Radiomics features of primary tumors were also obtained by using LIFEx-7.2.0 software. Logistic regression analyses were performed to determine the predictive factors for histopathological complete or near-complete response (Ryan regression score 0-1) and a decision tree model was created with the significant variables. Cox regression analyses were performed to determine the prognostic factors for the prediction of recurrence after surgery. Survival curves were estimated by the Kaplan-Meier method. Statistical analyses were performed on SPSS version 23.0. ***Results:*** The pathological complete/near-complete response was observed in 12 patients (36.4%). A decision tree model was created for prediction of treatment response after NAT with the significant variables, post-treatment ADCmin_2 (>85.5), ADCmin change (≥ 77%) and post-treatment tumor zone size nonuniformity (GLSZM_ZSNU_2) radiomics feature (≤24.8). The accuracy of the model was 94%. Recurrent/progressive disease was observed in 13 patients (39.4%) after resection. In univariate Cox regression analyses, ADCmin_2, TLG change and GLSZM_ZSNU_2 were significantly associated with progression-free survival (PFS). In multivariate regression analysis, ADCmin_2 and TLG change were found as independent prognostic factors (p=0.013, p=0.03, respectively). The Kaplan-Meier survival analysis showed that lower TLG change (< 85%), lower ADCmin_2 (≤ 85) were significantly associated with lower PFS rates (27.3% vs 77.3%, p=0.018; 41.2% vs 81.3%, p=0.006, respectively). ***Conclusion:*** ADCmin values and tumor heterogeneity parameter, ZSNU of primary tumor had predictive values in early pathological response assessment in patients with rectal cancer. Conversely, persistent high cellularity and insufficient metabolic-volumetric changes after NAT correlated with disease recurrence. Further studies with larger patients are needed to confirm these findings.

EP-0222

^{18}F-FDG PET/CT for treatment response prediction and evaluation in patients with liver metastases from colorectal carcinoma undergoing SBRT

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Aim/Introduction: The aim of the study was to investigate the role of ^{18}F-FDG PET/CT for treatment planning and response evaluation in patients with colorectal carcinoma undergoing stereotactic body radiation therapy (SBRT) for liver metastasis Additionally, we looked at the importance of certain metabolic parameters as predictive markers for the treatment response. ***Materials and Methods:*** We retrospectively analysed 22 patients with metastatic colorectal cancer who underwent SBRT for a total of 35 liver metastases. Each patient underwent a staging PET/CT scan prior to the procedure, as well as a follow-up PET/CT scan 3 to 6 months later. The local response for the treated lesions and the overall response were evaluated using PERCIST criteria. We measured and correlated pretherapy values for SUVmax, SUVmean, metabolic tumour volume (MTV) and total lesion glycolysis (TLG) with the treatment outcome. ***Results:*** When looking at overall response rates on the follow-up scans on a patient basis, 15 patients (68.2%) had progressive metabolic

disease (PMD), 3 (14,6%) had partial response (PMR) and 4 (18,2) of them had complete metabolic response (CMR). When looking at local treatment response a on lesion basis, there were 10 lesions with (28,6%) PMD, 13 lesions (37.1%) had PMR and 12 lesions (34,3%) with CMR. In all of the cases of CMR there were residual metabolically unactive hypodense lesions on the low-dose CT. In none of the cases there was uncertainty in the interpretation of the treatment response. In our study, the liver lesions that did not respond well to the treatment (PMD) had significantly higher initial values of MTV (MTVmedian=21.85; MTVmean=54.05-) and TLG (TLGmedian=108; TLGmean= 370.163) compared to those with PMR (MTVmedian=15.6; MTVmean= 25.5; TLGmedian=92.1; TLGmean=133.9) and CMR (MTVmedian=11.2; MTVmean= 18.2; TLGmedian=44.4; TLGmean=115.1). The initial values of SUVmax and SUVmean did not demonstrate patterns that could be clearly connected to the treatment outcome. ***Conclusion:*** In conclusion, ^{18}F-FDG PET/CT is a useful tool for treatment response assessment in patients who received SBRT for colorectal cancer liver metastases. Some metabolic parameters, such as MTV and TLG, might have predictive value for treatment response.

EP-13

e-Poster Area

B: Imaging Clinical Studies -> B1 Oncological Imaging Clinical Study -> B18a Prostate Staging

EP-0223

PSMA PET Imaging for Detection of Mesorectal Lymph Node Metastases in Prostate Cancer Impact on Patient Management and Treatment Strategies

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Aim/Introduction: This study aims to assess the accuracy of 68Ga-PSMA PET/CT in the detection of mesorectal lymph node (LNs) metastases in prostate cancer, as well as the importance of early identification LNs on patient management and treatment strategies. The predicted ability of 68Ga-PSMA PET/CT to alter patient management is achieved through the identification of additional LNs that affect prostate cancer staging. The potential of 68Ga-PSMA PET/CT to impact patient treatment has received little attention in the existing prostate cancer literature. ***Materials and Methods:*** This retrospective study includes 408 patients with prostate cancer who underwent 68Ga-PSMA PET/CT from 2016 to February 08, 2023. The following parameters were assessed: PSA levels at the time of PET/CT, location, number, and size of positive mesorectal LNs, and subsequent therapy. ***Results:*** Out of the 408 patients, 241 (59%) showed multiple radiotracer avid lymph nodes in the pelvic, pre sacral, mesorectal, and retroperitoneal LNs. Within this group, 27 (27/241 = 11%) had increased uptake in the perirectal, mesosigmoid, and retroperitoneal LNs, among these patients, 20 (20/241 = 8%) had multiple radiotracer avid sub centimetric lymph nodes in both mesosigmoid and mesorectal regions only in keeping with metastatic lymph nodes. The nodal involvement in the pelvic region was thoroughly examined, with 895 nodes detected in various locations. The prevalence of nodes in the common iliac, external iliac, and internal iliac regions was found to be 19.9%, 27.2%, and 21.0%, respectively. The paraortic and interaortocaval areas accounted for 2.02% and 1.46% of the total number of LNs. Mesorectal nodes made up 9.52% of LNs, indicating a significant proportion. Furthermore, 6.6% pre-sacral nodes and 5.0% pelvic sidewall nodes were involved. Of the total number of patients, 43.6% had common iliac LNs, 59.9% had external iliac LNs, 46.0% had internal iliac LNs, 20.8% had mesorectal LNs and 14.5% had pre-sacral LNs (figure 1). A detailed breakdown highlights the distribution of nodal involvement in various pelvic regions, providing useful insights for clinical evaluation and treatment considerations. ***Conclusion:*** In conclusion, this retrospective study demonstrated 68Ga-PSMA PET/CT ability to detect sub centimetric metastatic mesorectal LNs and improve prostate cancer staging. Thus, result influences patient management and treatment strategies by distinguishing between operable and non-operable cases of prostate cancer. ***References:*** 1-Hijazi S et al. Prostate. 2016 2-Rauscher I et al. J Nucl Med. 2016 3-Doughton JA et al. J Nucl Med. 2018.

EP-0224

An Innovative Approach with Ga-68 PSMA PET/CT: The PRIMARY Scoring System

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Aim/Introduction: Multiparametric magnetic resonance imaging is validated to diagnose clinically significant prostate cancer (csPCa). It has been demonstrated that the Ga-68 PSMA PET/CT-based PRIMARY scoring system (PSS) significantly improves sensitivity and negative predictive value in detecting csPCa. This study aims to investigate the relationship between PRIMARY score and histopathological findings in patients diagnosed with csPCa, undergoing staging with Ga-68 PSMA PET/CT imaging, and to evaluate the consistency of this scoring system among readers. ***Materials and Methods:*** Fifty-one patients with histopathologically diagnosed prostate cancer before prostatectomy underwent Ga-68 PSMA PET/CT and were included in the study. Retrospectively, staging Ga-68 PSMA PET/CT images were evaluated by three different nuclear medicine physicians blinded to each other unaware of the clinical, histopathologic, and laboratory findings. PRIMARY score were determined according to intraprostatic involvement patterns (1). PRIMARY score were compared with ISUP Grade Group (GG), serum PSA levels, and histopathological findings. ***Results:*** The mean age of participants was 71.2±7.4 years, with an average PSA level of 80.8±217.4 ng/ml. TUR-P was performed on 32 patients, and Total Prostatectomy on 19, with pathology reports classifying 1 patient as GG1, 10 as GG2, 4 as GG3, and 36 as GG5. According to PRIMARY Score analyses, 17 (33.3%) patients were assigned Score 2, 6 (11.8%) Score 4, and 28 (54.9%) Score 5. A statistically significant relationship was observed between PRIMARY Score, GG, and PSA levels ($p<0.001$, $p=0.046$, respectively). High concordance was found among nuclear medicine physicians' PRIMARY scoring ($p<0.001$). High-risk patterns (PRIMARY Score 4 and 5), were identified in 34 patients (66.7%), with a higher incidence of cribriform pattern ($p=0.036$); and also higher serum PSA levels were detected in this group ($p=0.034$). ***Conclusion:*** Our findings suggest that the PSS could be a potential tool in staging and managing csPCa. Moreover, the study establishes that PSS can be used as an objective and reliable evaluation method with high inter-reader agreement. The significant correlation between cribriform pattern, a marker of poor prognosis, and PRIMARY score is noteworthy. Our research indicates the satisfactory performance of the PSS in the early and effective detection and management of prostate cancer, though further extensive studies are required for validation. ***References:***

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EP-0225

The Intra- and Interobserver Variability of PSMA-expression Scores in Patients with Primary Prostate Cancer

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Aim/Introduction: The 4-point PSMA-expression score of prostate cancer lesions, according to the PROMISE criteria, is widely used for clinical and research purposes. This study aimed at determining the intra- and interobserver variability in the assessment of the PSMA-expression score of the primary prostate tumour in 100 patients staged with PSMA PET/CT. ***Materials and Methods:*** The observer agreement of visually assessed PSMA-expression scores according to PROMISE criteria was determined both before and after consensus training (CTR). This was compared to a quantification-based PSMA-expression score using SUVmax in the primary prostate tumour and reference organs. ***Results:*** The intra-observer agreement of the visually assessed PSMA-expression score of the primary prostate tumour was nearly perfect (κ 0.87), while interobserver agreement was only moderate and significantly lower (κ 0.57). After CTR, visual interobserver agreement improved (κ 0.70). Using quantitative analysis, the interobserver agreement further improved (κ 0.80). The intra-observer agreement of the visually assessed (after CTR) and quantification-based PSMA expression scores was nearly perfect (κ 0.92). Remarkably lower interobserver agreement rates were seen for [18F]PSMA-1007 compared to [18F]DCFPyL and [68Ga]Ga-PSMA-11. ***Conclusion:*** The intra-observer agreement of visually assessed PSMA expression scores was nearly perfect, while interobserver variability was only moderate. Consensus training and application of a quantification-based assessment using SUVmax further improved interobserver agreement rates.

EP-0226

Synthesis and in vitro evaluation of a small molecule [99mTc]Tc-PCBM as potential PD-L1 imaging agent

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Aim/Introduction: The checkpoint blockade immunotherapy of PD-1/PD-L1 has become a potent treatment strategy for cancers. However, the objective response rate of this immunotherapy is below 30%, which is expected to be improved. Expression level of PD-L1 play a key role in the guidance of immunotherapy, which could be quantified by noninvasive imaging with radiotracers. In this study, we develop a 99mTc labeled small molecule compound for PD-L1 imaging. ***Materials and Methods:*** The labeling precursor N - [2 - (3-cyanobenzene-1-methoxy) - 4 - (2- bromo-3-phenylbenzyloxy) - 5-chlorobenzyl] -2-piperidylglycylglycylglycylcysteine (PCBM) was synthesized from 2-bromo-3-iodotoluene in a seven-step reaction sequence. Using SnCl2 as reducing agent, and in the presence of sodium glucoheptonate, a series of studies were performed to optimize labeling efficiency of [99mTc]Tc-PCBM. The radiolabeling yield (RLY) and radiochemical purity (RCP) of [99mTc]Tc-PCBM were determined by high performance liquid chromatography (HPLC). The in vitro stabilities of [99mTc]Tc-PCBM was determined every 1h at room temperature. The partition coefficient of [99mTc]Tc-PCBM was determined in n-octanol and phosphate buffer (PB) (pH 7.4) and the uptake of [99mTc]Tc-PCBM was performed in PD-L1 positive cell (A375-hPD-L1) and PD-L1 negative cell (A375). ***Results:*** The chemical structures of the labeling precursor and its intermediates were verified by IR, 1HNMR and MS. RLY and RCP of [99mTc]Tc-PCBM were over 95% at selected condition. [99mTc]Tc-PCBM was stable up to 6 h in phosphate-buffered solution (PH=7.4) and radiochemical purities was over 90% at selected condition. Partition coefficient (lgP) of [99mTc]Tc-PCBM was 1.5 at pH 7.4 of the phosphate buffer. The uptake of [99mTc]Tc-PCBM in A375-hPD-L1(20.96%) cell is significantly higher than that in A375(4.75%) cell after co-incubated for 4 hours. ***Conclusion:*** [99mTc]Tc-PCBM is probably a potential SPECT PD-L1 imaging agent and further study is needed.

EP-0227

[18F]siPSMA-14 as a highly promising novel radiotracer for primary PET/CT staging of prostate cancer (PCa) patients: initial experience

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Aim/Introduction: 18F-siPSMA-14 PET/CT showed high detection rates corresponding to the data of other PSMA radiotracers. The aim of this study was to analyze the association between PSA values, clinical T stage, EAU risk groups and ISUP grade in locoregional nodal (N) and distant (M) staging of PCa with 18F-siPSMA-14 PET/CT detection rate and metastatic lesions incidence in patients with intermediate and high risk disease. ***Materials and Methods:*** We performed a retrospective analysis of 55 consecutive patients with diagnosed biopsy-proven intermediate and high risk PCa who underwent staging 18F-siPSMA-14 PET/CT (without furosemide) between November 2023 to February 2024. The mean age of the patients was 69.2 years. The chi-squared test was used for testing association between two categorical variables. ***Results:*** The median PSA level was 14.5 ng/ml and median International Society of Urological Pathology (ISUP) grade was 4 with high-risk disease in 49 (89.1%). There was a significant relationship between the PSA level (p<0.001), ISUP grade (p<0.001), EAU risk (p= 0.016) and the ability of 18F-siPSMA PET/CT to reveal the metastatic involvement. In males with intermediate-risk PC, metastases were identified in 1 (16.7%), compared to 21 (42.9%) with high-risk disease. Oligometastatic disease (≤5 lesions) was detected in 4 (7.3%) of patients, including 2 (3.6%) with a PSA level of <10 ng/ml and ISUP grade 4-5. Regional metastatic lymph nodes incidence was identified in 15 (27.3%) of males, including 10 (18.2%) with a PSA level of >20.0 ng/ml and 12 (21.8%) with ISUP grade 4-5. Distant lymph nodes were most commonly found in patients with a PSA level of >20 ng/mL (p <0.001) and clinical T 3-4 (p= 0.073). Bone metastases were identified in 12 (21.8%) of patients, including 8 (14.5%) with a PSA level of >20 ng/mL and 9 (16.4%) with ISUP grade 4-5. Visceral metastases were detected in 2 (3.6%) of males with a PSA level of >20 ng/mL and ISUP grade 4-5. Distant metastases as a whole were seen most commonly in

patients with high levels of PSA and ISUP grade 4-5. Low bladder activity provided an excellent contrast for visualization of lesions in this region. ***Conclusion:*** The novel [F^{18}]siPSMA14 PET radiotracer demonstrates favorable kinetics, providing excellent detection of metastatic lesions, oligometastatic disease in the initial staging of patients with high-risk PCa. The detection of locoregional nodal and distant metastatic spread of PCa is positively associated with PSA levels, ISUP grade and EAU risk groups.

EP-0228

Application of ^{68}Ga-PSMA PET/CT in Diagnosis and Management of Prostate Cancer Patients

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Aim/Introduction: The early and accurate diagnosis of locoregional recurrence or metastasis in prostate cancer (PC) has a significant impact on treatment options. 68Ga-PSMA PET/CT imaging has recently been introduced as a novel procedure in managing PC. The aim of this study was to evaluate the efficacy of PSMA PET/CT in managing PC patients and to compare the detection rate of PET/CT and bone scans (BSs) in detecting bone metastasis. ***Materials and Methods:*** We evaluated 415 patients with PC who underwent 68Ga-PSMA PET/CT between March 2015 and September 2018. The patients were classified into three groups: staging, biomedical recurrence (BCR), and follow-up or monitoring, based on the intent to perform PET/CT. ***Results:*** We evaluated 415 patients aged 41-99 (68.25 ± 9.59). Of these patients, 344 (82.9 %) had at least one localized lesion. The detection rates were 48.3 %, 52.6 %, 74.4 %, 79.6 %, and 93.9 % for a PSA value of < 0.2 ng/ml, ≥ 0.2-< 0.5 ng/ml, ≥ 0.5-< 1 ng/ml, ≥ 1-< 2 ng/ml, and ≥ 2 ng/ml, respectively ($p < 0.05$). The detection rates increased significantly with higher GSs; the rates were 68.3 % (28/41), 74.5 % (73/98), 93.9 % (46/49), and 91 % (61/67) for a GS of < 7, 7, 8, and > 8, respectively ($p < 0.05$). An ideal cut-off value of > 1.16 ng/ml was obtained for PSA value, which equates to specificity of 75 % and sensitivity of 77 %. In comparing BSs and PET/CT, a region-based analysis showed the superiority of PET/CT over BSs for all regions expect the skull ($p < 0.05$). PET/CT detected 258 suspicious regions, 255 of which were metastatic and three of which were equivocal. BSs detected only 223 suspicious regions, 203 of which were metastatic and 20 of which were equivocal. ***Conclusion:*** 68Ga-PSMA PET/CT showed a high detection rate for lesions in PC patients. PSA level, GS, and a PSA doubling time of less than 6 months were shown to be the affective variables. In addition, 68Ga-PSMA PET/CT showed better performance in detecting bone lesions than BSs.

EP-0229

Comparison of Ga-68 PSMA PET/CT scan with Tc-99m MDP bone scan for detecting skeletal metastasis in patients diagnosed with prostate cancer.

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Aim/Introduction: Prostate cancer ranks as the second most frequent type of cancer in men with approximately 1.41 million new cases each year as per Global Cancer Statistics 2022. Bone metastasis is the second most common site of prostate cancer spread, following lymph nodes. Traditionally, bone scans utilizing 99mTc-labeled methylene diphosphonate (99mTc-MDP) have been the preferred method for detecting bone metastases in prostate cancer patients. However, there is growing recognition of the effectiveness of Ga-68 PSMA PET/CT in assessing the extent of prostate cancer spread. This prospective study is aimed to compare the diagnostic performance of Ga-68 PSMA-11 PET/CT andTc-99m MDP bone scans in detecting skeletal metastases in patients diagnosed with prostate cancer. ***Materials and Methods:*** This study enrolled histopathologically confirmed prostate cancer patients who underwent both PET/CT andbone scan within a time frame of week from each other. Imaging procedures followed standardized protocols of PET/CT and bone scan.Skeletal metastases were identified by experienced Nuclear Medicine physicianbased on the characteristic findings on both scans, for lesions characterization. Concordance and discordance betweentwo modalities were noted and analyzed. The consistencies of number of lesions detected from PET/CT and bone scan were evaluated with Bland-Altman plot. ***Results:*** A total of 100 patients with the mean age 64.2 ± 8.83 years were prospectively included in this study. Of 100 patients, 83 (83%) patients showed concordance, while 17(17%) patients showed discordance in the detection of skeletal metastasis on both PET/CT scan and bone scan. Of 83concordant patients, the skeletal metastasis was seen in only 26 (32%) patients, however the remaining 57 (68.7%) patients hadno skeletal metastasis. All17 (89.4%) discordant patients were found to be positive for skeletal metastasis on PET/CT only. In 26 concordant patients with skeletal metastasis, the number of metastatic lesions assessed in 07 different anatomical regionssuch as skull, cervical spine, thoracic spine, lumbar spine, upper extremities, lower extremities, thorax, and pelvis were found to be 19, 20, 27, 33, 85, 80, and 49 on PET/CT, and 16, 17, 21, 25, 62, 56, and 36 on bone scan.Most (96.1%) of the dots on Bland-Altman Plot were within two 95% consistency limits indicating that there is no+ significant difference between the number of lesions detected by the two modalities. ***Conclusion:*** Though statistically insignificant, the number of lesions detected by Ga-68 PSMA PET/CT is much higher than that by the Tc-99m MDP bone scan for skeletal metastasis in prostate cancer patients.

EP-0230

Comparative evaluation of pelvic multi-parametric MRI and Ga-68 PSMA-11 PET/CT for Lymph Node staging in prostate cancer patients

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Aim/Introduction: Pelvic Multi-parametric MRI (mpMRI) has demonstrated promising outcomes in diagnosing, localizing, and staging clinically significant Prostate Carcinoma patients. Prostate-specific Membrane Antigen (PSMA) is highly expressed in prostate tissue and significantly overexpressed in PCa cells. PET/CT utilizing the PSMA inhibitor radiotracer 68Ga-HBED-CC (Ga-68 PSMA-11) holds potential to enhance sensitivity and specificity for preoperative lymph node (LN) staging. However, the comparative value of pelvic mpMRI and Ga-68 PSMA-11 PET/CT for LN staging in PCa remains uncertain. This study aims to evaluate the diagnostic accuracy of Ga-11 PSMA-11 PET/CT and mpMRI for the initial staging of intermediate and high-risk PCa patients. ***Materials and Methods:*** This study enrolled histopathologically confirmed PCa patients who underwent both mpMRI and Ga-68 PSMA-11 PET/CT scan. Experienced radiologists and nuclear medicine physicians visually analysed the obtained radiological (mpMRI) and nuclear images (PET/CT). Risk stratification (intermediate and high risk) of PCa patients was determined based on serum Prostatic specific antigen (PSA) levels and Gleason score in accordance with the

latest guidelines from the European Association of Urology (EAU). Cohen's Kappa statistic was calculated to assess the agreement between Ga-68 PSMA PET/CT and mpMRI in lymph node staging. ***Results:*** There were Ninety-five (95) patientshaving age: 66.6±8.07 years, median serum PSA level: 38.75 ng/ml (from 3.65 to 736.9ng/ml). 49 out of 95 patients (51%) were classified as having intermediate-risk prostate cancer based on their serum PSA level and Gleason score, while the remaining 46 out of 95 patients (48%) were categorized as having high-risk PCa. Among the 95 patients, 66 individuals (69.4%) exhibited concordance, while 29 patients (30.5%) exhibited discordance in detecting lymph node (LN) involvement between mpMRI and Ga-68 PSMA-11 PET/CT. Of the 66 concordant patients, 11 patients (16%) demonstrated LN involvement, and the remaining 55 patients (83%) showed no LN involvement on both mpMRI and PET/CT. Among the 29 discordant patients, 20 individuals (68%) displayed LN involvement on PET/CT, whereas the remaining 9 patients (31%) revealed LN involvement on mpMRI. The agreement between the Ga-68 PSMA-11 PET/CT and mpMRI in lymph node staging was found to be 69.4% (Cohen's k: 0.24) showing fair agreement. ***Conclusion:*** Ga-68 PSMA-11 PET/CT had better sensitivity in the initial assessment of lymph node (N) for patients with intermediate and high-risk prostate cancer (PCa). There was fair agreement (69.4%) between 68Ga-PSMA-11 PET/CT scans and pelvic mpMRI for LN staging.

EP-0232

Metabolic heterogeneity of human prostate cancer based on ^{18F}PSMA-1007 and ^{18F}FDG PET/CT and introducing the Dice Similarity Coefficient as a New Prognostic Parameter

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Aim/Introduction: This study assesses the diagnostic and prognostic capabilities of ^{18F}PSMA-1007 and ^{18F}FDG PET/CT in primary prostate cancer, exploring metabolic heterogeneity and related clinicopathologic features. It also evaluates the potential of Dice Similarity Coefficients (DSC) between PET and MRI as new prognostic markers. ***Materials and Methods:*** We analysed 32 prostate cancer patients using ^{18F}PSMA-1007 and ^{18F}FDG PET/CT for initial tumour staging. Histologic examinations confirmed the cancer presence in detected lesions, and immunohistochemistry (IHC) provided molecular insights. SUVmax values correlated with PSMA and GLUT1 expression levels, enhancing our understanding of tumour behaviour. ADC MRI-defined regions of interest were used to calculate DSC, offering a novel imaging prognostic parameter. ***Results:*** From 32 patients, 68 positive lesions were detected using ^{18F}PSMA-1007 PET/CT, with 47 (69.1%) confirmed as prostate cancer and 12 (17.6%) showing ^{18F}FDG positivity. IHC analysis revealed a significant reciprocal relationship between PSMA and GLUT1 expressions; regions with high GLUT1 typically exhibited low PSMA uptake, a pattern that correlates with the PET findings. Specifically, ^{18F}FDG-positive regions displayed considerably lower ^{18F}PSMA-1007 uptake (6.214 vs. 27.60, p=0.0021), suggesting reciprocal metabolic activities. Further DSC analysis indicated that lower PSMA DSC scores in ^{18F}FDG-positive tumours (0.6565 vs. 0.8015, p=0.0022) are associated with more aggressive disease. ROC curve analyses provided high AUC values (0.917 and 0.918) for differentiating advanced disease stages and identifying post-surgery biochemical failure, respectively. Additionally, a reciprocal correlation between ^{18F}FDG DSC scores and PSA doubling time (r=-0.7874, p=0.0204) highlighted that higher ^{18F}FDG uptake is linked to faster disease progression. ***Conclusion:*** In conclusion, there is a contrasting pattern of high ^{18F}FDG uptake but low ^{18F}PSMA-1007 PET/CT in mainly ductal-dominant PCa. We discovered that tumour hypoxia causes increased glycolysis and decreased ^{18F}PSMA-1007 uptake in PCa. Thus, the combination of ^{18F}PSMA-1007 PET/CT and ^{18F}FDG PET/CT can be a strategy for evaluating tumours with different metabolism. Moreover, the use of DSC has provided further insights into the prognostic potential of imaging biomarkers in PCa. Lower PSMA DSC scores in ^{18F}FDG positive tumours have been linked to advanced disease stages and a more aggressive tumour phenotype, as evidenced by a shorter PSA doubling time. This correlation emphasises the potential of DSC as a quantifiable measure that reflects tumour aggressiveness and could guide treatment strategies.

EP-0233

Role of ^{18F}-PSMA-1007 PET radiomics for seminal vesicle invasion prediction in men with primary prostate cancer

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Aim/Introduction: Seminal vesicle invasion (SVI) is a high-risk indicator for metastasis and recurrence of prostate cancer (PCa). This study aims to investigate whether machine learning-based radiomics models derived from ^{18F}-PSMA-1007 PET could predict SVI and progression-free survival (PFS) after radical prostatectomy (RP) in PCa patients. ***Materials and Methods:*** All patients who underwent ^{18F}-PSMA-1007 PET/CT before RP were enrolled. The intraprostatic lesion's volume of interest (VOI) was semi-automatically sketched with a threshold of 40% maximum standardized uptake value (SUVmax), namely 40%SUVmax-VOI. And seminal vesicle glands were manually contoured (SV-VOI). Features were selected using the Relief and select K best method, as well as the least absolute shrinkage and selection operator algorithm. Logistic regression, random forest, and support vector machine were used for model training. The performance of models from different VOIs was assessed using the ROC curve. The prediction performances of radiomics models were compared against the readers' assessment. Kaplan-Meier analysis was used to test the ability of selected radiomics features to determine the PFS probability. ***Results:*** A total of 112 patients were included in the training set, and 28 patients were in the test set. The highest AUC for the PET radiomics model of 40%SUVmax-VOI and the PET radiomics model of SV-VOI were 0.85 and 0.96 in the test set, respectively. The AUC of the PET radiomics model of SV-VOI was significantly higher than that of the readers' assessment ($P < 0.05$). Using the median of the radiomics scores as a cutoff, the Kaplan-Meier analysis showed that PET radiomics features were associated with PFS in patients with PCa. ***Conclusion:*** Radiomics models developed by preoperative ^{18F}-PSMA-1007 PET/CT were proven useful for the prediction of SVI, and PSMA PET radiomics features were correlated with PFS, suggesting that the PSMA PET radiomics might be a non-invasive tool for PCa characterization.

EP-0234

Pelvic Rosetta Classification (PRC) Project: An interdisciplinary proposal for a lymph node map of the pelvis in prostate cancer

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Aim/Introduction: The Pelvic Rosetta Classification (PRC) Project was initiated to create a landmark-based lymph node map of the pelvis for patients with prostate cancer (PCa) planned for surgical intervention. Aim of this new classification system is to harmonize communication between imaging specialists (nuclear medicine, radiology) and urologists, and to facilitate localization of suspicious extraprostatic lesions during surgery, accordingly. ***Materials and Methods:*** The project lead (DK, XH, GO, TM) defined anatomical margins of eight pelvic (external iliac, obturator fossa cranial/caudal, dorsal internal iliac, vesico-prostatic pedicle, mesorectal/perirectal, presacral, retropubic/preprostatic) and two adjacent extrapelvic (common iliac, intercommon) lymph node areas using anatomical landmarks that are consistently recognizable on morphological imaging (MRI, CT) and intraoperatively. Regions were contoured by 21 experts on five representative axial contrast enhanced CT images of a patient with PCa, depicting all defined areas. Contours were evaluated qualitatively and quantitatively. The mean Sørensen-Dice coefficient and the corresponding standard deviation (SD) were calculated in comparison to a baseline contour that was created by the first (DK) and senior (TM) authors, which was not available to the experts at the time of contouring to analyse the reproducibility of the proposed definitions. ***Results:*** Strong agreement between experts was found for the lymph node regions of the mesorectal and the retropubic spaces. In contrast, largest variations were observed for regions bordering the peritoneum and without a continuously identifiable margin on CT (e.g., obturator fossa). The mean Sørensen-Dice coefficients were lower for the vesico-prostatic pedicle (0.59, SD 0.27), obturator fossa (caudal: 0.54, SD 0.22; cranial: 0.67, SD 0.19), presacral (0.6, SD 0.17), and dorsal internal (0.64, SD 0.17) areas compared to the intercommon (0.71, SD 0.26), external (0.75, SD 0.2), common (0.77, SD 0.15), retropubic/preprostatic (0.83, SD 0.27), and mesorectal/perirectal (0.86, SD 0.24) regions. In the first consensus meeting, the areas "obturator fossa" (cranial and caudal), "internal", and "vesico-prostatic pedicle" were revised, and the inguinal lymph node region was defined. Furthermore, techniques to differentiate the intraperitoneal and extraperitoneal spaces were elaborated (e.g., identifying the course of mesenteric vessels). ***Conclusion:*** The proposed lymph node map of the pelvis for patients with PCa is the first multidisciplinary approach to facilitate communication between imaging specialists and surgeons based on landmarks identifiable on imaging and intraoperatively. Our results demonstrate fair reproducibility. Further development and validations are ongoing to ensure the successful implementation of the proposed classification in clinical practice.

EP-0235

Standardized Uptake Values and patterns of uptake on 68-Ga PSMA PET CT in prostatic lesions.

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Aim/Introduction: Assessment of the SUVmax values and the patterns of uptake on 68-Ga PSMA PET CT in benign and malignant prostatic lesions. ***Materials and Methods:*** This is a retrospective observational study done in patients referred for initial staging with 68-Ga PSMA PET CT in prostate cancer cases. SUVmax in the prostatic lesion was correlated with the risk category, ISUP grade groups, PSA and Gleason's score. The patterns of uptake in each malignant risk category and benign cases were studied. ***Results:*** Total of 325 subjects were included in the analysis (14 benign, 311 malignant). Median SUVmax of benign lesions was 8.29. This was close to the median SUVmax of Grade Group 1 lesions (7.67). Median SUVmax of the Grade Group 4 and 5 (26.42 and 26.55 respectively) were significantly higher than other Grade Groups. Positive correlation was noted between SUVmax values and ISUP grade groups (Spearman's correlation coefficient of 0.440, $p < 0.001$). Significant difference between SUVmax of the ISUP low risk, intermediate risk and high risk prostate cancer groups was observed with Kruskal Wallis test. It was observed that SUVmax of the prostatic lesion showed a positive correlation with the Gleason's score. Statistically significant difference was noted in the SUVmax values of benign, intermediate and high risk clinical categories. For the diagnosis of prostate cancer, SUVmax cut-off was evaluated using ROC analysis, which yielded a cut-off of 10.91 with sensitivity and specificity of 80% and 79% respectively, positive predictive value of 98.81 % and a diagnostic accuracy of 80%. Positive correlation was noted in SUVmax values and serum total PSA values ($p < 0.001$). Majority of the cases (benign and malignant) showed diffuse uptake pattern. With higher SUVmax in the prostatic lesion, in high risk cases, higher SUVmax was observed in nodal and skeletal metastases. ***Conclusion:*** Our study demonstrated SUVmax cutoff of 10.91 to differentiate between benign and high risk prostate cancer. SUVmax values can differentiate high risk prostate cancer from low/intermediate risk. There is considerable overlap between SUVmax values of benign and low risk prostate cancer. A strong trend of rising SUVmax value in prostatic lesion is observed with higher grade malignancy. It can emerge as a pre-biopsy non-invasive diagnostic tool, obviating the need of biopsy in case of higher grade malignancy. It aids targeted biopsy and treatment planning. SUVmax of prostatic lesion is a valuable determinant in risk classification and can change the risk group and management.

EP-0236

Management change after ^{68}Ga-PSMA-11 PET /CT in a large Prostate Cancer cohort with intermediate-unfavorable or high-risk at presentation. Results from a monocentric retrospective study.

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Aim/Introduction: The aim of this study was to evaluate 68Ga-PSMA-11 PET/CT (PET PSMA) impact on management if performed in a population with intermediate-unfavourable or high-risk of prostate cancer (PCa) at presentation according to D'Amico criteria. ***Materials and Methods:*** From July 2021 to March 2024 we performed 860 consecutive PET PSMA for staging PCa before primary treatment. According to our inclusion criteria, we selected patients with the following characteristics; 1) biopsy proven PCa 2) PSA values 3) Gleason Score 4) classified as intermediate-unfavourable or high risk according to D'Amico criteria. Five-hundred-thrirty-four patients met our criteria: 495 patients (92,7%) were high-risk and 39 (7,3%) were intermediate-unfavourable risk according to D'Amico criteria. PSMA PET was performed according to standard criteria and images were read by three nuclear medicine physicians with more than 5 years experience. Images interpretation followed PROMISE V2 and E-PSMA criteria. To avoid UBU (Unspecific Bone Uptake) only Scores 4 and 5 were classified as PET PSMA positive. ***Results:*** In the high-risk population 53 patients (10,7%) showed pelvic nodes metastasis (miN1/N2) only; 79 (16%) were positive for M criteria: 9 for distant nodes only (miM1a); 46 for bone metastasis only (miM1b 9,3%); 24 showing multiple metastasis: miM1a and/or b, and/or c (4,0%); within this group,one patient was miM1a-b-c, one was miM1a-c and 22 were miM1a-b. In the intermediate-unfavourable risk population (39 patients) one patient was miN2 (2,5%) and one was miM1b positive (2,5%). ***Conclusion:*** As recently confirmed by EAU guidelines (1)PSMA PET has become an essential tool to stage high risk PCa and might replace standard procedures like CT and Bone Scan. In our large series, we observed a major impact on management in 16% of the patients at high-risk (miM1a and miM1b), while a much lower major impact on management was observed in intermediate-unfavourable risk population (2,5%). In conclusion, a systematic use of PSMA PET in high-risk PCa patients might correctly addressed to systemic treatments (1) sparing futile surgery or RT. ***References:*** (1)https://d56bochluxqnz.cloudfront.net/documents/full-guideline/EAU-EANM-ESTRO-ESUR-ISUP-SIOG-Guidelines-on-Prostate-Cancer-2024_2024-04-09-132035_ypmy_2024-04-16-122605_lqpk.pdf.

EP-0237

Diagnostic value of multiphasic ^{68}GaPSMA11 PET/CT imaging in detection of prostate bed recurrence and regional lymph node metastasis in prostate cancer patients

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Aim/Introduction: . The aim of this study is to evaluate the clinical utility of early and delayed imaging in prostate cancer (PCa) patients as well as temporal changes in the semi-quantitative parameters. ***Materials and Methods:*** In this single-center retrospective study, 138 PCa patients were referred for 68Ga-PSMA PET/CT scan for various indications . Patients underwent standard 60 min imaging along with the first 4-min post-injection static acquisition, and delayed imaging, 2.5-3 h after injection, both from the pelvic field. Changes in the lesion SUVmax and target-to-background ratios (TBR) were recorded for each phase of the imaging. ***Results:*** The study evaluated 138 PCa patients, with an average age of 67.7 ± 8.7 years, a median PSA level of 7.5, and an interquartile range of (1.1-23.1), as well as Gleason scores ranging from 3+3 (3.6%) to 5+5 (4.2%). The positivity rates for PSMA-avid lesions in the early, whole-body, and delayed images were 71.5% (93/130), 73.9% (77/110), and 70% (77/110), respectively. The early phase, standard, and delayed images demonstrated prostate beds, local extraprostatic, lymph node, and bone lesions in the following order: 76, 29, 96, and 104 foci in the early phase; 80, 32, 117, and 111 lesions in the whole-body phase; and 61, 28, 98, and 52 lesions in the delayed phase, respectively. . The detection rates for local recurrence in the early, whole-body, and delayed phases were 13.8% (18/130), 15.9% (22/138), and 17.3% (19/110), respectively, with no statistically significant change (p=0.5). The detection rates for lymph node metastases were 23.8% (31/130), 29% (40/138), and 28% (30/110), with a significant difference observed between the early and whole-body phases (p=0.016). The detection rates for osseous lesions in the early, whole-body, and delayed images were 28.46% (37/130), 27.53% (38/138), and 21.81% (24/110), respectively, with no statistically significant difference found (p=0.139). ***Conclusion:*** The detection rates of bone lesions were comparable across all three phases. The early phase imaging was more effective for evaluation of local bladder invasion but was less successful in identifying prostate bed lesions, seminal vesicle invasion, and lymph node metastases. The increased SUVmax pattern appeared more prominent in corrected SUVmax (T/BG) than in SUVmax for various lesions. Additionally, the increasing pattern of SUVmean demonstrated a smaller increase in the proportion of patients compared to SUVmax in the transition from early to whole-body and early to delayed phase images.

EP-0238

Assessment of the Reproducibility, Accuracy, and Incremental Value of Delayed Imaging in PRIMARY Scoring: A Comparative Analysis of [^{68}Ga]Ga-PSMA-11 PET/CT Images

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Aim/Introduction: The primary aim of the study was to determine the supplemental value of delayed images in the diagnosis of clinical significant prostate cancer by using PRIMARY scoring on standard and delayed images obtained with [68Ga]Ga-PSMA PET/CT. The secondary aim of the study is to evaluate the intra-observer and inter-observer agreement in PRIMARY scoring

in standard and delayed imaging. ***Materials and Methods:*** 140 patients with bISUP (ISUP GG obtained after biopsy) 1-2 prostate cancer who had standard (mean 59±15 min) and delayed images (mean 138±21 min) with [68Ga]Ga-PSMA PET/CT before the radical prostatectomy were included in the retrospective study. Two experienced nuclear medicine physicians evaluated the images blindly, and discordant scoring was resolved by consensus of the third experienced nuclear medicine physician. A statistical analysis of diagnostic parameters was performed by consensus scoring. The images were also evaluated using PRIMARY scoring by four different nuclear medicine specialists, blind to each other and the patient's clinical information. For intraobserver analysis, a one-month interval was taken between two evaluations. ***Results:*** Of the patients, 51 had bISUP 1 and 89 had bISUP 2. In this patient group, 69% of bISUP 1 cases and 20% of bISUP 2 cases showed an increase in grade group after surgery. When comparing the diagnostic parameters, the sensitivity for PRIMARY scoring for the standard images was 71%, the specificity 35%, the positive predictive value 87% and the negative predictive value 17%, while for the delayed images the sensitivity was 92%, the specificity 20%, the positive predictive value 87% and the negative predictive value 29%. According to Cohen's Kappa analysis, intraobserver agreement was 0.536, 0.798, 0.593, and 0.638 for observers 1, 2, 3, and 4, respectively, for standard images and 0.697, 0.839, 0.769, and 0.740 for observers 1, 2, 3, and 4, respectively, for delayed images. The inter-observer agreement determined by Fleiss Kappa was 0.47 and 0.52 for the standard image in rounds 1 and 2, respectively, and 0.61 and 0.72 for the delayed image in rounds 1 and 2, respectively. ***Conclusion:*** Delayed imaging significantly improved the identification of csPCa patients missed on standard images. There was also enhanced reliability in both intraobserver and interobserver assessments with delayed images. Decreased background activity and increased primary tumor uptake led to better identification of lesions, with clearer discrimination between tumor and benign lesions. Consequently, delayed images have potential for identifying candidates suitable for active surveillance in routine clinical practice.

EP-0239

Clinical, pathological and imaging variables associated with prostate cancer detection by PSMA PET/CT and mpMRI

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Aim/Introduction: Multiparametric MRI (mpMRI) and PSMA-PET are complementary imaging modalities used in the pre-surgical staging of prostate cancer (PCa). Disagreements between the two imaging modalities are found in a small percentage of cases, and the reasons behind them are unclear. Aim: To assess differences in sensitivity and positive predictive value between pre-surgical PSMA-PET and mpMRI and characterize tumors detected and not detected by each imaging modality focusing on identifying the clinical, pathological and imaging variables associated with tumors detected by PSMA-PET and mpMRI invisible. ***Materials and Methods:*** This single-center, retrospective analysis included patients who underwent both PSMA-PET and mpMRI prior to radical prostatectomy with centralized imaging and pathology review. Two nuclear medicine physicians and 2 radiologists blindly and independently contoured PCa lesions on PSMA-PET and mpMRI, respectively. We used a majority rule (2:1) with a third reader for each modality in case of disagreement. We fused the PET/CT and MRI and assessed for agreement/disagreement visually, based on the overlapping lesion contours, and matched each lesion with the tumors delineated by a genito-urinary pathologist on whole-mount histopathology. Logistic regression models explored associations between clinico-pathological variables and tumor detection on imaging. ***Results:*** A total of 132 csPCa tumors from 100 patients were identified on surgical pathology. PSMA-PET and mpMRI identified 143 and 122 lesions, respectively. PSMA-PET showed higher sensitivity (87% vs 80%), but lower positive predictive value compared to mpMRI (87% vs 93%). Tumors correctly identified on each imaging modality had significantly higher ISUP GG, larger size, and were more likely to show large cribriform pattern and intraductal carcinoma. Tumors detected by both imaging modalities were significantly larger and had higher ISUP grade groups than those invisible on one or both imaging modalities. On multivariable analysis, smaller tumor size on pathology and older age were associated with PSMA PET/CT not detecting csPCa. Whereas for mpMRI, smaller tumor size on pathology was associated with invisible PCa, while ISUP GG4/5 vs GG2 was associated with lower odds of non-detection. csPCa tumors invisible on mpMRI but detected by PSMA-PET were smaller in size compared to those detected by both modalities. Limitations include selection bias in a surgical cohort. ***Conclusion:*** PSMA-PET tends to detect smaller csPCa not detected by mpMRI. Larger tumors on pathology with higher grade groups are more likely to be correctly detected by both imaging modalities. These findings provide insights for refining pre-surgical evaluation strategies in PCa.

EP-0240

^{68}Ga-PSMA PET/CT Based Multi-modal Deep Learning Model for Accurate Prediction of Pelvic Lymph-node Metastases in Prostate Cancer

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Aim/Introduction: The clinical nomogram is a crucial tool for assessing the need for extended pelvic lymph node dissection (ePLND) in conjunction with radical prostatectomy. However, its high sensitivity and low specificity have resulted in unnecessary ePLND and associated complications in 75-85% of patients. In addition, both PET and traditional imaging frequently underestimate lymph node metastases in prostate cancer (PCa). We aimed to develop a multi-modal deep learning model based on PSMA PET/CT for precise preoperative prediction of lymph node involvement (LNI) in PCa patients. ***Materials and Methods:*** We retrospectively enrolled a consecutive cohort of PCa patients who underwent 68Ga-PSMA-617 PET/CT before any initiating treatment, radical prostatectomy and ePLND were then carried out following a standard clinical assessment at a single tertiary referral center. Using ePLND postoperative pathology as the gold standard, Med3D deep learning network was developed to extract discriminative features from the volume of interests encompassing the entire prostate gland in PET and CT images. A multimodal deep learning model was then constructed and cross-validated to predict LNI by combining PET/CT features and clinical parameters, including age, prostate-specific antigen, Gleason grade group for biopsy, clinical tumor stage, and maximum normalized exposure to 68Ga-PSMA PET primary tumors. Optimal

risk-threshold was determined during model development and performance was compared with available nomograms and PET/CT visual assessments using area under the receiver operating characteristic curves (AUC), calibration plots, and decision curve analysis (DCA). ***Results:*** A total of 82 PCa patients were included in the study cohort between January 2020 and December 2023 and 24 patients had pathologically-confirmed LNI disease. Our multimodal deep learning approach demonstrated superior discriminative ability in predicting LNI compared to the reported results of PSMA PET/CT, the Memorial Sloan Kettering Cancer Center (MSKCC) nomogram, and the Briganti-2017 nomogram (AUC 0.89 [95% confidence interval [CI] 0.81-0.97] vs 0.82 [95% CI 0.73-0.92] vs 0.75 [95% CI 0.61-0.89] and 0.73 [95% CI 0.61-0.86], respectively; $p < 0.05$). Furthermore, our model exhibited good calibration similar to the common nomograms and significant higher net benefit at DCA with a threshold probability of ≥ 4%. ***Conclusion:*** Our validated multimodal deep learning model, which incorporates both clinical information and PSMA PET/CT features of prostate, outperforms PSMA PET/CT visual evaluation, the MSKCC and Briganti-2017 nomograms. It has the potential to enhance patient selection for ePLND compared to current clinical nomograms.

EP-0241

Prospective comparison of ^{18}F-PSMA-1007 PET/CT and MRI using histopathology as the reference standard for detecting and staging primary tumours in high-risk prostate cancer patients

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Aim/Introduction: Accurate detection, localisation, and staging of clinically significant prostate cancer (PCa) are paramount for therapy planning. The aim of this study was to compare the diagnostic performance of 18F-PSMA-1007 PET/CT and whole-body MRI (wbMRI) in the detection and local staging of intraprostatic tumour foci, using histopathology as the reference standard. ***Materials and Methods:*** The current study is part of a prospective single-centre trial (PROSTAGE, NCT03537391), where patients with newly diagnosed high-risk PCa underwent 18F-PSMA-1007 PET/CT, wbMRI with diffusion-weighted imaging (DWI), contrast-enhanced CT, bone scintigraphy and SPECT/CT for primary staging within 2 weeks from enrolment. Given the purpose of assessing the detection and staging of primary tumours, only patients treated with radical prostatectomy were included in study, and only 18F-PSMA-1007 PET/CT and MRI images were evaluated. Two readers for each modality reported the intraprostatic tumours using a 12-segment-based analysis. Seminal vesicle invasion (SVI) and extraprostatic extension (EPE) were also assessed. Histopathological analysis, including hematoxylin-eosin and PSMA immunochemistry, was performed. Imaging-pathology correspondence was assessed on a lesion level. ***Results:*** Nineteen patients were included in the study, with a mean age of 65 y (range 52-69), and a mean PSA of 8.7 ng/ml (range 5.9-13.5). The majority of the patients, 16 (84%), presented with an ISUP grade group of 3 or higher. Pathological stages were pT2 in 9 (47%) patients and pT3 in the remaining 10 (53%). A total of 38 intraprostatic lesions were detected through histopathological analysis. The detection rates of intraprostatic foci for 18F-PSMA-1007 PET/CT readers were 79% and 74%, respectively, and for MRI readers, the rates were 71% and 45%, respectively. The AUC values for SVI were 0.67 and 0.70 for 18F-PSMA-1007 PET/CT readers, and 0.70 and 0.70 for MRI readers, respectively. The corresponding AUC values for EPE were 0.57 and 0.50 for 18F-PSMA-1007 PET/CT readers, and 0.68 and 0.68 for MRI readers, respectively. ***Conclusion:*** 18F-PSMA-1007 PET/CT showed higher detection rates than wbMRI in assessing intraprostatic tumour foci. Comparable performance between the two modalities was observed in the assessment of SVI. Conversely, MRI seems to be more accurate than 18F-PSMA-1007 PET/CT in evaluating EPE.

EP-0242

Role of Semiquantitative Parameters of the Primary Tumor on Ga-68 PSMA PET/CT in Predicting Pelvic Lymph Node Metastasis: A Prospective Single-Center Study

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Aim/Introduction: The aim of our study was to investigate the diagnostic value of semiquantitative parameters of the primary tumor obtained from preoperative staging Ga-68 PSMA (Prostate-specific membrane antigen) PET/CT in predicting postoperatively proven pelvic lymph node (LN) metastasis in intermediate-high risk prostate cancer. ***Materials and Methods:*** In our study, we prospectively evaluated 50 patients with newly diagnosed, biopsy-proven, intermediate-high-risk prostate cancer who underwent radical prostatectomy with pelvic lymph node dissection and Ga-68 PSMA PET/CT for preoperative staging. SUVmax, SUVmean, TL-PSMA (Total lesion) and PSMA-TV (Tumor volume) parameters of the primary tumor were measured and recorded on Ga-68 PSMA PET/CT images. Postoperative pathology results were recorded. Non-parametric tests, chi-square test and ROC analysis were performed to determine the relationship between the parameters obtained from PSMA PET/CT and histopathologic data. ***Results:*** The postoperative histopathologic features of 50 patients (65±0.7 (52-76)) included in our study are shown in Table 1. Staging Ga 68 PSMA PET/CT showed PSMA expression in the LN in 11 patients (78%). In the postoperative histopathologic analysis , 38 (76%) patients had no LN metastasis, while 12 (26%) had LN metastasis. The sensitivity, specificity, NPV, PPV and accuracy of Ga 68 PSMA PET/CT in detecting LN metastasis were 66%, 92%, 89%, 72% and 86%, respectively. Primary tumor SUVmax, SUVmean, TL-PSMA and PSMA-TV were statistically significantly higher in histopathologically proven LN positive patients compared to negative patients (p=0.004, p=0.009, p<0.001, p=0.032, respectively). In ROC analysis, TL-PSMA had the highest diagnostic value in predicting histopathologic LN metastasis (AUC:0.86, 95% CGA:0.75-0.96, p<0.001). This value was respectfully followed by SUVmax (AUC:0.78, 95% CGA:0.64-0.91, p=0.004), SUVmean (AUC:0.75, 95% CGA:0.60-0.90, p=0.009), and PSMA-TV (AUC:0.70, 95% CGA:0.56-0.85, p=0.032). ROC analysis is shown in table 2. Additionally primary tumor SUVmax, SUVmean, TL-PSMA values

were also correlated with postoperative histopathological findings of seminal vesicle invasion (p=0.004, p=0.003, p=0.001, respectively), positive surgical margin (p=0.023, respectively), p=0.043, p=0.003), extraprostatic invasion (p=0.003, p=0.009, p=0.006, respectively), and higher pT stage (p= <0.001, p= <0.001, p= 0.001, p= 0.001, respectively). Although PSMA-TV, seminal vesicle invasion, positive surgical margin, extraprostatic invasion and higher pT stage were found to be higher in patients with PSMA-TV, they were not statistically significant (p=0.246, p=0.177, p=0.51, 0.706, respectively). ***Conclusion:*** We concluded that TL-PSMA, SUVmax and SUVmean parameters of the primary tumor, independent of LN PSMA expression on Ga-68 PSMA PET/CT, do contribute to the prediction of histopathological LN metastasis in patients with intermediate-high risk prostate cancer.

EP-0243

Immunohistochemical assessment of PSMA expression in biopsy samples predicts PSMA PET/CT uptake in prostate cancer: a new tool to choose the best primary staging imaging method?

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Aim/Introduction: In recent years, prostate-specific membrane antigen (PSMA) PET imaging has emerged as the most accurate method for staging primary prostate cancer (PCa). It has been shown that 5 to 10% of PCa lesions exhibit low to absent PSMA expression, as determined by immunohistochemistry. Identifying patients with low PSMA expression through verification in biopsy samples could suggest alternative imaging methods for staging purposes. ***Materials and Methods:*** Patients scheduled for robot-assisted radical prostatectomy between June 2021 and December 2022, and staged with Ga68-PSMA-11 PET imaging, were selected. Immunohistochemical analysis was performed on biopsy specimens, correlating with the respective International Society of Urological Pathology (ISUP) grade, and on each index lesion in the final histology. Results were quantified using the immunoreactive score (IRS). Gwet's agreement coefficient (AC1) calculated the concordance between PSMA expression in biopsy specimens and index lesions in final histology. Univariate and multivariate regression models assessed the influence of biopsy and final histology IRS on the maximum standardized uptake value (SUVmax). ***Results:*** Fifty patients were prospectively selected. The median IRS of the biopsy specimens was 6 (Interquartile Range [IQR] 4, 8.8). The concordance rate for immunohistochemical PSMA expression between biopsy specimens and the index lesion in final histology was 80%, with a statistically significant AC1 of 0.72 (confidence interval [CI] 0.5-0.9) (p < 0.001). Univariate linear regression analysis showed that both the average percentage of PSMA-positive cells and the average IRS in biopsy samples significantly affected SUVmax (beta= 1.2, CI 1.04-1.45, p = 0.02; and beta= 2.5, CI 1.2-3.1, p = 0.008, respectively). In multivariate regression models, the percentage of PSMA-positive cells and the IRS of the index lesion were significant predictors of SUVmax, after adjusting for tumor volume (beta= 1.22, CI 1.05-1.4, p = 0.01; and beta= 6.66, CI 2.03-21.8, p = 0.01, respectively). ***Conclusion:*** The immunohistochemical expression of PSMA in adenocarcinoma from prostate biopsy specimens demonstrates high concordance with PSMA expression in adenocarcinomas from radical prostatectomy specimens. PSMA expression level is an independent predictor of PSMA PET SUVmax. Assessing PSMA immunohistochemical expression preoperatively can significantly influence a more accurate, patient-specific diagnostic approach.

EP-0244

Assessing the Supplementary Role of PSMA PET Parameters in Metastatic Hormone-Sensitive Prostate Cancer Patients Initiating First-Line Therapy

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Aim/Introduction: The current categorization of disease as high or low-volume in metastatic hormone-sensitive prostate cancer relies on conventional imaging techniques outlined by the CHARTEED and LATITUDE criteria, rather than advanced imaging modalities. However, PSMA PET is increasingly being utilized, particularly in patients with high and very high risk of disease. Therefore, there is a critical need to assess the additional value provided by PSMA PET/CT in patients with metastatic hormone-sensitive prostate cancer. This study aimed to evaluate the utility of PSMA PET in this context. ***Materials and Methods:*** This retrospective monocentric study enrolled patients with metastatic hormone-sensitive prostate cancer who underwent PSMA PET/CT prior to initiating any first-line treatment and at the time of their best response. Patients enrolled in other clinical trials or lacking available PET images at any disease phase were excluded. PET images were quantitatively analyzed using whole-body total lesion activity (wb_TLA) and metabolic tumor volume (wb_MTV). Patients were followed clinically, and disease progression was recorded. Statistical analysis was performed using MedCalc software. ***Results:*** A total of 40 patients (median age: 69; range: 55-84 years) were included in the study. Median values of wb_TLA and wb_MTV significantly differed in patients categorized as having high and low disease burden based on the CHARTEED and LATITUDE criteria (all p < 0.005). The correlation between baseline and best-response PSA and wb_TLA were 71% and 81%, respectively, while correlations were lower for PSA and wb_MTV (38% and 41%, respectively). After a median follow-up time of 34 months (range: 5-97), 31 patients remained disease-free, while 8 experienced disease progression. Neither baseline wb_MTV nor wb_TLA were predictors of progression; however, the best response wb_TLA was significantly higher in patients who progressed compared to those who did not (median: 167 vs. 41, p < 0.05), such as PSA levels (0.88 vs. 0.03; p<0.05). ***Conclusion:*** Strong correlations between PSA levels and wb_TLA suggest PSMA PET's utility in monitoring disease response. While baseline wb_MTV and wb_TLA aren't independent predictors of progression, higher best response wb_TLA correlates with disease progression. These findings highlight PSMA PET's clinical relevance for treatment guidance and disease monitoring in this patient group, warranting further research.

EP-0245

The Relationship of Volumetric Parameters in GA-68 PSMA PET/CT with Clinical Data in Prostate Cancer Staging

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Aim/Introduction: The aim of this study is to evaluate the relationship between volumetric parameters in Ga-68 PSMA PET/CT performed for staging purposes in patients diagnosed with prostate cancer and PSA, Gleason Score, D'Amico Risk Classification and Memorial Sloan Kettering Cancer Center (MSKCC) nomogram. ***Materials and Methods:*** Patients, who underwent robotic radical prostatectomy between January 2020 and December 2022, and who had Ga-68 PSMA PET/CT performed for primary staging in Ankara Bilkent City Hospital, were retrospectively reviewed. PSMA PET/CT images were visually and quantitatively analysed. Regions of interest (VOI) for PSMA retention above the background activity in the prostate gland and lymph nodes were drawn in LIFEx v7.4 (Local Image Feature Using the Extraction) program with the threshold value set to 42%. SUVmax, whole body total lesion PSMA (wbTL-PSMA) and whole body PSMA tumour volumes (wbPSMA-TV) were calculated. In addition, preoperative PSA levels, Gleason scores, D'Amico risk groups, extraprostatic spread (EPE), lymph node involvement (LNI) and seminal vesicle invasion (SVI) probability values, obtained from the MSKCC nomogram, were recorded. The relationship between the calculated volumetric parameters and clinical data was examined with Pearson correlation analysis. ***Results:*** The mean age of 103 patients, who met the inclusion criteria, was 65.85±6.23 years, the mean serum PSA level before surgery was 16.90±16.16 ng/mL, the mean SUVmax was 17.82±20.84, the mean wb-PSMA-TV was 5.55±5.10 cm3 and mean wbTL-PSMA was 64.11±126.96. A significant correlation was detected between PSA levels and wbPSMA-TV, wbTL-PSMA and SUVmax values (r=0.45, r=0.60, r= 0.41, all p<0.01, respectively). While a significant correlation was found between SUVmax and wbTL-PSMA (p<0.01, r=0.55), no significant correlation was found between wbPSMA-TV and SUVmax values (p>0.05). A significant correlation was detected between preoperative Gleason scores and wbPSMA-TV, wbTL-PSMA and SUVmax values (r=0.24, r=0.34, r=0.27, respectively, all p<0.01). The patients included in the study were in the medium and high-risk class in the D'Amico risk category; while a significant correlation was found between D'Amico risk category, wbTL-PSMA and SUVmax values (r=0.26, r=0.26, p<0.01, respectively), there was no significant correlation with wbPSMA-TV (p>0.05). A significant correlation was detected between the EPE, LNI and SVI probability values obtained from the MSKCC nomogram and wbPSMA-TV, wbTL-PSMA and SUVmax values (p<0.01). ***Conclusion:*** Prospective studies in large patient groups are needed to reveal the relationship of clinical data with parameters such as SUVmax, wbTL-PSMA, wbPSMA-TV, obtained from Ga-68 PSMA PET/CT images taken during the primary staging of prostate cancer period.

EP-0246

PSMA PET/CT and Magnetic Resonsance Imaging Features in Patients with Favorable and Unfavorable Intermediate Risk Prostate Cancer

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Aim/Introduction: PET/CT using prostate-specific membrane antigen(PSMA)-based tracers is currently recommended in high-risk PCa. However, its potential benefits in intermediate-risk cases are still to be determined. We aimed to assess the receptorial features through PSMA-PET/CT, together with the magnetic resonance imaging (MRI) characteristics, in a cohort of patients with intermediate-risk PCa. ***Materials and Methods:*** We retrospectively recruited patients with intermediate-risk PCa who underwent [68Ga]Ga-PSMA-11 or $^{[18F]}$PSMA-1007 PET/CT at the Nuclear Medicine Units of the Humanitas group (Italy) for the initial staging. We collected clinical data, MRI, and PET/CT data, and informed consent. Both MRI and PSMA PET/CT images were visually inspected, and the PI-RADS v.2 and Primary Score (PS) were determined by two experienced readers. Our data analysis was conducted using MedCalc version 22.014. ***Results:*** A total of 144 patients were included in the study. The median initial PSA level was 7.31 ng/mL (range: 1.9-63 ng/mL). Based on the biopsy Gleason Score-GS, 84 patients (58.3%) were categorized as "favorable risk" (GS: 3+4), while 60 patients (41.7%) had an "unfavorable risk" (GS: 4+3). MRI-PIRADS scores (available in 126 cases) were distributed as follows: a score of 1-3 in 19 (15%), a score of 4 in 72 (57%) and a score of 5 in 35 patients (28%). At MRI, monofocal lesions were detected in 113 patients (78%), capsular invasion was observed in 22 patients (15%), vesicle invasion in 4 cases (3%). Lymph node involvement was identified in 2 patients, whereas bone pelvic lesions only in 1 case. At PSMA PET/CT, PS were: 14 (9.7%) scored 1, 11 (7.6%) scored 2A, 6 (4.2%) scored 2B, 13 (9%) scored 3, 63 (43.7%) scored 4, and 37 (25.7%) scored 5. PSMA PET/CT identified lymph node involvement in 11 and distant metastases in 12 patients (7.8% and 8.3%, respectively). Patients with both favorable and unfavorable disease exhibited a similar prevalence of PIRADS 4/5. However, the PS of 4/5 was more frequent in unfavorable (n=50/60; 83%) than in favorable disease (n=50/84; 60%) (p<0.01). PSMA PET/CT demonstrated a higher rate of lymph node involvement (9% vs. 7%) and distant metastases (12% vs. 6%) in patients with unfavorable than favorable risk, a distinction that MRI was unable to establish. ***Conclusion:*** For patients with intermediate-risk PCa, PSMA PET/CT offers an additional tool to predict unfavorable outcomes. Future prospective studies should delve deeper into this matter, exploring its relevance not just in the staging process but also during diagnosis.

EP-0247

The added value of PSMA PET/CT compared to mpMRI in detecting locoregional lymph nodes during the primary staging of intermediate-risk prostate cancer

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Aim/Introduction: In the 2024 European Association of Urology (EAU) guidelines, prostate-specific membrane antigen positron emission tomography/computed tomography (PSMA PET/CT) is strongly recommended for the primary staging of high-risk prostate cancer (PCa). However, the recommendation for its use in intermediate-risk settings remains "weak". This is primarily because, among the three available phase 3 trials focusing on primary staging, only two included intermediate-risk patients, who constituted a small percentage compared to those at high-risk. Indeed, the pre-test probability of distant metastatic disease in the intermediate-risk group is low. Consequently, the added value of PSMA PET/CT, compared to multiparametric magnetic resonance imaging (mpMRI) for nodal assessment, requires further evaluation. In this single-center retrospective study, we compared the diagnostic accuracy of PSMA PET/CT and mpMRI for locoregional lymphnode (N) staging in patients with high- and intermediate-risk PCa. ***Materials and Methods:*** We retrospectively analyzed PCa patients who underwent primary staging mpMRI and [18F]PSMA-1007 PET/CT at our institution between 01/2020 and 01/2022. Inclusion criteria were: (i) histologically confirmed PCa categorized as (ii) intermediate- or high-risk according to the D'Amico classification, and (iii) treated with radical prostatectomy and extended pelvic lymphnode dissection (ePLND). Positive nodes were defined as nodes > 8 mm at mpMRI and nodes with PSMA-RADS 4-to-5 at PET/CT, following the standardized E-PSMA reporting criteria. The reference standard for the N-stage was histopathology (pN). We calculated sensitivity, specificity, positive and negative predictive value (PPV and NPV), for mpMRI alone and the combination of mpMRI and PSMA PET/CT in both intermediate- and high-risk patients. ***Results:*** Out of 100 PCa patients, 61 were at intermediate-risk and 39 at high-risk, resulting in 5 (8.2%) and 17 (43.6%) cases of pN1, respectively. In the intermediate-risk PCa setting, the combination of mpMRI and PSMA PET/CT significantly enhanced the sensitivity of N detection compared to mpMRI alone (40% vs. 20%, p=0.016), without significantly reducing PPV (11.8% vs. 16.7%, p=0.441) or NPV (93.2% vs. 92.7%, p=0.915). As expected, in the high-risk setting, combining the two imaging modalities increased both sensitivity (94.1% vs. 52.9%, p<0.001) and NPV (92.3% vs. 69.2%, p=0.010) compared to mpMRI alone. ***Conclusion:*** The combination of PSMA PET/CT and mpMRI increased the sensitivity of N-staging in newly diagnosed intermediate-risk PCa patients without compromising the test's PPV and NPV. Given the high NPV in the PCa intermediate-risk scenario, further studies are necessary to assess the role of a multimodal imaging approach in theoretically preventing the need for ePLND.

EP-0248

Spleen versus right parotid gland for PSMA expression scoring in Prostate cancer imaging with ^{18}F-PSMA-1007 PET/CT according to PROMISE : a critical approach

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Aim/Introduction: PROMISE offers standardized interpretation of Prostate cancer (ProCa) lesions in ^{18}F-PSMA-1007 PET/CT by scoring based to their uptake in comparison to three reference organs : 0 (< blood pool [BP]), 1(= or > BP and < spleen [SPL]), 2 (= or > SPL and < right parotid gland [RPG]) and 3 (=l or > RPG) [1]. For miTNM classification, PSMA scores and CT and/or MRI data are used to characterise lesions as positive/negative/equivocal. We explore the unconvenient situation of SPL uptake higher than RPG. ***Materials and Methods:*** One hundrent thirty-seven men (aged 50-90 years) with ProCa and 18F-PSMA-1007 PET/CT scan were enrolled, one with abdominal splenosis after splenectomy, none with spenomegaly, haematologic disease, RPG excision or radiotherapy. The suspect lesions were scored according to PROMISE. SUVmax of BP, SPL and RPG were measured in all as was SPL radiodensity. The correlation between SPL and RPG SUVmax was estimated by linear regression analysis. According to their RPG/SPL SUVmax ratio the patients were allocated into groups 1 (ratio > 1) and 2 (ratio = or < 1). The demographic, biochemical and metabolic data of the two groups were compared by Mann-Whitney test. Data are shown as mean±SD. ***Results:*** SUVmax of SPL and RPG are not related to each other. Twenty five out of 137 patients (18.2%) were allocated in group 2. Inversely to PROMISE, their lesion scores 2 and 3 were based on RPG and SPL uptake respectively. The RPG/SPL SUVmax ratio was 1.8±0.1 vs 0.7±0.0, for the groups 1 and 2 respectively (p<0.001). SUVmax of MD, RPG and SPL was 1.8±0.5 vs 1.4±0.8, 22.5±6.1 vs 13.7±4.8 9, and 13.1±4.3 vs 19.0±5.3 for groups 1 and 2 respectively (p<0.05 for all paired comparisons). Age, BMI, administered activity, SPL radiodensity and PSA levels did not significantly differ between the groups. ***Conclusion:*** PROMISE is widely used as a tool for uniform interpretation and reporting 18F-PSMA-1007 PET scans, based on an ordered, organ activity-related scoring system. However, for a considerable percentage of patients this scoring escalation (BP, SPL, RPG) is not valid, with both enhancement of PSMA uptake by the SPL and attenuation in the RPG about equally contributing to this deviation. The biologic basis of the finding, may deserve further attention, especially in relation to disease burden. ***References:*** Eiber M et al. Prostate Cancer Molecular Imaging Standardized Evaluation (PROMISE): Proposed miTNM Classification for the Interpretation of PSMA-Ligand PET/CT. J Nucl Med 2018.

EP-14

e-Poster Area

B: Imaging Clinical Studies -> B1 Oncological Imaging Clinical Study -> B18b Prostate BC Recurrence

EP-0249

Clinical value of a negative ^{18}F-PSMA PET/CT study in patients with PSA recurrence level below 1 ng/mL after radical prostatectomy. Impact on salvage radiotherapy.

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Aim/Introduction: To evaluate the value of pelvic salvage radiotherapy (PSRT) in patients with a negative 18F-PSMA-PET/CT study. ***Materials and Methods:*** We prospectively included 138 patients with post-prostatectomy biochemical recurrence of prostate cancer [mean PSA 0.80 ng/mL (range 0.17-1.0 ng/mL)] who were referred for an 18F-PSMA-PET/CT study.The 18F-PSMA-PET/CT scan was negative in 66/138 patients (47.82%). Differences were analysed between those patients who were or were not candidates for pelvic salvage radiotherapy (PSRT) decided upon multidisciplinary committee and patient consent, with a minimum

follow-up time for 1 year. Response to treatment was defined as a 50% reduction in PSA levels. Recurrence was ascertained upon clinical, analytical and imaging follow-up outcomes. ***Results:*** 59.09% (39/66) of the patients with a negative 18F-PSMA-PET/CT underwent PSRT.Of these, 89.74% (35/39) patients demonstrated response to treatment (PSMA false negatives). In the remaining four patients: one increased PSA, one remained unchanged and two showed only no PSA response (not confirmed on the 18F-PSMA-PET/CT follow-up study). 40.90% (27/66) of patients with negative 18F-PSMA-PET/CT did not undergo PSRT.Of these, progressive PSA elevation was observed in 55.55% (15/27) (PSMA false negatives), localising recurrence on the 18F-PSMA-PET/CT follow-up study in 4 patients: one local recurrence, one iliac lymph node recurrence and two bone recurrence cases.Of the remaining 11 patients (40.74%), three showed fluctuating PSA levels and 8 decreasing PSA values. ***Conclusion:*** Our series confirmed 50 (75.75%) 18F-PSMA-PET/CT false negatives cases.Patients with post-prostatectomy biochemical recurrence and a negative 18F-PSMA-PET/CT study are likely to benefit from pelvic salvage radiotherapy, with response seen in 89.74% of our cases.

EP-0250

Optimizing Prostate Cancer Recurrence Diagnosis using PSMA and Choline PET Radiomics

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Aim/Introduction: To evaluate the potential of 18F-PSMA-1007 (PSMA) compared to ^{18}F-Choline PET/CT (FCH) for identifying metastatic lesions in prostate cancer (PCa) patients with biochemical recurrence (BCR) using radiomic features and quantitative biomarkers. ***Materials and Methods:*** This prospective study recruited 106 BCR patients who had undergone primary PCa treatment. All received both PSMA and FCH PET/CT scans within a 10-day window, followed by a minimum 6-month follow-up. Clinical data (pathology, PSA, doubling time, velocity, and prior treatment) was analyzed. Standardized uptake value (SUV) max, mean, PSMA/Choline total volume, and total lesion PSMA/Choline were calculated for all identified lesions using LifeX software. ***Results:*** Of the 286 lesions identified, the majority 140 (49%) were lymph node metastases, 118 (41.2%) were bone metastases and 28 lesions (9.8%) were locoregional recurrences of prostate cancer. The median SUVmax value was significantly higher for ^{18}F-PSMA compared to ^{18}F-Choline for all 286 lesions (8.26 vs. 4.99 respectively, p<0.001). There were statistically significant differences in median SUVmean, PSMA/FCH-TV and TL-PSMA/FCH between the two radiotracers (4.29 vs. 2.92, 1.97 vs. 1.53 and 7.31 vs. 4.37 respectively, p<0.001). The correlation between SUVmean/ SUVmax and PSA level was moderate, both for ^{18}F-PSMA (r=0.44, p<0.001; r=0.44, p<0.001) and ^{18}F-Choline (r=0.35, p<0.001; r=0.41, p<0.001). TL-PSMA/FCH demonstrated statistically significant positive correlations with both PSA level and PSA velocity for both ^{18}F-PSMA (r = 0.56, p < 0.001; r = 0.57, p < 0.001) and ^{18}F-Choline (r = 0.49, p < 0.001; r = 0.51, p < 0.001). While patients who received hormone therapy showed higher median SUVmax values for both radiotracers compared to those who did not, the difference was statistically significant only for ^{18}F-PSMA (p < 0.05) ***Conclusion:*** Our study suggests that ^{18}F-PSMA-1007 outperforms ^{18}F-Choline in detecting metastatic lesions based on radiomic features and quantitative biomarkers in BCR patients. This improved performance may be particularly relevant for patients with lower PSA levels. ***References:*** 1. Panagiotidis E et al. Comparison of ^{18}F-PSMA-1007 and ^{18}F-Choline PET/CT in prostate cancer patients with biochemical recurrence: a phase 3, prospective, multicenter, randomized study. Nucl Med Commun. 2023;44:1126-34. 2. Panagiotidis E et al. Review of artificial intelligence clinical applications in Nuclear Medicine. Nucl Med Commun. 2024;45:24-34.

EP-0251

Evaluation of a novel the most promising radiofluorinated PSMA inhibitor ^{18}F-siPSMA-14 in patients with biochemical recurrence of prostate cancer (PCa)- initial experience

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Aim/Introduction: The encouraging preclinical assessment of $^{[18F]}$siPSMA-14 was confirmed in an promising proof-of-concept study in PCa males. The aim of this study was to analyze the diagnostic value of $^{[18F]}$siPSMA-14 in patients with PC undergoing imaging for biochemical failure after radical therapy and to define the predictive factors of 18F-siPSMA PET/CT positivity in this context. ***Materials and Methods:*** We performed a retrospective analysis of 67 consecutive patients with biochemical recurrence (BCR) after radical treatment for PC (surgery or radiotherapy (RT)) who underwent 18F-siPSMA-14 PET/CT between November 2023 and February 2024. Potential influences of several factors such as age, International Society of Urological Pathology (ISUP) grade, T stage, actual PSA (aPSA) value and androgen deprivation therapy (ADT) were evaluated. Univariate statistical analysis was performed to assess parameters associated with 18F-siPSMA-14 PET/CT positivity. ***Results:*** The mean age (± SD), median iPSA and aPSA of the patients were: 69.7 (8.2) years, 14.0 ng/ml and 2.5 ng/ml, respectively. 18F-siPSMA PET/CT detected recurrent disease in 49 patients (73.1%). In 24 patients (35.8 %) a local recurrence was revealed. Metastatic lymph nodes incidence was 20 (29.9%). Bone metastases were observed in 22 patients (32.8%) and visceral metastases in 3 patients (4.5%). Lymph nodes plus bone metastases were detected in 6 patients (9.0 %). In univariate analysis, the ISUP groups, the T stage and ADT were found to be predictors of positivity. Tumor-detection was positively associated with iPSA and aPSA levels, whereas ISUP grade, T stage and EAU risk groups showed only a positive tendency. The detection rates were 22.2%, 50.0%, 60.0%, 66.7%, 77.8%, 90.0% and 95.5% for aPSA levels (ng/ml) of 0.2- <0.3, 0.3- <0.4, 0.4- <0.5, 0.5- <1.0, 1.0- <2.0, 2.0- <5.0 and ≥ 5.0, respectively. aPSA was significantly higher in PSMA-positive patients than in PSMA-negative patients (p=0.037). PET-positive males presented a faster kinetic (PSAdt), p =0.074. 18F-PSMA-14 PET/CT was positive in 5 of 6 patients (83.3%) with PSA <0.5 ng/mL and PSAdt <6 months, and in 3 of 14 patients (21.4 %) with PSA <0.5 ng/mL and PSAdt≥6 months. ***Conclusion:*** $^{[18F]}$siPSMA-14 shows excellent kinetics for the restaging of Pca and provides high detection rates of recurrent PC after radical treatment even in close proximity to the bladder and at low aPSA levels. The PSA value at the time of the examination appear to be the main predictor of 18F-siPSMA PET/CT positive findings. Tumor detection is positively associated with iPSA and aPSA levels.

EP-0252

Clinical Value of Volumetric Parameters PSMA-TL and PSMA-TV in Patients with Early Biochemical Recurrence of Prostate Cancer

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Aim/Introduction: Our study aimed to assess if there are any correlations between quantifiable volumetric parameters PSMA-TV (PSMA tumour volume), PSMA-TL (PSMA total lesion uptake = PSMA-TV * SUVmean) and whole-body tumour burden (1) with already well-established biochemical biomarkers and risk factors of prostate cancer (PC), as well to compare them with treatment response in patients with early onset of biochemical recurrence and low serum PSA values (<2 ng/ml). ***Materials and Methods:*** We performed a retrospective analysis of 55 patients with biochemical recurrence of PC who underwent 68Ga-PSMA PET-CT scan. Lesions with visually higher uptake compared to the surrounding tissue were rated as PSMA-positive, indicating local recurrence or metastases. In total 198 PSMA avid lesions were reported and analysed further. We used volumetric semi-automatic analysis (Syngo.via volumes of interest (VOIs) with isocontours) to calculate SUVmean, PSMA-TV and PSMA-TL. Whole-body PSMA-total volume (wbPSMA-TV) and whole-body PSMA-total lesion (wbPSMA-TL) were calculated by the sum of each lesion. ***Results:*** A high positive correlation was found between serum PSA values and wbPSMA-TL (Pearsons r=0.628; p< 0.001) and between PSA and wbPSMA-TV (Pearsons r=0.533; p< 0.001). wbPSMA-TV and wbPSMA-TL values were significantly higher in the intermediate unfavourable and high-risk group (ISUP 3,4,5) than in the favourable intermediate and low-risk group (ISUP 1,2) (p<0.001). Patients with shorter PSAdt (doubling time) of less than 6 months also had significantly higher values of wbPSMA-TV and wbPSMA-TL. ***Conclusion:*** PSMA-derived volumetric parameters are excellent imaging biomarkers for the whole-body tumour burden of PC. Higher PSA values, unfavourable PSAdt and high ISUP grade groups are all associated with larger tumour volumes. Whole-body PSMA-TL especially showed a superior correlation with PSA values and should be added in scan reports as an adequate semi-quantitative evaluation of disease. Higher wbPSMA-TV and wbPSMA-TL were also associated with a lower percentage of complete or partial biochemical response.

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EP-0253

Prediction of biochemical recurrence in patients following radical prostatectomy using preoperative [^{68}Ga]Ga-PSMA PET/CT prostate lesion uptake features

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Aim/Introduction: Biochemical recurrence (BCR) after radical prostatectomy (RP) remains a challenge, affecting a substantial proportion of patients. Despite the development of clinical models integrating traditional prognostic indicators such as PSA levels, clinical T staging, and Gleason score, their predictive accuracy for BCR remains suboptimal. [68Ga]Ga-PSMA PET/CT is a fundamental tool for staging and re-staging after RP. However, the prognostic potential of staging [68Ga]Ga-PSMA PET/CT to predict BCR after RP has been rarely investigated. Therefore, this study aims to investigate whether staging [68Ga]Ga-PSMA PET/CT has predictive value for BCR after RP. ***Materials and Methods:*** The dataset was retrospectively collected from patients who underwent a staging [68Ga]Ga-PSMA PET/CT scan followed by RP at our hospital, from 2017 to 2020. From the 80 patients initially found, 18 were later excluded: 5 since [68Ga]Ga-PSMA PET/CT was performed outside of our institute, and their PET data were unavailable; 8 because they required adjuvant radiotherapy post-RP; 3 due to persistence and subsequent biochemical progression within the first three months after RP; and 2 had also other primary tumors. At surgery, the final dataset (62 patients) had a mean age of 64±6.5 years and, a PSA of 8.91±6.61 ng/mL. All prostate lesions were identified and semi-automatically segmented based on a Bayesian classifier algorithm in the [68Ga]Ga-PSMA PET/CT images by an experienced observer. Prostate lesion PSMA-uptake-related SUVmax, SUVpeak, SUVmean, MTV, and TL-PSMA were extracted. Clinicopathological variables were also collected, namely, Gleason score, clinical T staging, N staging and grade group at RP, and time to BCR or follow-up. Cox regression analysis was performed to assess the association between PSMA-uptake-based features and clinicopathological features with the time to BCR. ***Results:*** During follow-up, 26 patients (42%) experienced BCR with a median time of 1904 days (95%CI:1442-2366) post-RP. Cox multivariate analysis conducted on PSMA-uptake-based features revealed that only SUVpeak was a statistically significant predictor (HR=1.10, 95%CI:1.01-1.19), suggesting a 10% increase in the expected hazard of BCR for an increase of 1 in SUVpeak (IBM SPSS software, Backward Stepwise - LR Conditional). Cox multivariate analysis showed that when clinical T staging, Gleason score, and SUVpeak were assessed together, SUVpeak still preserved potential as an independent predictor of BCR, although not statistically significant (HR=1.08, 95%CI:0.99-1.18). ***Conclusion:*** Our results show that SUVpeak might be an independent predictor of BCR after RP, thus emphasizing the value of staging [68Ga]Ga-PSMA PET/CT. Further studies with larger datasets should be performed to confirm this finding.

EP-0254

Prostate Cancer Survival Time Prediction Using Radiomic Features from PET/CT Scans

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Aim/Introduction: Prostate cancer poses a significant challenge due to its high prevalence and unfavourable outcomes for patients with metastatic disease. This study aims to develop a model to predict overall survival (OS) for patients with metastatic biochemically recurrent (BCR) prostate cancer. Such advancements could facilitate personalised treatment approaches, potentially extending patient survival durations. ***Materials and Methods:*** A multi-centre cohort of 238 patients diagnosed with BCR metastatic prostate cancer were included in

the study. Each patient underwent a [68Ga]Ga Prostate Specific Membrane Antigen (PSMA)-11 PET/CT scan, with lesions manually segmented by an expert nuclear medicine physician. From these scans, radiomic features, including various quantitative imaging metrics, were extracted from the identified lesions. We conducted a univariate analysis using Kaplan-Meier curves and Cox proportional hazards models to identify radiomic features correlated with OS. Radiomic data was then combined with key clinical parameters, including age, weight, and initial staging, for multivariable analysis. Three models were compared: a clinical-only, radiomics-only, and a combined feature model, using a Cox proportional hazards model. To ensure robustness, we resampled the dataset 1000 times using bootstrapping techniques. This was done to establish 95% confidence intervals (CI) for optimism-corrected concordance indices and to identify highly prognostic features within each model group. Finally, we developed custom predictive models based on these highly prognostic features to improve predictive capabilities. ***Results:*** In our univariate analysis, 68 out of 118 radiomic features correlated significantly with OS, including total lesional volume, maximum 2D diameter of the lesion, and distribution of pixel intensity, among others. The optimism-corrected 95% CI for the concordance indices of the multivariable models were as follows: radiomics-only model 0.671 (95% CI, 0.554-0.742), clinical-only model 0.721 (95% CI, 0.651-0.779), and combination model 0.724 (95% CI, 0.656-0.785). Both the clinical-only and combination models exhibited similar performance; however, further analysis is required to verify these results. Additionally, traditional clinical features like age, staging, and lesion count were consistently correlated with OS. ***Conclusion:*** Preliminary results generated from this study indicate that radiomics features in combination with standard clinical variables have the potential to prognose patient OS. Comparisons between this combined model and individual radiomic and clinical models will be undertaken to determine the additive benefit that radiomics has. Accurate predictions of OS can guide clinicians in tailoring treatments, thereby improving patient outcomes, especially for metastatic prostate cancer.

EP-0255

The utility of the PET/CT with ^{18}F-Piflufolastat in the localization of locoregional and distant recurrence in patients diagnosed with prostate cancer and its relationship with the different ISUP prognostic grades and PSA values.

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Aim/Introduction: To determine the detection rates of locoregional and distant recurrences in patients with prostate cancer by PET/CT with 18F-Piflufolastat and its positivity in relation to different ISUP prognostic grades and PSA values. ***Materials and Methods:*** We included 358 patients (68.8 years ± 7.2 years), diagnosed with prostate cancer, who were referred to our department for a PET/CT study with 18F-Piflufolastat, between October/2020 and April/2024, due to biochemical recurrence. The initial curative treatment for the majority was radical prostatectomy (320/358). A PET/CT study, centred on the cranium-pelvis, was acquired 120 minutes after intravenous administration of 333 MBq of 18F-Piflufolastat, after administration of 20 mg of furosemide 60 minutes prior to image acquisition. In the positive studies, the SUVmax value of the target lesion was located and quantified. The rate of positive PET/CT studies was calculated as a function of ISUP grades and PSA value at recurrence, as well as the correlation of SUVmax value with the different prognostic grades. ***Results:*** Patients were classified into three groups according to their prognostic grade at diagnosis (ISUP Grades), ISUP 1: 56/358, ISUP 2-3: 172/358 and ISUP 4-5: 127/358. 2/290 patients had no medical reports. PET/CT localised the recurrence in 58.9% of patients (211/358), with an average SUVmax value of the target lesions of 11.2. The most frequent site of target lesions was: prostate/prostatic bed 30.80% (65/211), pelvic lymphadenopathy 45.02% (95/211), retroperitoneal lymphadenopathy 8.53% (18/211), bone 14.21% (30/211) and other 1.42% (3/211). The proportion of positive scans according to ISUP prognostic groups was: ISUP 1: 48.21% (27/56), ISUP 2-3: 56.97% (98/172) and ISUP 4-5: 66.14% (84/127) and according to PSA values (ng/ml) at recurrence was: between 0.2-0.5: 42.10% (72/171), 0.51-1: 69.42% (84/121), 1.1-2: 80% (28/35) and ≥2: 87.09% (27/31). There was no significant difference between SUVmax values of target lesions according to ISUP grades. ***Conclusion:*** PET/CT with 18F-Piflufolastat is a useful technique for localisation of recurrence in patients with biochemical recurrence of prostate cancer. The pelvic lymph node disease was the most frequent localisation. A significant increase in the proportion of positive scans is observed the higher the PSA levels at recurrence and the ISUP prognostic grade at diagnosis, however, the mean SUVmax value of target lesions does not correlate with ISUP grades.

EP-0256

PSMA-RADS in the assessment of ^{18}F-DCFPyL (PSMA) PET/CT and its correlation with prostate-specific antigen values.

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Aim/Introduction: To evaluate the findings of 18F-DCFPyL PET/CT in biochemical recurrence (BCR) of prostate cancer (PC) treated with curative intent using the PSMA-RADS version 1.0 classification and its correlation with PSA and its kinetics. ***Materials and Methods:*** Observational and prospective study, including patients with BCR of PC, who underwent 18F-DCFPyL imaging between October 2020 and August 2022. Results were categorized as positive and negative, using confirmatory parameters such as pathological anatomy, other imaging tests, and/or clinical follow-up. Lesions were classified according to their prostate-specific membrane antigen (PSMA) expression intensity (IS) (score 0-3) and their probability of malignancy using the PSMA-RADS version 1.0 system. Finally, we analysed the association between IS and PSMA-RADS with PSA values and kinetics. ***Results:*** A total of 101 patients were included (mean age: 63.24±6.37 years). 88 patients had a positive 18F-DCFPyL study (detection rate: 87.1%). 21.8% had recurrence in the prostatic fossa, 29.7% pelvic lymph node involvement, 9% retroperitoneal involvement, and 22.8% distant disease. A total of 199 lesions were detected. Of them, 1.6% had an IS-0, 50.5% IS-1, 25.8% IS-2, and 22% IS-3; with 2.2% classified as PSMA-RADS-1, 4.8% as PSMA-RADS-2, 26.3% as PSMA-RADS-3A, 21% as PSMA-RADS-3B, 0.5% as PSMA-RADS-3D, 36.6% as PSMA-RADS-4, and 8.6% as PSMA-RADS-5. PSA trigger values showed association with PSMA-RADS (p= 0.04) and IS (p= 0.037). Similarly, PSA velocity was associated with PSMA-RADS (p= 0.015). ***Conclusion:*** 18F-DCFPyL PET/CT

demonstrates good performance in detecting BCR of PC. PSMA-RADS classification is feasible in clinical practice and is associated with PSA values.

EP-0257

[68Ga]-Ga PSMA PET/CT in Detecting the Prostate Cancer Recurrence after HIFU and Brachytherapy Treatment: a Retrospective Analysis.

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Aim/Introduction: Focal therapy presents an encouraging approach for selectively treating clinically significant localized prostate cancer (PCa), with minimal invasiveness and potentially more cost-effectiveness. Among these therapeutic options, High-Intensity Focused Ultrasound (HIFU) and brachytherapy, remain limited due to the lack of long-term evidence regarding their efficacy in tumor control. It's recommended to conduct patient follow-ups utilizing biopsies and multiparametric MRI (mpMRI). Nevertheless, mpMRI results after intervention frequently yield false negatives. PET/CT with PSMA has shown promising results in identifying recurrence or residual disease following brachytherapy and HIFU therapy, with high sensitivity and specificity in detecting prostate cancer lesions, including those missed by conventional imaging modalities. Therefore, it can be a valuable tool in post-treatment surveillance, aiding in the early detection of recurrence or residual disease, which may prompt timely intervention or further treatment adjustments. ***Materials and Methods:*** We retrospectively analyzed patients with history of PCa who underwent [68Ga]Ga-PSMA PET/CT for biochemical recurrence (BCR) after HIFU or brachytherapy. Patients were screened from 2016 to 2024. ***Results:*** 22 patients were enrolled in the study. The population included 5 (23%) patients with low-risk PCa, 2 (9%) with intermediate risk, 5 (23%) with intermediate unfavorable risk, 3 (14%) with high risk and for 7 (32%) patients the GS was not known. 7/22 (32%) underwent HIFU, while 15/22 (68%) underwent brachytherapy. Among these patients, 1 underwent HIFU after radical prostatectomy (RP), 4 underwent hormonal therapy after focal therapy, while 2 underwent RP after brachytherapy. The median time elapsed from the procedure to the PET scan execution was 77 months (17 - 90). The median PSA value at the time of investigation was 3 ng/ml (1 - 4). The [68Ga]Ga-PSMA PET/CT was able to identify the site of PCa recurrence in 63,6% (14/22) of patients with BCR. 7/14 (50%) out of the positive PSMA PET/CT scans were found to be positive at the prostate with median SUVmax of 13 (6 - 16); 2/14 (14%) were positive at lymph node level with median SUVmax of 4 (3 - 9) while 4/14 (28%) of them were found to have metastatic localization with median SUVmax of 8 (7 - 9). ***Conclusion:*** Focal therapies, such as HIFU and brachytherapy, are minimally invasive and cost-effective, representing a good therapeutic option in the treatment of localized and clinically significant PCa. PSMA PET/CT is an effective diagnostic tool to detect a recurrence of the disease and plan a potential new treatment.

EP-0258

Impact of [18F]PSMA-1007 PET Imaging on Diagnosis and Management of Recurrent Prostate Cancer - A real-world-experience with a bi-centric, retrospective study involving 776 patients

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Aim/Introduction: As the first approved 18F labelled PSMA-ligand in Europe, [18F]PSMA-1007 is supposed to draw the attention of uro-oncological community increasingly due to its practicability and superior diagnostic performance in low PSA-window compared with its counterparts. Several studies, to date, have underscored the abovementioned features of this ligand in a series of small to moderately large cohorts. We aimed, however, to demonstrate the diagnostic performance of [18F]PSMA-1007 with a large cohort in a real-world setting in patients with biochemical recurrence (BCR), as this represents probably the leading indication for PSMA-PET. Another endpoint of this study was to determine the impact of the diagnostic performance in terms of therapy management. ***Materials and Methods:*** This bicentric retrospective study included 776 patients with BCR, who have undergone [18F]PSMA-1007 imaging in University Hospital Duesseldorf and University Hospital Heidelberg as part of routine clinical care. We correlated the detection rate of [18F]PSMA-1007 with different PSA cutoff levels across our entire cohort. Additionally, we analyzed the incidence of different types of malignant lesions in the setting of BCR like local recurrence (LR), lymph node (LNM), bone (BM), or distant metastases. Furthermore, we investigated the impact of [18F]PSMA-1007 in terms of the subsequent clinical management strategies. ***Results:*** [18F]PSMA-1007 PET/CT detected lesions in 659 of 776 cases (84,9%). Categorized according to different PSA cutoff levels, the detection rate was found to be 68.6%, 85.6%, 87.5% and 95.8% for PSA levels of 0.2 - <0.5, 0.5 - <1.0, 1.0 - <2.0 and ≥2, respectively. The most frequent PSMA positive lesions were pelvine LNM (38.8%) followed by LR (35.2%) and BM (34.4%). Due to losses from the follow-up, we could evaluate the subsequent clinical management only in 506 cases (30,8% wait and watch, 29,4% PSMA-guided radiotherapy, 20,0% ADT, 8,7% further diagnostics, 4,7% radiotherapy (PSMA-guided) and ADT, 4,2% surgery, 2,2% chemotherapy). Patients with LR (n=173) tended to undergo PSMA-guided radiotherapy more frequently compared to other subgroups (37% PSMA-guided radiotherapy, 27% ADT, 13% wait and watch, 10% further diagnostics, 9% radiotherapy (PSMA-guided) and ADT, 4% surgery). ***Conclusion:*** Obviously, with increasing expertise in PSMA reporting and improved patient pre-selection, we observe the diagnostic performance of [18F]PSMA-1007 imaging even increasing in comparison to the existing literature data. Correspondingly, this impacts the subsequent therapy approach, especially by LR, due to increasing rates of personalized PSMA-guided therapy management. ***References:*** Giesel et al., J Nucl Med 2019; 60:362-368, DOI: 10.2967/jnumed.118.212233.

EP-0259

Optimized detection of local recurrence of prostate cancer using dual-time [18F]PSMA-1007 imaging with combination of TOF and PSF reconstruction

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Aim/Introduction: [18F]PSMA-1007 imaging has significantly improved the diagnostic accuracy in patients with biochemical recurrence (BCR) due to its predominantly hepatobiliary excretion, enabling a better assessment of small lesions in prostate bed. Yet, accurate detection of local recurrence (LR) in early BCR of prostate cancer (PC) represents one of the major challenges due to typically small lesion size resulting in relatively low PSMA uptake. Within this analysis, we sought to assess the impact of dual-time point acquisition protocol and the added value of the reconstruction algorithm with combination of TOF (time of flight) and PSF (point spread function) on the accurate detection of LR in BCR. ***Materials and Methods:*** We retrospectively included 36 consecutive patients with suspect LR in BCR who received a [18F]PSMA-1007 PET/CT scan with late images of the pelvis per standard clinical care. We evaluated tracer uptake and tumour to background ratio (TBR) using semiquantitative PET parameters on baseline and late images based on the reconstruction algorithms of ordered subset expectation maximum (OSEM) and the combination of TOF and PSF. ***Results:*** LR was detected on baseline images with OSEM in 33 cases with a median SUVmax of 5.2 (range 2.4 - 18.2) and a median TBR of 6.4 (range 2.9 - 14.0) and in all 36 cases on baseline images with TOF+PSF reconstruction algorithm with median SUVmax of 9.4 (range 4.1 - 36.4) and a median TBR of 8.0 (range 3.5 - 16.5). An added value of late images was observed on the images with OSEM (median SUVmax of 6.5 (range 2.2 - 21.7)) as two further cases with LR were detected compared with baseline. TOF+PSF led to a significant increase of semiquantitative parameters on late images (median SUVmax of 10.8 (range 4.0 - 40.9)). Late images of pelvis provided a better detectability of lesions located at critical sites such as vesicourethral anastomosis. The subsequent therapy could be followed up in 19 cases: 14 patients received PSMA-guided radiotherapy, 3 active surveillance, 1 ADT and 1 PSMA-guided radiotherapy plus ADT. ***Conclusion:*** This study highlights the substantial added value of TOF+PSF reconstruction algorithm and dual-time point protocol on the detection of small-sized lesions with only faint tracer uptake in prostate bed in BCR. Furthermore, the dual-time imaging would improve the diagnostic certainty for the lesions at critical sites such as vesicourethral anastomosis and ensure individualized therapy management.

EP-0260

Experiences with 18F-JK-PSMA-07 PET/CT Scans in Biochemical Recurrence of Prostate Adenocarci

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Aim/Introduction: Prostate-specific membrane antigen (PSMA)-based molecular imaging is currently the most sensitive method for confirming and localizing tumor recurrence in the biochemical recurrence of prostate cancer after primary definitive therapy. ***Materials and Methods:*** We performed a retrospective analysis of data from 54 patients who presented with biochemical recurrence (total serum prostate-specific antigen [PSA] elevation) after definitive treatment, and underwent 18F-JK-PSMA-7 PET/CT scans between July 2021 and January 2024. PET/CT scans were evaluated for the presence of local recurrence, lymph node and distant metastases. Patients were divided into two subgroups according to pre-test PSA level and PSA doubling time (PSAdt). Detection rates (DR) were calculated for the entire patient group and for the subgroups. In case of PSMA PET-positivity, we examined whether there was correlation between the maximum standardized uptake value (SUVmax) of the most intense lesion and the PSA level or PSAdt. ***Results:*** 43 of 54 patients presented with PSMA-avid lesions consistent with prostate carcinoma, resulting in a per patient DR of 79.6% . Pathological PSMA-avid lesions were most commonly found in the prostate bed (n=19) and pelvic lymph nodes (n=19), and suspected tumour spread was also reported in extrapelvic lymph nodes (n=7), bones (n=16) and other organs (n=4). DRs per subgroups were as follows: PSA≤1 ng/ml: 57.9% vs. PSA>1 ng/ml: 91.4% (p=0.027); and PSAdt≤6 months: 80.8% vs. PSAdt>6 months: 78.6% (p=NS). Patients with PSA≤1 ng/ml and PSAdt>6 months formed a group with especially low DR of 54,5%. In patients with PSMA positivity, the most intense lesion SUVmax was significantly higher in the PSA>1 ng/ml group than in patients with PSA≤1 ng/ml (20.2±31.8 vs. 9.6±7.9; p=0.0374). Similarly, higher SUVmax values were also measured in patients with PSAdt less than 6 months than in patients with more moderate PSAdt (20.8±33 vs. 11±8; p=0.006). ***Conclusion:*** PSMA PET/CT is a sensitive method for the detection and localization of recurrent prostate carcinomas with the highest detection rate for PSA levels above 1 ng/ml and/or short PSAdt, in accordance with literature. On the other hand, detection rate was considerably low in patients with low PSA levels and long PSAdt. The uptake intensity of 18F-JK-PSMA-7 showed correlation with PSA levels and (invertedly) with PSAdt.

EP-0261

Impact of short-term androgen deprivation therapy on PSMA PET/CT in prostate cancer patients suspected biochemical recurrence

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Aim/Introduction: PSMA PET/CT has now spread worldwide and is clinically useful in staging and determining recurrence of prostate cancer. The correlation between androgen deprivation therapy (ADT) and PSMA ligand uptake in patients has been analyzed by several researchers, which has important implications

for judging metastatic lesions, especially biochemical recurrence. In this study, it was performed to analyze the correlation between PSA and PSMA parameters, and their effect on PSMA PET/CT according to short-term ADT use in patients with suspected biochemical recurrence. ***Materials and Methods:*** Patients who underwent 68Ga-PSMA-11 PET/CT scans between November 2023 and March 2024 (n = 186) were retrospectively evaluated. Clinical information including pathologic result with Gleason score, PSA level, and ADT status were evaluated. The maximal standardized uptake value (maxSUV) of urethral anastomosis site and suspected metastatic lesions on 68Ga-PSMA-11 PET/CT was measured. Descriptive statistics included the mean ± standard deviation for each clinical characteristic. Student t-tests and Mann-Whitney U tests were used for comparing quantitative variables with or without a normal distribution, respectively, between the groups. Correlations between two variable distributions were analyzed with the Pearson correlation coefficient (PCC). ***Results:*** Sixty-four patients who performed 68Ga-PSMA-11 PET/CT for evaluation of biochemical recurrence after radical prostatectomy were finally included in this study: 39/64 (61%) were treated with ADT before PET scan. The clinical parameters between the two groups based on short term ADT use before PET scan were not statistically significant (age, 66.97 ± 6.41 vs 69.04 ± 7.57, p = 0.238; Gleason score, 7.44 ± 0.75 vs 7.74 ± 0.95, p = 0.20; PSA level, 0.57 ± 0.63 vs 0.84 ± 0.93, p = 0.169). The maxSUVs of suspected metastatic lesions on PSMA PET scan were weakly and positively correlated with PSAs at scan time (PCC = 0.25, p = 0.048). In addition, the maxSUVs of the group without ADT use before PET scan were moderately and positively correlated with PSA levels (PCC = 0.51, p < 0.01). On the other hand, the maxSUVs in the group with ADT use were not correlated with PSA levels (PCC = 0.21, p = 0.302), suggesting that ADT probably affected PSMA ligand uptake in the metastatic lesion. ***Conclusion:*** The short-term use of ADT before PSMA PET/CT may significantly affect the visibility of recurrent or metastatic lesions on PSMA PET/CT in patients with suspected recurrence. Therefore, performing PSMA PET/CT first may need to be considered before initiating ADT.

EP-0262

Comparison of ^{18}F-PSMA-1007 and ^{18}F-DCFPyL PET-CT in prostate cancer patients with occult biochemical recurrence with low PSA values.

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Aim/Introduction: Our porpouse was to compare the diagnostic accuracy and equivocal findings of PET-CT ^{18}F-DCFPyL and ^{18}F-PSMA-1007 in occult biochemical recurrence (BCR) of prostate carcinoma (PCa) with low PSA values. ***Materials and Methods:*** Sixty-eight patients underwent a PSMA-ligand PET-CT for BCR of PCa evaluation, ^{18}F-DCFPyL or ^{18}F-PSMA-1007, depending of the availability of the radiopharmaceuticals without other criteria. ^{18}F-DCFPyL was synthesized and delivered by Curium Pharma Spain and ^{18}F-PSMA-1007 by IRAB Spain . Patients received an intravenous injection between 299 to 333MBq. After 90 min, a Whole body PET with a diagnostic CT Scan were performed in a Siemens Biograph, following recomendations of EANM Guidelines. Iodine endovenous contrast was given except contraindications. PET/CT images were reviewed using SyngoVia-20 (Siemens Healthineers) by two experimented nuclear medicine physicians . Imaging standardized evaluation for the interpretation of PSMA-Ligand PET/CT for Prostate Cancer Molecular (PROMISE) were used. ***Results:*** 34 patientes (50%) underwent a PET-CT with ^{18}F-PSMA-1007, and the other 34 with ^{18}F-DCFPyL. Not statistical differences betweeen both groups were found in clinical initial staging (ISUP and PSA values), primary treatments even PSA nadir after primary. PSA BCR values just before PET-CT were similar (PET-1007 group median: 0.5ng/mL; PET-DCFPyL group median: 0.6ng/mL, p:0.419), and was no statistical differences in PSA doubling time (p:0.524). PET positive findings for recurrence of PCa were observed in 20 of 34 (58.8%)in PET-PSMA-1007 group, and 15 of 34 (45.5%) in PET-DCFPyL group, but not statistical differences were found (p:0.332). Locations of the recurrences were similar, p:0.538, (local: 17.6% vs 15.2%; and adenopathy: 32.4% vs 21.2%, respectively). A statistically significant higher number of non-cancer related bone images (intermediate or high PSMA expresión) was observed in the PET-1007 group (29.4% vs 6.7%, p:0.026), mostly in ribs. Just one extra imagen study (bone MRI) was needed to clarify PET equivocal bone finding. ***Conclusion:*** ^{18}F-PSMA-1007 and ^{18}F-DCFPyL PET-CT show very similar results in the assessment of BCR of PCa with low PSA values. A higher number non-PCa related bone images was observed in the PET-1007 group, with non increase of equivocal diagnosis in the final report , done by a nuclear medicine expert.

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Study of the added value of late PET/CT with $^{[18F]}$F-DCFPyL in the evaluation of patients with prostate cancer.

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Aim/Introduction: To evaluate the utility of 120-minute delayed images compared to standard images acquired at 60 minutes with PET/CT $^{[18F]}$ F-DCFPyL in patients with prostate cancer. ***Materials and Methods:*** Retrospective study of 39 patients with prostate cancer (69.5 ± 7.01 years) referred to the service between November 2022 and December 2023. Of these patients, 33 had suspected recurrence (PSA range: 0.22-12 ng/mL), 5 were for initial staging (high risk), and 1 was referred to assess treatment response. All patients underwent a $^{[18F]}$F-DCFPyL PET/CT study from the cranial vertex to the mid-thighs at 60 minutes post-injection (p.i.) and an abdominopelvic PET/CT at 120 minutes p.i. For quantitative analysis, SUVmax was calculated for the parotid glands, liver, vascular pool, and target lesions on the 60-minute images, and SUVmax of the liver, vascular pool, and target lesions at 120 minutes were determined. In addition, the intensity of PSMA expression (PSMA score, 0-3)[1] was determined, and the PROMISE guide was used for molecular staging (miTNM) [2] . ***Results:*** In 11/39 patients, the study was negative (28.2%) at 60 and 120 minutes. In 26/28 patients, there was an increase in SUVmax of $^{[18F]}$F-DCFPyL on the 120-minute images (92.3%). Pathological uptake was only detected in the 120-minute images in 2 patients. In 9/26 patients, the PSMA score increased, while the miTNM was only modified in 4. Of these 4 patients in whom the miTNM was modified, there were changes in patient management

in 2 of them (2/26). ***Conclusion:*** Preliminary findings indicate that although there is an increase in [18F]F-DCFPyL uptake in PET/CT images at 120 minutes p.i., this increase does not appear to be significant enough to justify changes in patient clinical management. ***References:*** 1-Ceci F, Oprea-Lager DE, Emmett L, et al. E-PSMA: the EANM standardized reporting guidelines v1.0 for PSMA-PET. Eur J Nucl Med Mol Imaging. 2021 May;48(5):1626-1638. 2-Eiber M, Herrmann K, Calais J, et al. Prostate Cancer Molecular Imaging Standardized Evaluation (PROMISE): Proposed miTNM Classification for the Interpretation of PSMA-Ligand PET/CT. J Nucl Med. 2018 Mar;59(3):469-478.

EP-0264

Intraindividual comparison of Ga-68-AMTG and Ga-68-PSMA PET/CT in patients with mCRPC in a theranostic setting

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Aim/Introduction: While 68Ga- / 177Lu - labelled PSMA has shown promising results in theranostics settings for patients with mCRPC, still 10-20% of patients with recurrent prostate cancer have no sufficient PSMA expression or it is lost during the course of treatment. For this reason alternative options targeting other expressed molecular entities, like the GRPr antagonists, are being studied. RM2 showed a potential complementary theranostic role together with PSMA, but in vivo studies showed a low in vivo stability of the peptide. New approaches include substitution of unstable aminoacid endings in the RM2 molecule with more stable aminoacid bonds, resulting in derivate molecules like AMTG. Preclinical comparison with Cu-64 and Ga-68 labelled RM2 and AMTG showed promising results with more favorable pharmacokinetics and increased metabolic stability for diagnostic imaging using the derivate AMTG. Thus is to presume that AMTG would be a suitable option for theranostics in PSMA-negative prostate cancer. ***Materials and Methods:*** 13 mCRPC patients were scanned with [68Ga]Ga-PSMA-11 as well as [68Ga]Ga-AMTG to identify PSMA or AMTG positivity, 3 of the 2 times, resulting in a total of 17 examinations. Visual uptake and semi-quantitative parameters (SUVmax, SUVpeak, Total Tumor Volume (TTV) and Total Lesion Metabolism (TLM) were compared in 112 metastatic reference lesions (38 lymph nodes, 67 bone, 5 liver, 2 others). ***Results:*** In the visual assessment all patients showed a PSMA uptake of any grade, of whom only 4 showed a higher, 12 a lower and 1 no AMTG uptake. In 3/17 examinations showed complementary AMTG-positive / PSMA-negative and AMTG-negative / PSMA-positive lesions. SUVmax and SUVpeak were higher for PSMA than for AMTG subsuming all reference lesions. A separate analysis regarding uptake in different lesions was significantly relevant: lymph node ($p = 0.0015$), bone ($p = 0.0131$) and liver metastases ($p = 0.0625$). ***Conclusion:*** Most of the included advanced mCRPC patients presented with a higher number of PSMA-positive lesions and higher uptake on [68Ga]Ga-PSMA compared to [68Ga]GaAMTG PET/CT. Almost no lesion showed high PSMA and AMTG uptake simultaneously, suggesting a fundamental change in tumor biology. Patients with absent or weak PSMA but high AMTG uptake may benefit from the use of [68Ga]Ga-AMTG in restaging and a theranostic approach with additional [177Lu]Lu-AMTG therapy.

EP-0265

The predictive ability of pre-therapeutic ^{18}F-PSMA-1007 PET/MRI imaging features for biochemical recurrence after primary definitive treatment for prostate cancer

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Aim/Introduction: Radical prostatectomy (RP) remains the recommended treatment for patients with localized prostate cancer (PCa). However, nearly 40% of patients experience biochemical recurrence (BCR) after primary definitive treatment. The clinical D'Amico risk-group stratification model has been developed to predict BCR, including preoperative prostate-specific antigen (PSA), clinical T staging, and Gleason scores from histopathology. Clinical studies showed that the D'Amico model's predictive accuracy for 5-year BCR was below than 70%. It has been reported that either MR assessment or PSMA PET imaging has promising predictive ability respectively for BCR of PCa after prostatectomy. In this study, we aim to evaluate the predictive value of pre-therapeutic images obtained by integrated PET/MR with ^{18}F-PSMA-1007 for postoperative BCR in PCa patients, and to establish a predictive model for BCR by using gained multiple-modality parameters. ***Materials and Methods:*** Consecutive patients, who underwent pre-therapeutic ^{18}F-PSMA-1007 PET/MR imaging from double hospitals in shanghai and were followed up for at least two years after RP, were included in this retrospective double-center study. The correlation between PET/MR multiple parameters and the risk of BCR were analyzed by Chi-square test. The COX multivariate regression analysis was utilized to identify significant influencing PET/MR parameters. Their relationship with the outcomes after surgery was tested through Kaplan-Meier analysis. Finally, a predictive model based on ^{18}F-PSMA-1007 PET/MR was developed, and its predictive performance was compared with that of D'Amico, single-factor SUVmax or PI-RADS model. ***Results:*** 71 patients were included, whose ^{18}F-PSMA-1007 PET/MR imaging parameters, including primary prostate cancer SUVmax, PI-RADS score, ADCmin, and distant metastasis with PSMA uptake, were statistically significantly correlated with their clinical outcomes. COX regression verified that primary prostate cancer SUVmax and PI-RADS scores were significant predictors of BCR. Patients with higher uptake of SUVmax (>14.96) or higher PI-RADS (PI-RADS≥4) had more possibility of BCR. Model based on both had the highest predictive value, with its AUC being 0.858, which performed better than that of D'Amico model (AUC=0.789), single-factor SUVmax model (AUC=0.819), and single-factor PI-RADS model (AUC=0.702). ***Conclusion:*** Model based on primary prostate cancer SUVmax and PI-RADS score from integrated PET/MR with ^{18}F-PSMA-1007, had the best predictive ability for BCR of two years post-RP. However, further large-scale prospective studies are needed.

EP-0266

Comparative analysis of ^{68}Ga-PSMA-11 and ^{18}F-PSMA-1007 in prostate cancer restaging PET/CT: differences and similarities

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Aim/Introduction: We investigated the diagnostic performance of 68Ga-PSMA-11 and 18F-PSMA-1007 PET/CT in biochemical recurrent PC patients (BCR), according to clinical and histological parameters. ***Materials and Methods:*** In our centre, 3200 PC patients underwent PET/CT with radiolabelled-choline, fluciclovine, or PSMA; we selected BCR patients with 68Ga-PSMA-11 (Ga-group) or 18F-PSMA-1007 (F-group) PET/CT from July 2022 to August 2023. Patients'clinical features - PSA, Gleason Score (GS<8 or ≥8), ISUP (<3 or ≥ 3), EAU BCR risk group (high/low) - and clinical follow-up were registered. Chi-square, Fisher's exact, and Mann-Whitney U tests were used for calculating the correlation between PET detection rate (DR) and patient features in Ga- and in F-group. Moreover, we calculated the optimal PSA cut-off to predict PET response by ROC curve analysis. Defining clinical follow-up as the gold standard, in both radiotracers-group and in PSA cut-off subgroups, we evaluated sensitivity, specificity, accuracy, PPV, NPV. Finally, in both groups we identified the lesion with greater uptake - reference lesion - and related its SUVmax with the clinical features. A p<0.05 was statistically significant. ***Results:*** We evaluated 120 patients, 77/120 (64.16%) in Ga-group and 43/120 (35.83%) in F-group. A positive PET was found in 32/77 (41.55%) Ga-group patients, with a higher DR (20/77, 26%) in lymph nodes, and in 21/43 (48.83%) F-group patients, with a higher DR in prostate bed (12/43, 27.90%). A statistically significant correlation between PET outcome and GS (p= 0.006), ISUP (p= 0.007) and BCR risk class (p= 0.038) was highlighted only in Ga-group; particularly we found a positive PET scan in 75% of GS≥ 8 and ISUP≥ 3 patients and in 90.6% of high BCR patients. The optimal PSA cut-off predicting a positive PET was 0.85 ng/mL (AUC 0.71, 95% CI 0.611-0.804), with a significative correlation with PET outcome in both groups. Sensitivity, specificity, PPV, NPV, and accuracy in Ga- and F-group were: 68.88% vs 70.37%, 95.65% vs 86.66%, 96.87% vs 90.47%, 61.11% vs 61.90% and 77.94% vs 76.19%, respectively. Only in F-group, SUVmax had a statistically significative positive correlation with patient's clinical features, particularly GS (p= 0.031) and PSA cut-off (p=0.046). ***Conclusion:*** Direct comparison data between 68Ga- or 18F-PSMA are still limited, but our analysis highlighted similar reliability and effectiveness in BCR patients evaluation. The higher 18F-PSMA loco-regional DR was probably explained by its lower urinary excretion. In the real world, most Nuclear Medicine Units choose between these two radiopharmaceuticals based on their availability.

EP-0267

Lymph nodal PSMA-PET/CT radiomic dissemination features to predict Prostate Cancer biochemical recurrence

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Aim/Introduction: We investigated the clinical significance of PSMA-PET/CT metabolic and dissemination radiomic features of lymph nodal disease in improving the recurrence prediction in prostate cancer (PC) patients. ***Materials and Methods:*** We screened 202 68Ga/18F-PSMA PET/CT performed in PC patients for staging/restaging purpose, selecting patients who presented only lymph nodal disease. For each scan, the LN with the highest uptake was identified and SUVmax, SUVmean, MTV and TLA calculated. The distance between the most-avid LN and pubic symphysis (Dmax1) was calculated for each patient, and normalized to the body surface area (SDmax1). In addition, the farthest LN from prostate bed was pointed out and the absolute and normalized distances (Dmax2, SDmax2) were registered. After PET exams, data about the following treatment and the time of PSA recurrence were collected during 1-year follow-up. The relation between LN metabolic (SUVmax, SUVmean, MTV, TLA) and dissemination (Dmax1, Dmax2, SDmax1, SDmax2) features and PSA recurrence was assessed using Mann-Whitney U test. The cut-off points predictive of recurrence for all the features were determined using ROC analysis. The respective prognostic effects were achieved using the Kaplan-Meier and multiple linear stepwise regression analyses. A p<0.05 was statistically significant. ***Results:*** 40 patients were included in our analysis (mean age 72, range 51-85). Median value of SUVmax, SUVmean, MTV, TLA, Dmax1, Dmax2, SDmax1, SDmax2 were: 12.15 (range: 1.5-83.0), 7.61 (range: 0.86-51.4), 1035mm3 (range: 5.87-253000), 6.4 g/mlxcm3 (range: 1.6-360.2), 108.15mm (range: 65.5-473.8), 113.65mm (range: 68-518.3), 55.96mm (range: 32.42-241.3), 58.25mm (range: 34.13-262.83). In 14/40 (35%) patients, LN was outside the pelvis. In 26/36 (72%), Dmax1 and Dmax2 were coincident. At 1-year follow-up, 23/40 (57.5%) patients experienced PSA recurrence. A strong positive correlation between Dmax1 (p=0.016), Dmax2 (p=0.001), SDmax1 (p=0.03) and SDmax2 (p=0.001) and PSA recurrence was observed. At 1-year PSA follow-up, these parameters were significantly higher in patients with relapse than in patients without. Kaplan-Meier analysis estimated a median PFS of 10.0 months (95%CI 7.8-12.0), and showed the prognostic value of TLA (p=0.023), Dmax1 (p=0.043) and Dmax2 (p=0.023), using as optimal cut-off: 11.2 g/mlxcm3, 136.9mm and 175.4mm respectively. Dmax2 was identified as the unique predictor of biochemical recurrence by multiple linear regression (p=0.001). ***Conclusion:*** Our preliminary results showed that PET metabolic (TLA) and dissemination radiomics (Dmax1, Dmax2) features of lymph nodal disease can improve the prediction of recurrence in PC patients. Particularly, the farthest LN from prostate bed appeared the most reliable feature in the prognostic model.

EP-0268

The prediction value of PSMA and FDG heterogeneity phenotype in mCRPC novel endocrine therapy

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Aim/Introduction: This study used PSMA and FDG to evaluate the inter-lesion heterogeneity of prostate cancer and explored the predictive value of heterogeneity subtyping for novel endocrine therapy (NHT). ***Materials and Methods:*** This study included 205 patients with prostate cancer who underwent 18F-FDG and 68Ga-PSMA imaging, including 23 patients with BCR, 68 patients with mCSPC, and 114 patients with mCRPC, among mCRPC,62 received NHT. The patients were divided based on the lesion heterogeneity of dual PET/CT images. Group 1 defined as the PSMA+FDG- group, which only showed PSMA+FDG- lesions; Group 2 defined as the PSMA+FDG+ group, which showed at least one PSMA+FDG+ lesion but no PSMA-FDG+ lesion, combined or not with PSMA+FDG- lesions; and Group 3 defined as the PSMA-FDG+ group, which showed at least one PSMA-FDG+ lesion, combined or not with PSMA+FDG- and PSMA+FDG+ lesions. The highest FDG uptake lesion was selected as the analysis target lesion, and the SUVratio was defined as the ratio of PSMA-SUVmax to FDG-SUVmax. Survival analysis methods were used to explore the predictive value of the parameter SUVratio for the PFS of patients

receiving NHT. ***Results:*** The proportion of Group1 (PSMA+FDG-) decreases in the three stages of BCR, mCSPC, and mCRPC, while the proportion of Group2 and Group3 containing (FDG+) increases in sequence, with a statistically significant difference (p=0.001). In the BCR stage, the proportions of Group1-3 were (60.9%, 14/23) vs [34.8%, 8/23] vs [4.3%, 1/23], p<0.001), respectively. For mCSPC patient, the proportions of three groups were (27.9%, 19/68) vs [61.8%, 42/68] vs [10.3%, 7/68], p<0.001), respectively. In mCRPC, the proportion of three groups were (15.8%, 18/114) vs [71.9%, 82/114] vs[12.3%, 14/114], p<0.001), respectively. In the NHA treatment cohort, the proportions of three groups were 15.8% vs 71.9% vs 12.3%. The median PFS of Group 3 patients was significantly lower than Group 1 (133-day vs 497-day, p=0.027). The K-M curve of Group 2 partially overlaps with both Group 1 and 3, and cannot be well stratified. Subgroup analysis of Group 2 revealed that patients with high SUV ratio (cutoff value 2.5) had a higher PSA50 response rate (73.7% vs 33.3%, p=0.014), and a longer median PFS (368 vs 147 days, p=0.031). ***Conclusion:*** The use of FDG and PSMA dual tracers can better understand the heterogeneity between lesions in patients, and the SUVratio parameter can assist in early prediction of NHT. However, there is currently a lack of clear biological feature explanations for SUVratio.

EP-0269

Matched-pair analysis of molecular image outcomes in patients with biochemical recurrent prostate cancer: [^{68}Ga]Ga-PSMA-11 or [^{18F}]-PSMA-1007?

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Aim/Introduction: To determine which tracer ([68Ga]Ga-PSMA-11 or [^{18F}]PSMA-1007) was suggested to identify underlying lesions in prostate cancer (PCa) patients with biochemical recurrence (BCR) under various clinical conditions. ***Materials and Methods:*** 64 PCa patients with BCR after radical prostatectomy (RP) who underwent [^{18F}]PSMA-1007 PET/CT imaging were included and a series of similar clinical criteria were used to match the same number of patients who underwent [68Ga]Ga-PSMA-11 PET/CT scans. ***Results:*** In total, 531 and 216 PSMA-ligand positive lesions were revealed by [^{18F}]PSMA-1007 and [68Ga]Ga-PSMA-11, respectively. [^{18F}]PSMA-1007 had greater overall detection rate (DR) (81.3% vs. 59.4%, p=0.007) than [68Ga]Ga-PSMA-11. The DR (38.1% vs. 71.4%, p=0.002) of [^{18F}]PSMA-1007 were found to be higher than those of [68Ga]Ga-PSMA-11 in patients with PSA < 1 ng/mL. For PSA 1-3 ng/mL, [68Ga]Ga-PSMA-11 (p=1.000) was more accurate than [^{18F}]PSMA-1007 (p=0.035) in detecting oligometastatic patients. Compared to [68Ga]Ga-PSMA-11, [^{18F}]PSMA-1007 found more local recurrent lesions in the prostatic fossa (16 vs. 8), but 68.8% and 100% of these individuals were oligometastatic (p=0.214), respectively. However, [^{18F}]PSMA-1007 had more unspecific bone uptake (98 vs. 34) and ganglia uptake (128 vs. 46). ***Conclusion:*** The two tracers here suggested are both effective for detecting lesions in PCa patients at BCR. In patients with PSA < 1ng/mL in [^{18F}] PSMA-1007, better recurrence/metastasis detection is achievable. For PSA 1-3 ng/mL, [68Ga]Ga-PSMA-11 was more accurate in detecting oligometastatic patients.

EP-0270

Clinical Association of Deep Learning Enabled Total PSMA Lesion Quotient (TLQ) and Prostate Cancer Molecular Imaging Standardized Evaluation (PROMISE) Criteria with Outcome in Prostate Cancer Patients

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Aim/Introduction: PSMA PET imaging is playing an important role in the management of prostate cancer patients, including patient eligibility for PSMA-targeted therapies. However, clinical applications of imaging biomarkers are limited by time consuming calculation of whole body PSMA PET parameters. The objective of this study was to evaluate the association of deep learning-enabled total body quantitative PSMA biomarkers, recommended in the PROMISE framework, with clinical outcome. ***Materials and Methods:*** We retrospectively evaluated prostate cancer patients who underwent PSMA PET-CT for biochemical recurrence (BCR) after initial treatment with curative intent. PSMA PET-CT images were analyzed with the CE marked aPROMISE application for automated segmentation and quantification of SUVmean, tumor volume (Vol), PSMAscore and TLQ (Vol:SUVmean quotient). To generate the quantitative PSMA biomarkers, the reader had to agree or disagree with the pre-defined hotspots marked as candidate lesions by the deep-learning network. The quantitative PSMA parameters were correlated with baseline PSA value at time of PSMA PET-CT and with outcome measures - time to subsequent treatment. Non-parametric Spearman correlation was used to evaluate the association between baseline PSA and quantitative PSMA score. Cox Proportional model with scaled parameters was used to evaluate association with outcome. ***Results:*** We evaluated biomarkers in PSMA PET images at BCR and oncologic outcome in prostate cancer patients. All 69 patients were followed for disease progression and subsequent treatments. The median follow-up time was 112 weeks and 20/69 patients (30%) received subsequent systemic therapies. There was significant (p<0.0001) association of all quantitative PSMA biomarkers with baseline PSA. TLQ was significantly associated with outcome (HR= 1.41 p= 0.023), PSMAscore (HR=1.23; p=0.065) and Vol (HR=1.23; p=0.066) were close to significant. SUVmean (HR=1.02; p=0.942) and SUVmax (HR=1.16; p=0.413) were not clinically significant in their association with outcome. ***Conclusion:*** The study demonstrated that deep learning enabled PSMA biomarkers TLQ and PSMAscore are clinically relevant and may play a significant role in management of prostate cancer patients in BCR setting. Incorporating these biomarkers in prospective and controlled studies are required to validate the findings.

EP-0271

Additional value of whole-body MRI compared to PSMA PET in biochemically recurring prostate cancer

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Aim/Introduction: At present, prostate-specific membrane antigen (PSMA) PET is the standard imaging modality in biochemically recurring (BCR) prostate cancer (PCa). The role of whole-body magnetic resonance imaging (wb-MRI), however, remains unclear in this setting. Our aim is to evaluate the additional value of wb-MRI compared to PSMA PET in patients with BCR PCa. ***Materials and Methods:*** A post-hoc analysis of data of a prospective monocentric study, including patients with BCR PCa who received a hybrid [68Ga]Ga-PSMA-11 or [18F] PSMA-1007 PET/MRI. Patients were included in this analysis if follow-up data including histopathological results, follow-up imaging and PSA levels following targeted salvage radiation or systemic therapy were available for at least 2 years after PSMA PET/MRI. PSMA PET and wb-MRI scans were independently assessed for the presence and number of malignant lesions, on a patient and organ level. Each malignant lesion was correlated with the available follow-up data of the patient to determine its true positive (TP) or false positive (FP) nature. Comparison between PSMA PET and wb-MRI was done using the TP detection rate (TPPET/(union TPPET and TPMRI); TPMRI/(union TPPET and TPMRI)), positive predictive value (PPV, TPPET/(TPPET and FPPET); TPMRI/(FPMRIand TPMRI)) and number of TP malignant lesions. ***Results:*** A total of 76 patients with BCR PCa were included. At patient level, TP detection rate of PET was higher than wb-MRI, (35/35, 100% versus 23/35, 66%, respectively, p=0.0005) and PET observed a higher number of TP lesions compared to MRI (mean 2.2 versus 1.3, respectively, p=0.0021). At organ level, TP detection rate on PET was higher compared to wb-MRI (47/52, 90% versus 31/52, 60%, respectively, p=0.0042). Organ-specific analysis revealed a higher TP detection rate of distant metastases (i.e. extrapelvic lymph nodes, bone lesions and visceral lesions) on PET compared to MRI (19/20, 95% versus 12/20, 60%, respectively, p=0.039). The number of TP lesions in an organ on PET was higher compared to MRI (mean 1.9 versus 0.9, respectively, p=<0.0001). Organ-specific analysis revealed a higher number of TP lesions on PET compared to wb-MRI for pelvic lymph nodes and all lymph nodes (mean 2.0 versus 1.2, p=0.016 and mean 2.9 versus 1.2, p=0.028, respectively). No difference was seen in PPV between PET and wb-MRI on both patient and organ level. ***Conclusion:*** In patients with BCR PCa, wb-MRI (i) does not provide additional value regarding the TP detection rate compared to PSMA PET and (ii) is equivalent to PSMA PET for PPV.

EP-15

e-Poster Area

B: Imaging Clinical Studies -> B1 Oncological Imaging Clinical Study -> B18c Prostate Other

EP-0272

Use of ^{68}Ga-PSMA-HBED-CC (^{68}Ga-PSMA-11) PET/CT At Initial Staging For Intermediate And High-Risk Prostate Cancer

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Aim/Introduction: 68Ga-PSMA-HBED-CC (68Ga-PSMA-11) PET/CT remains as a clinically relevant and commonly used technique for the detection of regional lymph-node and distant mmetastases in prostate cancer patients at initial staging with its consequent therapeutic behaviors. The aim of this research was to assess the sensitivity and specificity of 68Ga-PSMA-11 PET/CT for the initial staging of intermediate and high-risk prostate cancer. ***Materials and Methods:*** This is a retrospective, descriptive, observational and multicenter study that included 15 centers in Uruguay and 68 consecutive patients in which 68Ga PSMA-11 PET/CT was used as initial staging after diagnosis of intermediate and high-risk prostate cancer, between January 2019 and October 2023. All patients were previously staged with abdominopelvic computed tomography and bone scan.All patients underwent routine 68Ga-PSMA-11 PET/CT scanning with a 64-slice PET/CT scan with TOF correction. Histopathology, correlative imaging, and/or clinical follow-up were considered the gold standard for reference, and follow-up was conducted at least 5 months after PET/CT scanning. Sensitivity, specificity, and predictive values were calculated. ***Results:*** The mean age was 66 years (range 50-84 years) and the mean PSA was 24.9 ng/mL (range: 10-152 ng/mL). 35.8% of patients were intermediate risk CP and 64.2% high risk. The overall detection rate was 82% (56/68) for 68Ga-PSMA-11 PET/CT. 44.8% of patients had positive 68Ga-PSMA-11 PET/CT for nodal and bone metastasis. A total of 145 extra-prostatic lesions were detected in the bone (n = 56), lymph-nodes (n = 88), and lung (n = 1) by the PET tracer. At initial staging sensitivity and specificity for nodal and bone metastasis was 50% and 87%, and 69% and 76%, respectively. ***Conclusion:*** In our series 68Ga-PSMA-11 PET/CT has a higher sensitivity and specificity for diagnosis of nodal and bone metastasis than conventional imaging with computed tomography and bone scan. This is an novel imaging technique for the assessment of primary medium and high-risk prostate cancer with promising potential for the detection of metastatic spread that would impact patient management. ***References:*** Prostate Cancer, Version 2.2019, NCCN Clinical Practice Guidelines in Oncology. Shen, G., et al. Comparison of choline-PET/CT, MRI, SPECT, and bone scintigraphy in the diagnosis of bone metastases in patients with prostate cancer: a meta-analysis. Skeletal Radiol, 2014. 43: 1503.

EP-0273

Innovative Approaches in Prostate Cancer Management: The Efficacy of Ga-68 PSMA PET/CT in Detecting Bone Metastases

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Aim/Introduction: Identifying bone metastases in prostate cancer patients poses a considerable challenge, particularly prior to the emergence of morphological changes discernible through conventional diagnostic methodologies. The aim of this study is to compare the performance of Ga-68 PSMA PET/CT with MRI, CT, and Bone Scintigraphy in detecting bone metastases. ***Materials and Methods:*** A retrospective analysis was conducted on 1113 patients diagnosed with prostate adenocarcinoma, with a Gleason Score of 6 or higher, who presented to our clinic between 2016 and 2023. Of these patients, 126 with MRI, CT, or Bone Scintigraphy images within a 30-day period before and after the Ga-68 PSMA PET/CT imaging for staging purposes were included in the study. Patients were divided into three groups based on the nature of bone metastases: "sclerotic," "bone marrow," and "mixed type" for those with both sclerotic and bone marrow metastases,

and the findings were compared. ***Results:*** The average age of the patients included in the study was 70.98 ±10.19 years, and the average serum PSA value was 246.7± 406.34 µgr/L. In addition to Ga-68 PSMA PET/CT imaging, 53 patients had MRI, 61 had CT, and 32 had Bone Scintigraphy. The Ga-68 PSMA PET/CT images were evaluated independently by two nuclear medicine specialists, without reference to findings from other imaging methods. Of the patients, 65 (51.5%) were in the sclerotic group, 12 (9.5%) in the bone marrow group, and 49 (39%) in the mixed group. The median PSA value was 59.78 mg/dl in the sclerotic group, 104.1 mg/dl in the mixed group, and 3.72 mg/dl in the bone marrow group. When compared with Ga-68 PSMA PET/CT, it was observed that CT failed to detect metastatic bone lesions in 52% of the patients. This rate was calculated as 26% for MRI and 8% for Bone Scintigraphy. ***Conclusion:*** Compared with conventional imaging methods (MRI, CT) and Bone Scintigraphy, Ga-68 PSMA PET/CT has been found to be more successful in detecting bone marrow metastases, especially before morphological changes have occurred. CT, MRI, and Bone Scintigraphy can show false negativity in metastatic bone/bone marrow lesions. In situations where Ga-68 PSMA PET/CT cannot be performed, Bone Scintigraphy maintains its superiority over CT and MRI. Especially in patients with medium and high-risk prostate cancer, for staging, assessing response to treatment, in clinically suspected bone metastases, and/or detected biochemical recurrence, Ga-68 PSMA PET/CT should be considered as the primary examination to be referred to.

EP-0274

The first-in-human study of ^{64}Cu-PSMA-3Q for real-time intraoperatively targeted biopsy in patients with suspected prostate cancer

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Aim/Introduction: At present, the most common biopsy method for prostate cancer(PCa) is transrectal ultrasound-guided biopsy (TRUS-Bx), but there are still some limitations, such as technical leakage and postoperative complications due to the excessive number of cores. Prostate-specific membrane antigen (PSMA)-targeting radiopharmaceuticals are ideal tools for the diagnosis and treatment of prostate cancer. PSMA PET/CT guided targeted biopsy is expected to become a new method to further improve the diagnostic rate of prostate cancer. This study aims to develop a novel PSMA radiotracer, 64Cu-labeled PSMA, with a long half-life and to explore the feasibility of quantitative radioactive uptake in biopsy tissue to guide accurate intraoperative puncture. ***Materials and Methods:*** 64Cu-PSMA-3Q was prepared and its stability, PSMA specificity, and micro-PET imaging were analyzed. A total of four consecutive patients with suspected PCa were enrolled. All patients underwent 64Cu-PSMA-3Q PET/CT scans followed by PET/CT image-guided 24 hours later. The radioactivity of the biopsy tissue was measured as counts per minute (cpm) in a wiper well gamma spectrometer during the operation. Finally, groups were grouped based on pathological results and statistical results were analyzed. ***Results:*** Micro-PET imaging of 64Cu-PSMA-3Q can clearly differentiate 22Rv1 tumor from background with a high SUVmax(2.23±0.49, 2.59±0.18 and 2.84±0.46 at 1h, 6h and 24h, respectively)and a tumor-to-muscle ratio(15.43±4.44, 20.09±0.95 and 18.06±1.59 at 1h, 6h and 24h, respectively). A total of 44 biopsy cores were obtained in 4 patients, of which 14 cores were pathologically positive for prostate cancer. The median cpm was overall significantly higher in needles with PCa (212, 271 cpm) compared to needles without PCa (18, 34 cpm , P<0.0001). ROC analysis yielded an AUC of 0.965, with an optimal cut-off to confirm PCa at 130 cpm (sensitivity: 100%; specificity: 92.9%). Only 1 out of 14 positive biopsy cores had a count of 18, which was much lower than the average of the prostate cancer group. It may be related to the small proportion of tumor tissue taken by biopsy. ***Conclusion:*** The uptake of 64Cu-PSMA-3Q in prostate cancer can be used to accurately confirm the lesion sampling during biopsy. This technology can enhance the confidence of the biopsy provider, reduce the number of puncture needles, and thus reduce the pain of patients and the occurrence of postoperative complications. Therefore, it is expected to become a promising new tool for biopsy in patients with suspected PCa.

EP-0275

Confirmed Extraprostatic Findings Showing Psma Expression On Gallium-68 Psma Pet/CT Imaging

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Aim/Introduction: Aim:The aim of this study was to investigate the findings of PSMA receptor expression on Ga68 PSMA PET/CT imaging that are not related to prostate malignancy. ***Materials and Methods:*** Methods:The medical data of 1345 Ga68 patients who underwent PSMA PET/CT imaging between 2018 and 2024 were retrospectively analyzed. Among these patients, 31 patients who showed PSMA receptor affinity and were radiologically, histopathologically or clinically confirmed not to be secondary to prostate malignancy were included in the study. ***Results:*** In 1 patient who underwent Ga68 PSMA PET/CT and was found to have no involvement secondary to prostate malignancy, the brain lesion was radiologically proven to be osseous cavernous hemangioma in 1 patient and secondary to encephalomalacia in 1 patient.The breast involvement seen in 1 patient was correlated with radiology as secondary to gynecomastia.4 Radiologic correlation of the single bone lesion observed in 4 patients revealed fibrous dysplasia in 1, hemangioma in 1, and artifactual involvement in 2.The diffuse bone involvement observed in 3 patients was radiologically and clinically confirmed to be secondary to Paget's disease.The asymmetric rosenmuller fossa involvement in 1 patient was evaluated as inflammation after clinical examination, and the intense transverse colon involvement in 1 patient was evaluated as physiologic after colonoscopy.2 Of the histopathologically confirmed thyroid nodules observed in 2 patients, 1 was found to be PTK and 1 was found to have atypia of uncertain significance.1 patient with suspicious uptake in the prostate lobe was histopathologically confirmed as chronic prostatitis.1 patient with heterogeneous increased uptake in the liver was interpreted as secondary to multiple cystic lesions by USG.15 Histopathologically, lung adenocarcinoma was detected in 1 patient, chronic bronchitis in 1 patient and inflammatory process in 2 patients. The other patients were found to have benign features such as post-radiotherapy changes, tuberculosis sequelae, consolidation areas, sequelae emphysematous changes, interstitial lung disease after radiological and clinical follow-up. ***Conclusion:*** It should be considered that benign lesions, inflammatory processes and other malignant processes may show PSMA expression. It is also recommended that other malignancies with PSMA receptor affinity should be evaluated for suitability for PRRT. ***References:*** ηττπσ://δοι.οργ/10.1053/φ.σεμνυχλμεδ.2021.06.016

EP-0276

Correlation of Lesion-Based SUV Parameters Calculated in Ga-68 PSMA PET/CT and Lu-177 PSMA SPECT/CT in Patients with Metastatic Castration-Resistant Prostate Cancer.

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Aim/Introduction: This study aims to investigate the correlation between lesion-based SUV parameters obtained from the 24-hour Lutetium-177 Prostate Spesific Membrane Antigen (Lu-177 PSMA) quantitative Single Photon Emission Tomography/Computer Tomography (SPECT/CT) examination and the SUV parameters from pre-treatment Ga-68 PSMA PET/CT imaging in patients with metastatic castration-resistant prostate cancer (mCRPC) undergoing prostate-specific membrane antigen (PSMA) targeted radioligand therapy (RLT). Furthermore, the aim is to determine the relationship between lesion-based treatment response and these parameters. ***Materials and Methods:*** In the scope of the research SUV parameters, locations, and sizes of physiological and metastatic lesions were calculated from the 24th hour Lu-177 PSMA quantitative SPECT/CT imaging of 55 patients who received at least 2 cycles of Lu-177 PSMA treatment between November 2021 and August 2023. SUV parameters from the same regions were also calculated from Ga-68 PSMA PET/CT before Lu-177 PSMA treatment. Patient data, including Gleason score, age and previous treatments before Lu-177 PSMA therapy, were noted. Lesion-based treatment response was examined by comparing post-treatment Ga-68 PSMA PET/CT with pre-treatment Ga-68 PSMA PET/CT after each of the two Lu-177 PSMA treatments. ***Results:*** Our research revealed that SUV parameters obtained from Ga-68 PSMA PET/CT were higher than those obtained from Lu-177 PSMA SPECT/CT and a moderate to high correlation between the two measurements, especially higher in physiological areas ($p<0.05$). In the subgroup analysis of malignant lesions according to their location, it was determined that primary prostate lesions showed the highest correlation level ($R^2=0.72$, $p<0.01$) in the SUVmax parameter. A higher correlation level was observed in malignant lesions with a volume >3 mL ($R^2=0.67$; $R^2=0.74$). SUV parameters from Lu-177 PSMA SPECT/CT were identified as an independent predictor for lesion-based treatment response. ***Conclusion:*** The correlation of lesion-based SUV parameters obtained from the two imagings is high, and our findings demonstrate the predictive value of SPECT/CT imaging after PSMA Radioligand therapy (RLT) for treatment response. ***References:*** 1. Madsen MT, Menda Y, O'Dorisio TM, O'Dorisio MS. Single time point dose estimate for exponential clearance. Medical physics. 2018;45(5):2318-24.2. Arvola S, Jambor I, Kuisma A, Kemppainen J, Kajander S, Seppänen M, et al. Comparison of standardized uptake values between 99mTc-HDP SPECT/CT and 18F-NaF PET/CT in bone metastases of breast and prostate cancer. EJNMMI research. 2019;9(1):1-9.

EP-0277

Prognostic value of PSMA PET/CT in synchronous metastatic hormone-sensitive prostate cancer: an interim analysis

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Aim/Introduction: In synchronous metastatic hormone-sensitive prostate cancer (mHSPC), stratification into low- and high-volume disease according to the CHAARTED criteria [1] is used to guide treatment decisions. However, these criteria were based on conventional imaging and since the introduction of PSMA PET/CT, the definition of low- and high-volume disease has become unclear. This study aims to provide insight into the prognostic value of PSMA PET/CT in combination with clinical parameters, which can serve as a basis for this redefinition. ***Materials and Methods:*** Patients with mHSPC staged with PSMA PET/CT were included in this retrospective study. After delineation with a threshold of SUV=4 [2], the PET parameters SUVmax, total tumour volume (PSMA-TV), total lesion uptake (TL-PSMA), DmaxVox and metastatic sites were extracted. The clinical parameters WHO performance status, iPSA, Gleason score and age were also collected. The primary endpoints of this study were time to PSA progression (PFS, according to the PCWG3 criteria) and time to death (OS) in months. Cox regression analysis, with stratification for received treatment, was used to assess the prognostic value of all parameters. ***Results:*** Of the 200 patients enrolled, 90 have been analysed so far. They either received ADT + radiotherapy to the prostate (n=12), ADT only (n=43) or ADT + docetaxel chemotherapy (n=35). PSA progression was seen in 61 patients, 41 patients had died at the time of analysis. Median follow-up was 48 months. In univariate analysis, Gleason score, PSMA-TV, TL-PSMA, DmaxVox and the presence of visceral metastases were prognostic markers for PFS; WHO performance status and age were prognostic markers for OS (all $p < 0.05$). In multivariate analysis, PSMA-TV (HR=1.25 per 100 mL increase [1.05-1.50]) and the presence of visceral metastases (HR=7.929 [1.23-51.2]) remained prognostic markers for PFS; WHO performance status (HR=1.94, [1.22-3.10]) remained a prognostic marker for OS. iPSA and SUVmax had no prognostic value in this analysis. ***Conclusion:*** Interim analysis revealed that multiple PSMA PET parameters and clinical parameters have prognostic value in synchronous mHSPC patients. Results from the 200 included patients will follow soon. This will increase statistical power and hopefully provide solid new insights into the risk stratification of mHSPC patients and aid treatment decision-making, also for triple therapy patient selection. ***References:*** [1] https://doi.org/10.1056/nejmoa1503747 [2] https://doi.org/10.3389%2Ffonc.2021.663631.

EP-0278

Detection rate and impact on clinical management for ^{68}Ga-PSMA-11 PET/CT at very low serum PSA: a single-center, retrospective analysis

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Aim/Introduction: The utility of 68Gallium prostate-specific membrane antigen-11 positron emission tomography/computed tomography (68Ga-PSMA-11 PET/CT) in detecting PSMA-positive lesions at levels considered undetectable (≤ 0.1 ng/ml) is unknown. It is also unknown how scans performed at PSA ≤0.1 ng/ml affect subsequent clinical management. The aims of this study were: (1) to measure the detection rate and characterize lesions identified by 68Ga-PSMA-11 PET/CT performed at PSA levels ≤0.1 ng/ml and (2) to evaluate subsequent changes in clinical management based on these scans. ***Materials and Methods:*** We retrospectively screened 3340 patients in 7 clinical trials of 68Ga-PSMA-11 PET/CT performed at UCLA (October

2016-January 2023). Of these, 3% (n=95) met the inclusion criteria of serum PSA levels ≤0.1 ng/ml within 12 weeks of scan. We collected their clinical data from institutional electronic medical records, and subgroup analyses were performed for serum PSA levels ≤0.1 ng/ml (n=95), ≤0.05 ng/ml (n= 51), and ≤0.01 ng/ml (n=12). A positive 68Ga-PSMA-11 PET/CT scan was defined as having at least one definite/suspicious PSMA positive lesion. ***Results:*** Detection rates were 42% (40/95), 47% (24/51), and 33% (4/12) at PSA ≤0.1 ng/ml, ≤0.05 ng/ml, and ≤0.01 ng/ml, respectively. Of the 40 patients with PSMA-positive findings at PSA ≤0.1 ng/ml, 30% (12/40) of patients had M0 disease and 70% (28/40) of patients had M1 disease. A total of 38 metastatic lesions were identified in patients with M1 disease, of which 63% were osseous lesions (miM1b). 13% were metastatic lesions in solid organs (liver and lung). Follow-up treatment data was missing in 33% (31/95) patients. Among those with treatment data available, 47% (30/64) had PSMA-positive definitive/suspicious lesions. Among these, 67% (20/30) had a change in clinical management. Initiating radiation therapy was the most common change in management seen in 65% (13/20) of patients. ***Conclusion:*** In our study, the detection rates of 68Ga-PSMA-11 PET/CT at PSA of ≤0.1 ng/ml, ≤0.05 ng/ml, and ≤0.01 ng/ml were 42%, 47%, and 33%, respectively. At PSA ≤0.1 ng/ml, positive findings detected on 68Ga-PSMA-11 PET/CT led to a change in management in 67% of patients, with initiation of radiation therapy being the most common change. Overall, our study suggests the potential benefit of performing 68Ga-PSMA-11 PET/CT at the level of PSA that is considered undetectable (≤0.1 ng/ml). It also highlights the fact that important decisions on clinical management are made based on these scans in clinical practice.

EP-0279

Pretreatment PSMA PET/CT scans predict treatment response and survival in metastatic castration-resistant prostate cancer: a patient-level and lesion-level analysis

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Aim/Introduction: Metastatic castration-resistant prostate cancer (mCRPC) is a heterogeneous disease with varying survival outcomes. This study investigated whether pretreatment PSMA PET/CT can predict treatment response and survival, which can aid treatment decision-making. ***Materials and Methods:*** 57 mCRPC patients underwent [18F]PSMA-1007 PET/CT at baseline and for assessing imaging response to treatment with androgen receptor-targeted agents or chemotherapy. For patient-level analysis, intensity-based, volumetric and dissemination parameters were extracted from pretreatment PSMA PET/CT, and compared to age, Gleason score and laboratory parameters. PSMA PET/CT scans were delineated using a fixed threshold of SUV=4 [1]. Cox regression analysis evaluated their prognostic value for progression-free survival (PFS, time to either PSA progression on imaging-based progression) and overall survival (OS). For lesion-level analysis (N=300), lesion location and morphological, intensity-based and radiomic texture-based GLCM features were analysed. Logistic regression analysis evaluated their ability to predict lesion progression, defined as increase in volume or PSMA-uptake > 30%. All analyses were corrected for line of treatment. ***Results:*** 29 patients received androgen receptor-targeted agents, 28 patients received chemotherapy. Median follow-up was 28.4 months. Total tumour volume (HR=1.38 per doubling [1.14-1.67]), total lesion uptake (HR=1.36 per doubling [1.13-1.63]), DmaxVox (HR=1.04 per cm increase [1.01-1.06]) and metastatic locations were prognostic for OS, all independent of PSA (HR=0.8 per doubling [0.7-1.0]) and haemoglobin level (HR=0.6 per mmol/L increase [0.4-0.8]). For PFS, only total tumour volume and total lesion uptake (for both HR=1.18 per doubling [1.01-1.38]) had prognostic value. On lesion-level, lesion location (HR=0.32 prostate versus bone [0.12-0.84], HR=0.43 lymph node versus bone [0.24-0.78]) and SUVmean (HR=1.53 per doubling [1.04-2.24]) were the best independent prognostic markers of lesion progression on PSMA PET/CT. Volumetric and texture-based radiomics features were no independent prognostic markers. ***Conclusion:*** Pretreatment PSMA PET/CT scans had prognostic value in mCRPC patients receiving androgen receptor-targeted agents or chemotherapy, both on patient-level and lesion-level and independent of line of treatment. Therefore, PSMA PET/CT can aid treatment decision-making. Further research is required to validate these prognostic models in larger patient cohorts. ***References:*** [1] https://doi.org/10.3389%2Ffonc.2021.663631.

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Fully automated AI-based quantification of tumour volume on PSMA PET-CT images is significantly associated with overall survival in patients with prostate cancer

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Aim/Introduction: We have developed a fully automated artificial intelligence (AI)-based method for detection and quantification of prostate cancer related lesions on [18F]PSMA-1007 PET-CT images. The aim was to determine if automatically obtained measurements of total lesion volume (TLV) is associated with overall survival (OS). ***Materials and Methods:*** A total of 277 patients, referred for clinically indicated PSMA PET-CT between September 2019 and July 2021 due to either primary staging of newly diagnosed high-risk prostate cancer or due to secondary staging of biochemical recurrence were included. TLV for the prostate tumour/prostate recurrence, pelvic lymph node metastases, distant lymph node metastases, bone metastases as well as the total TLV were automatically obtained from the AI method. No manual corrections were made. Uni- and bivariate (adjusted for age) cox regression models for TLV (ml) were used for survival analysis. Harrel's concordance index (C-index) was used for model prediction. Patients were followed for a maximum of 4 years. ***Results:*** During the follow-up period, 36 (13%) of the 277 patients died. TLV for the prostate tumour/prostate recurrence, pelvic lymph node metastases, distant lymph node metastases, bone metastases and total TTV were all significantly associated to overall survival, both unadjusted and adjusted for age ($p<0.001$ for all). Hazard ratios varied between 1.0021 (total TLV) an 1.014 (pelvic lymph node metastases). C-indices were 0.58 for the prostate tumour, 0.63 for pelvic lymph node metastases, 0.67 for distant lymph node metastases, 0.66 for bone metastases and 0.70 for total TLV. ***Conclusion:*** Our fully automated AI-based

method for quantification of prostate cancer related lesions on [18F] PSMA-1007 PET-CT was significantly associated with OS. The total TLV had better predictive potential compared to TLV measured individually in the prostate, lymph nodes and bone. ***References:*** Trägårdh E, et al. Freely available, fully automated AI-based analysis of primary tumour and metastases of prostate cancer in whole-body [18F]PSMA-1007 PET-CT. Diagnostics(Basel) 2022;12:2101.

EP-0281

First-in-human study of [68Ga]Ga-AAZTA-093, a novel PSMA-targeting agent, in patients with prostate cancer

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Aim/Introduction: Prostate-specific membrane antigen (PSMA) is a promising target for the diagnosis and radioligand therapy (RLT) of prostate cancer (PCa). A series of previous studies have confirmed that [68Ga]Ga-P16-093 showed significantly higher tumor uptake and better target-to-background ratio than [68Ga]Ga-PSMA-11 and [68Ga]Ga-PSMA-617 in patients with PCa. Unfortunately, P16-093 used HBED-CC as a chelator, which can't be labeled with 177Lu for radioligand therapy. Therefore, a new agent, [68Ga]Ga-AAZTA-093 using AAZTA as the chelator suitable for labeling of both 68Ga and 177Lu was developed. The purpose of this study is to explore the clinical application of [68Ga]Ga-AAZTA-093, as well as to compare with [68Ga]Ga-PSMA-11 and [68Ga]Ga-PSMA-617 by PET/CT imaging, respectively. ***Materials and Methods:*** We prospectively enrolled 14 PCa patients for comparative purposes. Among them, 11 patients underwent paired [68Ga]Ga-AAZTA-093 and [68Ga]Ga-PSMA-11 PET/CT, and 3 patients underwent paired [68Ga]Ga-AAZTA-093 and [68Ga]Ga-PSMA-617 PET/CT. Four (4) patients underwent serial dynamic PET scans for [68Ga]Ga-AAZTA-093, and the others underwent PET imaging at fixed time points (60 min for standard scan and 150 min for delayed scan). Standardized uptake values (SUV) were measured for semi-quantitative comparison. ***Results:*** [68Ga]Ga-AAZTA-093 PET/CT scans showed measurably higher SUVmax in tumors than [68Ga]Ga-PSMA-11 PET/CT (25.9 ± 17.0 vs. 21.4 ± 12.7, P = 0.032, at 60 min; 30.0 ± 18.6 vs. 26.1 ± 18.6, P = 0.011, at 150 min). It also showed a higher tumor uptake than [68Ga]Ga-PSMA-617 PET/CT (24.4 ± 10.5 vs. 16.2 ± 8.8, P = 0.132, at 60min,; 29.2 ± 11.2 vs. 20.1 ± 9.6, P = 0.101, at 150 min). In this limited study, biodistribution of [68Ga]Ga-AAZTA-093 showed major uptakes in normal organs (salivary glands, blood pool, kidneys, spleen, liver, muscle, and urinary bladder). But results suggested no statistically significant differences in comparison with [68Ga]Ga-PSMA-11 and [68Ga]Ga-PSMA-617. [68Ga]Ga-AAZTA-093 PET/CT scans yielded similar lesion detection rates as compared with [68Ga]Ga-PSMA-11 and [68Ga]Ga-PSMA-617 PET/CT. However, the same AAZTA-093 has been labeled with [177Lu]Lu(III), which might be useful for radionuclide therapy in the future. ***Conclusion:*** [68Ga]Ga-AAZTA-093 showed improved tumor uptake and retention than [68Ga]Ga-PSMA-11 and [68Ga]Ga-PSMA-617. It is likely that [68Ga]Ga/[177Lu]Lu-AAZTA-093 may be useful as a novel PSMA-targeting agents for both diagnosis and radiotherapy of prostate cancer. Further investigations in a larger number of cohorts were warranted.

EP-0282

Comparison of PSMA Immunohistochemistry Scoring Systems to Parametric [18F]PSMA-1007 PET/MRI in Primary Prostate Cancer

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Aim/Introduction: Quantification of prostate-specific membrane antigen (PSMA) expression via PSMA positron emission tomography (PET) is well-established, however quantification of PSMA via immunohistochemistry (IHC) is not standardized. Our aim was to determine the most optimal PSMA IHC scoring system to quantify PSMA expression with PSMA PET as reference standard. ***Materials and Methods:*** Primary intermediate- and high-risk prostate cancer patients received an [18F]PSMA-1007 PET/MRI followed by radical prostatectomy as part of a prospective trial. SUVmax, SUVmean and Ki of the prostate tumour was determined. Prostate tumours were stained with anti-PSMA antibodies and scored by 2 readers via 8 intensity-based IHC scoring systems using a combination of intensity and percentage of positively stained tumour cells (i.e. H-score, immunoreactivity scorepredominant intensity (IRSpredominant intensity), IRS classificationpredominant intensity, IRSmean intensity, IRS classificationmean intensity, Allred score, predominant expression pattern and Shannon diversity index (SDI)), and 2 percentage-based IHC scoring systems (i.e. percentage negatively stained cells and total percentage positively stained cells). Spearman's rank correlation coefficients (ρ) were calculated between PET parameters and IHC scoring systems. Inter-reader agreement for the IHC scoring systems was measured by the intraclass correlation coefficient (ICC). ***Results:*** Fifty tumours in 46 patients were analysed. Of the intensity-based scoring systems, H-score had the best correlation with SUVmax (ρ 0.615, p<0.0001) and SUVmean (ρ 0.570, p<0.0001) and the second best correlation with Ki (ρ 0.411, p=0.0030). SDI had the best correlation with Ki (ρ -0.440, p=0.0014) and the second best correlation with SUVmax (ρ -0.516, p=0.0001) and SUVmean (ρ -0.490, p=0.0003). IRS classificationmean intensity had the third best correlation with SUVmax (ρ 0.515, p=0.0001), SUVmean (ρ 0.481, p=0.0004) and Ki (ρ 0.358, p=0.0106). A moderate inter-reader agreement was observed for H-score (ICC 0.663, 95% CI 0.495-0.797), SDI (ICC 0.546, 95% CI 0.354-0.725) and IRS classificationmean intensity (ICC 0.545, 95% CI 0.353-0.725). Compared to the intensity-based scoring systems, the percentage-based scoring systems showed overall lower correlation coefficients between percentage negatively stained cells and total percentage positively stained cells with SUVmax (ρ -0.432 and 0.432, respectively, p=0.0018), SUVmean (ρ -0.382 and 0.382, respectively, p=0.0061) and Ki (ρ -0.401 and 0.401, respectively, p=0.0039). Good inter-reader

agreement was noted for the percentage of negatively stained cells and total percentage of positively stained cells (both ICC 0.832, 95% CI 0.729-0.901). ***Conclusion:*** H-score had the best correlation with PSMA PET quantification and an acceptable inter-reader agreement. Therefore, we deem H-score the most optimal PSMA IHC scoring system.

EP-0283

Imaging and outcome correlates of ctDNA methylation markers in prostate cancer: A comparative, cross-sectional [^{68}Ga]Ga-PSMA-11 PET/CT study

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Aim/Introduction: We previously identified a panel of prostate cancer (PCa) -specific circulating tumor DNA methylation markers (meth-ctDNA) [1] with potential for PCa diagnosis and prognosis. To validate their clinical utility, we compared these markers against PSA levels and PSMA PET/CT findings to assess their relative predictive value for clinically actionable disease presence and survival outcomes. ***Materials and Methods:*** 122 patients with confirmed PCa (70.9 (± 7.6) years) who underwent [^{68}Ga]Ga-PSMA-11 PET/CT and plasma sampling between 03/2019 and 08/2021 were analysed. cfDNA was extracted, and a panel of PCa-specific meth-ctDNA markers was queried via methylation-sensitive restriction enzyme digestion coupled with quantitative PCR (MSRE-qPCR). PSMA PET scans were qualitative and quantitatively assessed. PSA and meth-ctDNA markers were compared with PSMA-PET findings according to their castration status, and their relative prognostic value for survival outcomes in castration-resistant PCa (CRPC) patients was evaluated. ***Results:*** For the total cohort and for hormone-sensitive (hsPC, N = 58) patients, PSA exhibited the highest discriminative power to distinguish between patients with negative and tumor-indicative PSMA PET scans (AUC 0.77, CI=[0.683; 0.857] and 0.737, CI=[0.609; 0.866], respectively). In CRPC (N = 64), the meth-ctDNA marker KLF8 performed best (AUC 0.824, CI=[0.652; 0.92]). For the differentiation of non- and metastatic PSMA PET scans, the meth-ctDNA marker CHST11 (AUC 0.705, CI=[0.618; 0.793]) performed best overall, while KLF8 discriminated best in the hsPC (AUC - 0.662, CI=[0.519; 0.806]) and CRPC (AUC 0.85, CI=[0.743; 0.957]) groups.Several meth-ctDNA markers correlated low to moderate with the total PSMA-positive tumor volume (PSMA-TV) in the overall cohort (5/8) and CRPC groups (6/8), while PSA levels correlated moderately to strongly with PSMA-TV in all groups (all $p < 0.001$). Survival outcomes in CRPC patients were significantly and independently associated with the meth-ctDNA marker LDAH and PSA ($p = 0.0168$ and $p < 0.001$, respectively). ***Conclusion:*** The studied ctDNA methylation markers are promising for the minimal-invasive detection and prognostication of advanced, castration-resistant disease but do not allow for clinical characterization of hormone-sensitive PCa. This warrants further prospective studies for their applicability for systemic therapy response and outcome prediction in advanced CRPC and their incremental value for disease monitoring in PSA-low advanced PCa. ***References:*** [1] Dillinger, Thomas, et al. "Identification of tumor tissue-derived DNA methylation biomarkers for the detection and therapy response evaluation of metastatic castration resistant prostate cancer in liquid biopsies." Molecular Cancer 21 (2022): 1-8.

EP-0284

Quantitative parameters to discriminate indeterminate bone lesions on [^{18F}]-PSMA-1007 PET/CT in prostate cancer imaging

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Aim/Introduction: ^{18}F-PSMA-1007 for prostate cancer imaging offers the distinct advantage of low urinary excretion, but is burdened by a high rate of false-positive findings due to unspecific focal bone uptake (UBU), as previously described in a few reports. UBUs are significantly more frequent on digital PET scanners than on analogic scanners. Aim of the study was to determine which semi-quantitative parameter allows to better discriminate between unspecific and metastatic ^{18}F-PSMA bone uptake ***Materials and Methods:*** Eighty-three patients with prostate cancer who underwent an ^{18}F-PSMA PET/CT scan using a digital tomograph were retrospectively evaluated. A total of 183 equivocal bone foci with no morphological correlate or atypical bone lesion at the co-registered CT scan were analysed. Bone focal uptake areas have been definitively classified as benign (n = 119) or malignant (n = 64) by follow-up or MRI imaging. ROC curve analysis was used to assess the best threshold for SUVmax, SUVmean, tumor-to-liver SUV ratio (TLR) and tumor-to-blood-pool SUV ratio (TBR). ***Results:*** The median SUVmax was 5.9 for UBU (interquartile range 5,0-7,0) and 14.7 for metastases (interquartile range 9.9-23.7). A similar accuracy to discriminate unspecific from malignant lesions was observed for SUVmax (cut-off 8.7; sensitivity 0.81; specificity 0.9; accuracy 0.87; PPV 0.81; NPV 0.9), SUVmean (cut-off 5.1; sensitivity 0.81; specificity 0.91; accuracy 0.87; PPV 0.83; NPV 0.9), TLR (cut-off 0.6; sensitivity 0.77; specificity 0.92; accuracy 0.86; PPV 0.83; NPV 0.88), and TBR (cut-off 4; sensitivity 0.78; specificity 0.88; accuracy 0.85; PPV 0.78; NPV 0.88). ***Conclusion:*** In conclusion, the semi-quantitative PET parameters analysed could be conveniently used to discriminate between unspecific and metastatic bone uptake in cases of no morphological correlate or atypical bone lesions at CT scan in patients with prostate cancer.

EP-0285

Prediction of Lymph Node Metastasis in Prostate Cancer Patients Using 68 Ga-PSMA PET Radiomics Based Machine Learning Techniques

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Aim/Introduction: Extended pelvic lymph node dissection (ePLND) provides staging and prognostic information in prostate cancer (PCa) patients. Sentinel lymph node biopsy (SLNB) can avoid the more invasive ePLND in patients with negative findings. This study aims to evaluate the performance of 68 Ga-PSMA PET radiomics based using a machine learning approach for predicting lymph node metastasis in PCa patients. ***Materials and Methods:*** In this retrospective study, 68 Ga-PSMA PET scans of 28 PCa patients were examined, with 12 positive and 16 negative

lymph node pathologies. Texture analysis was performed using LIFEX version 7.6.3. When insufficient data was filtered out in the LIFEX program, the remaining 86 different parameters were evaluated using the WEKA platform for machine learning analysis. Predictability values were tested following assessments with several decision tree algorithms, such as RandomForest. Machine learning prediction accuracy was evaluated using metrics such as Accuracy, F-Measure, Precision, Recall, and PRC Area. ***Results:*** Accuracy values were found to be 90%, 60%, 70%, 50%, and 60% for RandomForest, RandomTree, HoeffdingTree, J48, and OneR algorithms, respectively. Additionally, F-Measure, Precision, Recall, and PRC Area values were calculated. (Table-1) (Weka software). ***Conclusion:*** The analysis of data obtained from LIFEX image analysis using WEKA-based machine learning algorithms determined that some tissue parameters in 68 Ga-PSMA PET imaging are significantly associated with pathology results verified through intraoperative lymph node sampling. Positive outcomes were achieved on the effectiveness of machine learning applications in predicting data in the pool, with accuracy values reaching up to 90%. The main limitation of the study is its retrospective nature, which lacks a standardized single protocol for creating texture data. This situation affects data distribution, and it is thought that accuracy values predicted by the machine would be more successful with data obtained from a standard protocol and the inclusion of larger patient groups in the study. ***References:*** 1. Fossati, N., et al. The Benefits and Harms of Different Extents of Lymph Node Dissection During Radical Prostatectomy for Prostate Cancer: A Systematic Review. Eur Urol, 2017. 72: 84. https://pubmed.ncbi.nlm.nih.gov/281263512. van der Poel, H.G., et al. Sentinel node biopsy for prostate cancer: report from a consensus panel meeting. BJU Int, 2017. 120: 204. https://pubmed.ncbi.nlm.nih.gov/28188689.

EP-0286

Effect of furosemide on the bladder quantitative parameters in patients undergoing Gallium-68[68Ga] Ga-PSMA-11 PET/CT for diagnosis of prostate cancer

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Aim/Introduction: PRIMARY2 (NCT05154162) is investigating [68Ga]Ga-PSMA-11 PET/CT for prostate cancer diagnosis. Sites of intraprostatic PSMA uptake may be masked by intense bladder activity. One prospective analysis investigated furosemide in patients with prostate cancer in the setting of staging and biochemical recurrence[1]. We aim to investigate the effects of furosemide on quantitative parameters in the bladder in patients undergoing [68Ga]Ga-PSMA-11 PET/CT in the diagnostic setting. ***Materials and Methods:*** Patients with suspected prostate cancer, PI-RADS 2 or 3 on mpMRI, and who had a pelvic-only [68Ga]Ga-PSMA-11 PET/CT were included. The non-furosemide group (PRIMARY trial) was compared with the furosemide group (PRIMARY2 trial) who received furosemide 20 mg IV at time of radiotracer injection. A pelvic-only PET/CT was acquired between 60-70 minutes, without intravenous contrast. Ordered subset expectation maximisation (OSEM) algorithm was used for tomographic reconstruction. Quantitative parameters of the bladder (SUVmax and volume) were measured by two experienced nuclear medicine physicians using an edge-detection tool. 95% confidence intervals were calculated using t-distributions. Association between furosemide and SUVmax was examined with linear regression, adjusting for bladder volume. ***Results:*** Between August 30th 2019 and March 31st 2024, 95 patients were eligible with 53 in the furosemide group (F+) and 42 in the non-furosemide group (F-). Baseline characteristics were similar (F+ vs F-) with median (IQR) age 63 (59-66) vs 64 (58-68) years, PSA 5.3 (4.5-7.2) vs 5.4 (4.3-7.0) ng/mL, and 38/53 (72%) vs 28/42 (67%) had PI-RADS 2 on mpMRI. Technical parameters were similar between groups, with 152 (138-182) MBq vs 152 (106-181) MBq injected [68Ga]Ga-PSMA-11 and uptake time of 61 (60-64) min vs 63 (60-65) min. The median (IQR) SUVmax in the bladder (F+ vs F-) was 11.1 (7.5-14.6) vs 34.8 (18.0-64.2), with a mean difference of 30.9 (95%CI 22.0-39.8). The bladder's volume also considerably differed between groups with 213 (156-303) mL vs 85 (49-148) mL, and a mean difference of 126 mL (95%CI 88-164 mL). After adjusting for bladder volume, the F+ group had a SUVmax 23.0 lower than the F- group (95%CI 12.5-33.5). ***Conclusion:*** Furosemide substantially decreases bladder uptake in patients undergoing [68Ga]Ga-PSMA-11 PET/CT for prostate cancer diagnosis. ***References:*** 1.Fennesy N, Lee J, HoB, Ali SA, Paschkewitz R, et al. Frusemide aids diagnostic interpretation of 68Ga-PSMA positron emission tomography/CT in men with prostate cancer. J Med Imaging Radiat Oncol. 2017;61:739-44.

EP-0287

Combine uptake patterns and MRI findings to evaluate incidentalomas of the prostate detected by ^{18}F-FDG PET/CT

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Aim/Introduction: Patients with no history of prostate cancer who undergo 18F-FDG PET/CT scans discover abnormal uptake in the prostate, referred to as prostate incidentalomas. The aim of this study was to investigate the relationship between different uptake patterns of prostate incidentalomas in 18F-FDG PET/CT and possibility of malignancy. We also evaluated whether the consistency of the extent of incidentalomas between 18F-FDG PET/CT and MRI was helpful in the diagnosis of malignant lesions. ***Materials and Methods:*** All patients without history of prostate cancer found prostatic incidentalomas in 18F-FDG PET/CT were retrospectively evaluated. The uptake patterns of incidentalomas were divided into three categories: focal lesions (Pattern 1), focal lesions in a diffuse background (Pattern 2) or diffuse (Pattern 3). The patients' MRI images were further evaluated to determine whether the lesion was consistent with 18F-FDG PET/CT. The probability of malignancy was compared between different groups. ***Results:*** In total, 70 patients were included, and the prevalence of malignancy was 34.3% (24/70). SUVmax, TBR, SUVmax/ADC and TBR/ADC of prostate incidentalomas exhibited statistical differences between the benign and malignant groups. The proportion of the three uptake patterns were respectively 22.9% (16/70), 15.7% (11/70) and 61.4% (43/70). Malignancy is more common in focal lesions (Pattern 1+2) than diffuse lesions (Pattern 3) (51.9% vs 23.3%), and focal lesions in diffuse backgrounds (Pattern 2) are more likely to

suggest malignancy (73.0% vs 37.5% and 23.3%). For focal lesions, when 18F-FDG PET/CT findings were consistent with MRI, the prostate incidentalomas are more likely to be malignant (71.4% vs 11.1%, 100.0% vs 0.0%). ***Conclusion:*** 18F-FDG PET/CT uptake patterns of prostate incidentalomas can help to identify potentially malignant lesions. Malignancy is more common in focal lesions than diffuse lesions. Focal lesions in diffuse backgrounds and lesions consistent with MRI are more likely to suggest malignancy.

EP-0288

The Relation of ^{68}Ga PSMA PET/CT Radiomics Features with Treatment Response and Overall Survival in Metastatic Castration-Resistant Prostate Cancer Patients Undergoing ^{177}Lu PSMA Radioligand Therapy

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Aim/Introduction: The study aims to investigate the relation of radiomics features obtained from 68Ga PSMA PET/CT with treatment response and overall survival in patients with mCRPC and received 177Lu-PSMA therapy. ***Materials and Methods:*** Between November 2021 and September 2023, a total of 61 mCRPC patients who had received at least 2 cycles of 177Lu-PSMA therapy in our clinic with pre-treatment 68Ga PSMA PET/CT imaging were included in this retrospective study. For each scan, PSMA involvement above the background activity in prostate gland, bones, lymph nodes and other distant metastases were plotted semiautomatical with 40% threshold by an experienced nuclear medicine physician. Radiomic features and SUV-based volumetric parameters were extracted from PET images for a total of 1129 lesions. Patients were classified into two groups according to the "Prostate Cancer Working Group-3" (PCWG-3) criteria; the biochemical response was defined as a 50% or more reduction in the PSA level compared to the baseline. Otherwise, the patient was considered as no response. ***Results:*** Biochemical response was observed in 24 cases (39,3%), and 38 cases (71%) died during follow-up. According to the logistic regression model made with variables with high AUC values that are associated with the biochemical response to treatment, it was determined that GLRLM-LRE was an independent predictive parameter in showing the biochemical response to treatment. GLRLM-LRE value was negatively correlated with the biochemical response (OR=0,396 p=0,012). According to the median follow-up data of 12 months (2-27 months) on 53 patients for whom survival data were available; the average overall survival of the patients was found to be 11.82 ± 1.32 months. In the logistic regression model made with variables with high AUC values that were associated with mortality in patients; PSMA-TV was an independent predictive parameter predicting the risk of mortality in patients. It was determined that as the PSMA-TV value increased, the risk of mortality increased in patients (OR=1.014 p=0.038<0.05). ***Conclusion:*** In our study, GLRLM-LRE was found to be an independent predictive parameter in showing biochemical response; and PSMA-TV was found to be an independant predictive parameter in determining the risk of mortality in patients. We think that this study is one of the first steps towards identifying noninvasive prognostic biomarkers. For the data obtained using texture analysis methods to be used in daily nuclear medicine practice; there is a need for prospective and multicenter studies with a high number of patients in the field of radiomics.

EP-0289

^{68}Ga-PSMA-617 and ^{68}Ga-RM26 PET/MRI in Disease Localization and Eligibility Assessment for Potential Focal Therapy Candidates with Biopsy-proven Low-/Intermediate-Risk Prostate Cancer: a Whole-Mount Pathology-based Study

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Aim/Introduction: Focal therapy (FT) is a promising and minimally invasive strategy to selectively ablate localized prostate cancer (PCa). However, conventional diagnostic techniques inadequately identify appropriate candidates, and under-sampling/sampling biases persist in biopsy pathology-based prospective FT trials. In the current study, we aim to evaluate the potential value of 68Ga-PSMA-617 and 68Ga-RM26 PET (individually and combined with mpMRI) in preoperative assessments for FT. ***Materials and Methods:*** Patients with biopsy-proven low-/intermediate-risk prostate cancer (PCa), who underwent mpMRI, 68Ga-PSMA-617 and 68Ga-RM26 PET were included from a prospective database. mpMRI was interpreted using PI-RADS v2.1, while PET was interpreted considering any positive focal lesion uptake (PETFL). Whole-mount pathology from prostatectomy specimen served as the reference standard. Detection rates for csPCa (lesion-level) and diagnostic performances for extent delineation (segment-level) were assessed and compared using the McNemar test, areas-under-curves (AUCs) and the Delong test. Identification of FT-ineligible men (index lesion ISUP>3 or contralateral csPCa) for each modality were documented. Finally, a second analysis for diagnostic performance was performed in truly FT-eligible men. ***Results:*** Thirty-eight men, with overall 73 csPCa lesions, were included. The csPCa detection rate (lesion-level) was 72.6%, 78.1%, 76.7%, 87.7% and 94.5% for mpMRI, 68Ga-PSMA-617, 68Ga-RM26 PET, mpMRI + 68Ga-PSMA-617 PET and mpMRI + 68Ga-RM26 PET, respectively. AUC for localization delineation (segment-level) for corresponding modalities above was 0.81 (0.77-0.84), 0.85 (0.81-0.88), 0.84 (0.80-0.87), 0.87 (0.84-0.90) and 0.90 (0.87-0.93), respectively. 20 of 38 (53%) men with index lesion ISUP>3 or contralateral csPCa were confirmed ineligible for FT. mpMRI, mpMRI + biopsy, mpMRI + 68Ga-PSMA-617 PET and mpMRI + 68Ga-RM26 PET identified 12 (60%), 15 (75%), 20 (100%) and 17 (85%) of all 20 FT-ineligible men, respectively. Finally, mpMRI, 68Ga-PSMA-617, 68Ga-RM26 PET, mpMRI + 68Ga-PSMA-617 PET and mpMRI + 68Ga-RM26 PET identified 76.9%, 69.2%, 76.9%, 88.5% and 100% csPCa lesions in all FT-eligible men. ***Conclusion:*** 68Ga-PSMA-617 PET demonstrated excellent sensitivity in detecting index lesions and contralateral csPCa, identifying 100% FT-ineligible men when combining with mpMRI. mpMRI + 68Ga-RM26 PET detected 100% csPCa lesions in FT-eligible men. PSMA- and GRPR-PET/MRI are potentially robust tools to minimize selection failure and out-of-field disease in men with low-/intermediate-risk PCa considered for FT.

EP-0290

Can ML-based Ga-68 PSMA PET/CT radiomics predict biochemical response in patients receiving Lu-177 PSMA treatment?

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Aim/Introduction: Prostate cancer is the second most common

malignancy in men after lung cancer and the fifth most common cause of cancer-related deaths. Lu-177 PSMA treatment is an internal radiotherapy method that targets metastatic tumor foci and has less effect on the healthy tissue. It has a cell irradiating effect by binding to its receptor on the cell membrane of metastatic foci expressing PSMA. Radiomics is a rapidly developing branch of research that refers to the acquisition and analysis of quantitative data according to the gray level intensities of voxels in the image and the distribution of these intensities. The aim of machine learning is to first select the information that is important for the problem at hand and create a model that will allow predicting results from new data with this information. In this study, we aimed to evaluate the prediction performance of Ga-68 PSMA PET/CT based machine learning radiomixes performed before treatment in patients receiving Lu-177. ***Materials and Methods:*** Lesions showing increased Ga-68 PSMA uptake from the pre-treatment Ga-68 PSMA PET images of 61 patients who received Lu-177 PSMA treatment in our clinic were segmented using the Local Image Features Extraction (LIFEx) program, accepting 40% of the SUVmax value as a threshold value. For each lesion, first- and second-order radiomic texture features and SUV-based conventional PET measurements were obtained. The obtained tissue properties were compared with the patient's biochemical response parameters. ML algorithms were implemented using Python 2.3, Pycaret library to identify significant patterns. In the study, the prediction performances of 15 ML algorithms were compared. The best model was then evaluated on the test set and combined with the voting classifier. ***Results:*** The average age of 61 patients who met the inclusion criteria was 71.2 ± 7.2 years. Patients with a 50% or more decrease in PSA after two cycles of Lu-177 PSMA treatment were considered to be responsive to treatment, and cases other than this were considered to be non-response to treatment. Biochemical response was observed in 24 patients (39%). The best model among ML algorithms was determined as decision tree classifier. In the algorithm; Accuracy score (accuracy): 0.97, precision score (specificity): 0.95, F1 score (Precision and recall harmonic average): 0.96. ***Conclusion:*** ML-based PSMA PET/CT radiomixes can predict biochemical response with high accuracy in patients with prostate carcinoma receiving Lu-177 PSMA treatment. Further studies with a larger patient group are needed on this subject.

EP-0291

PSMA PET/CT imaging outperforms PSA-based treatment response evaluation for predicting overall survival in metastatic castration-resistant prostate cancer patients

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Aim/Introduction: In metastatic castration-resistant prostate cancer (mCRPC), assessing response to treatment is important for disease management. However, monitoring serum prostate-specific antigen (PSA) levels is not always accurate. This study aimed to assess the efficacy of PSMA PET/CT in treatment response evaluation and survival prediction in mCRPC patients, compared to PSA. ***Materials and Methods:*** 57 mCRPC patients underwent [18F]PSMA-1007 PET/CT at baseline and for treatment response evaluation of either androgen receptor-targeted agents (after 3 months) or chemotherapy (after completion). Visual assessment categorised overall response and response of the worst responding lesion as partial response (PR), stable disease (SD), or progressive disease (PD). Changes in SUVmax, total tumour volume and total lesion uptake were calculated. PSA response was defined according to the PCWG3 criteria. Cox regression analysis identified predictors of overall survival. ***Results:*** PSMA PET/CT and PSA response were discordant in 46% of patients, and PSMA PET/CT response was worse in 92% of these cases. Overall response on PSMA PET/CT independently predicted overall survival (iPD versus non-iPD: HR=6.83, p<0.001), outperforming PSA response and other PSMA PET/CT parameters. Among patients with a PSA decline of >50%, 30% showed PD on PSMA PET/CT (iPD), correlating with higher mortality risk (iPD versus non-iPD: HR=8.72, p=0.002). No flare was observed on PSMA PET/CT. ***Conclusion:*** The use of PSMA PET/CT to assess treatment response at predefined time points showed a higher prognostic value than PSA-based response in mCRPC patients treated with androgen receptor-targeted agents and chemotherapy. Further results on the cost-effectiveness and potential impact on patient outcomes will follow.

EP-0292

Composite prediction score to interpret bone focal uptakes in hormone-sensitive prostate cancer patients imaged with [18F]PSMA-1007 PET/CT

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Aim/Introduction: [18F]PSMA-1007 has significantly advanced PET imaging for prostate cancer (PCa), yet its propensity for non-specific bone uptakes (UBUs) poses a clinical challenge. Our study aimed to investigate whether a combination of clinical, laboratory, and imaging parameters could predict true skeletal metastases in patients exhibiting [18F]PSMA-1007 bone focal uptakes, potentially guiding the interpretation of imaging results. ***Materials and Methods:*** We retrospectively analyzed [18F]PSMA-1007 PET/CT scans performed in 534 patients with hormone-sensitive PCa at three tertiary-level cancer centers. Three expert nuclear medicine physicians visually checked for the presence of focal bone tracer uptakes. For each, a volume of interest (VOI) was manually drawn using a threshold method (40%) to extract SUVmax, SUVmean, PSMA-tumor volume (PSMA-TV), and total lesion PSMA (PSMA-TL). The same VOI was applied to CT images to calculate mean and maximum Hounsfield Units (HU). Clinical and laboratory data were collected from electronic medical records. A composite reference standard, including follow-up i) histopathology, ii) biochemistry, and iii) imaging data, was used to distinguish between PCa bone metastases and UBUs. ***Results:*** 448 bone [18F] PSMA-1007 focal uptakes were identified from 267/534 (50%) PCa patients. According to the reference standard, 188/448 (41.9%)

corresponded to PCa metastases. At the univariate per-lesion analysis, PET/CT indication (staging vs. restaging, p=0.01), PSA at the time of PCa diagnosis (p=0.001) and at PET/CT (p=0.02), the initial ISUP grade group (p=0.009), the ongoing androgen-deprivation therapy (ADT) at the time of PET/CT (p<0.001), the site of bone tracer uptake (p<0.001), SUVmax (p<0.001), TL-PSMA (p=0.01), HUmean (p=0.001), and HUmax (p=0.001) were associated with the presence of PCa metastases. In the multivariate analysis, after setting the center as an offset variable, the ongoing ADT at PET/CT (p<0.001), SUVmax (p<0.001), and HUmean (p<0.001) resulted in independent predictors of bone metastases. The composite prediction model which combined these parameters achieved an AUC of 0.87 and was validated through 10-fold internal cross-validation. A decision curve analysis was performed. Except for a small range of low threshold probabilities, intervening on patients based on the score leads to higher net benefit compared to intervening for all or for none. ***Conclusion:*** This novel composite prediction model demonstrated high accuracy in distinguishing UBUs from bone metastases in PCa patients showing [18F]PSMA-1007 focal bone uptakes. Its application may aid clinicians in accurately interpreting imaging results, thereby potentially reducing the risk of patients' over-staging.

EP-0293

Insights into Renal Split Function Assessment via PSMA-ligand PET/CT

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Aim/Introduction: Tc99m-mercapto-acetyltriglycine (MAG3)-scintigraphy in addition to prostate-specific membrane antigen (PSMA) PET is used as pre-therapeutic work-up prior to Lu177-PSMA radioligand therapy (RLT). PSMA expression in proximal kidney tubule cells leads to significant PSMA-PET tracer uptake, offering potentially valuable insights into renal function. We hypothesize that parameters of renal function may be extracted from PSMA-PET with the potential to replace MAG3-scintigraphy, e.g. for external beam radiation therapy (EBRT) planning. ***Materials and Methods:*** We evaluated 302 metastatic, castration-resistant prostate cancer patients with PSMA-PET/CT (^{18}F-rhPSMA-7.3 [^{18}F-flotufolastat] n=221, 68Ga-PSMA-11 n=81), MAG3-scintigraphy and serum creatinine prior to 177Lu-PSMA I&T RLT. PSMA PET-derived Split Renal Function (PSMA-SRF) was calculated as follows: SRFright=(volumeRight×SUVmeanRight)/(volumeRight×SUVmeanRight+volumeLeft×SUVmeanLeft). MAG3-based SRF was determined using the standard integral method during renal secretion phase. To assess global renal function, we examined the correlation between Total Renal Uptake (TRU=volumeLeft×SUVmeanLeft+volumeRight×SUVmeanRight), Tubular Excretion Rate (TER) of MAG3, and serum creatinine levels. Those were compared to MAG3-SFR using Pearson correlation and Bland-Altman analyses. ***Results:*** PSMA-SRF and MAG3-SRF showed a strong and highly significant correlation (P<0.0001; r= 0.82; CI 95% 0.78-0.85). Bland-Altman analysis verified measurement alignment. High correlations were also observed in the subgroup analyses of patients with ^{18}F--rhPSMA-7.3, and 68Ga-PSMA-11 (r=0.84; CI95% 0.79-0.87, P < 0.0001 and r=0.78; CI 95% 0.68-0.85, P < 0.0001 respectively). TER demonstrated a moderate correlation with TRU (r=0.36; CI95% 0.26-0.45, P<0.0001). ***Conclusion:*** PSMA-PET-derived SRF is highly concordant with the standard technique MAG3-scintigraphy. Prospective studies are warranted to confirm these findings to potentially neglect MAG3-scintigraphy prior to PSMA-PET targeted EBRT of retroperitoneal lesions.

EP-0294

The predictive power of total tumor and bone tumor volumes and prostate-specific antigen levels before prostate-specific membrane antigen-targeted radioligand therapy to predict overall survival.

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Aim/Introduction: Metastatic castration-resistant prostate cancer (mCRPC) presents significant treatment challenges, necessitating innovative therapeutic approaches like PSMA-targeted radioligand therapy (PRLT). Assessing tumor burden through PSMA-PET/CT scans offers a new biomarker suitable for therapy management and ability to predict patient outcomes. This study investigates the predictive capabilities of Total Tumor Volume (TV), Bone Tumor Volume (BV), and Prostate-Specific Antigen levels (PSA) obtained prior to PRLT on overall survival (OS) in mCRPC patients. The objective is to identify the strongest predictor among these parameters, potentially better guiding more personalized treatment strategies. ***Materials and Methods:*** A retrospective analysis was conducted on 104 mCRPC patients scheduled to PRLT. Prior to therapy, each patient was assessed with a baseline PSMA-PET/CT scan (PSMA-11 n=92 / PSMA-1007 n=12). The PET/CT images were semi-automatically segmented according to the PERCIST-LIVER criteria. Metastases were automatically detected and categorized as 'Skeleton' OR 'other'. Using the ROC method, optimal cutoffs for TV, BV, and PSA were determined and patients were stratified into two distinct groups (low and high values) for each parameter based on OS. ***Results:*** Kaplan-Meier curves indicated significantly lower survival rates in the high-value groups (p<0.001) (17.6 vs 7.4mo. for TV, 17.27 vs 6.62mo. for BV and 22.7 vs 9.7mo. for PSA). Univariate Cox regression analysis identified TV, BV, and PSA as significant predictors of OS, with hazard ratios (HR) as follows: TV (HR: 2.97, p<0.001), BV (HR: 3.39, p<0.001), and PSA (HR: 3.90, p<0.001). The Mann-Whitney U test confirmed a significant difference between the alive and deceased patients among for TV, BV, and PSA (p<0.001), and TV showed the highest absolute Z-value (-4.851), followed by PSA1 (-4.001) and BV (-3.381). ***Conclusion:*** This study confirms that a TV >151,96 ml, BV > 116,51 ml, and PSA levels > 72,9 ng/ml have a significant negative impact on OS in patients with mCRPC treated with PRLT. Among these factors, TV emerged as the strongest predictor, highlighting its potential as a marker for guiding therapeutic strategies and optimizing treatment outcomes.

EP-0295

Robot-assisted [^{99m}Tc]Tc-PSMA-SPECT: Are we going to the next level with 'drop-in' radioguidance?

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Aim/Introduction: Following the clinical success of prostate-specific membrane antigen (PSMA) receptor-targeted PET in the diagnosis of prostate cancer, there is a huge push towards PSMA-targeted therapy, including PSMA-targeted surgery (1). The 'drop-in' gamma probe technology has made 99mTc-PSMA-targeted resections compatible with robotic surgery. In this setting the 'drop-in' probe provides an intraoperative acoustical and numerical readout with respect to tracer avid lymph nodes (2,3). Using a new technology entitled robot-assisted [99mTc]Tc-PSMA-SPECT, we are now trying to improve upon the target identification accuracy for this application. This includes using dedicated tracking and reconstruction methods to generate a gantry-free tomographic scan within the surgical field. ***Materials and Methods:*** Three recurrent prostate cancer patients underwent robot-assisted 99mTc-PSMA-targeted salvage surgery. Patients received a [68Ga]Ga-PSMA-11 or [18F]DCFPyl 3D PSMA PET/CT within 60 days before salvage surgery according to the local protocol. This image was used to select patients with local disease that remained confined to <3 soft-tissue lesions. Selected patients received an intravenous injection of [99mTc]Tc-PSMA I&S (≈550MBq) 21-26 hours prior to surgery. Before surgery, preoperative SPECT/CT was performed. During surgery, 99mTc-PSMA-avid nodes were traced using a 'drop-in' gamma probe functionalized with three sterile PEEK-ring markers. Using the markers, the position of the probe was established via custom computer-vision segmentation and tracking software. Maximum-likelihood expectation-maximization (MLEM) reconstruction algorithm that combined the counts/s, probe positioning and look-up table facilitated gantry-free robot-assisted [99mTc]Tc-PSMA-SPECT reconstructions. These tomographic images were overlayed on the endoscopic view. All excised nodal specimens were analyzed at pathology. ***Results:*** Preoperative [99mTc]Tc-PSMA I&S SPECT/CT imaging revealed a total of three lymph nodes located at the left obturator (2 lymph nodes) and left common iliac, and one local recurrence at seminal vesicle. Intraoperatively, three lesions were pursued and successfully traced using the tracked 'drop-in' probe (median 32 counts/s). Robotic-SPECT scans provided volumetric information on the tracer distribution in all lesions within a volume of approximately 100x100x100 mm, thereby "visualizing" the PSMA-expressing lesions. Ex vivo and (histo)pathological examinations confirmed the target-removal. Median lesion diameter was 15 mm. ***Conclusion:*** Robot-assisted [99mTc]Tc-PSMA-SPECT for PSMA-targeted surgery is feasible. By offering 3D tomographic imaging it helps improve the surgeon's appreciation of the tracer distribution within the surgical field. A critical next step in facilitating high-precision surgical decision-making. ***References:*** [1] Berrens, Anne-Claire, et al. European Urology Open Science 54 (2023): 43-55. [2] de Barros, Hilda A., et al. European Urology 82.1 (2022): 97-105. [3] Gandaglia, Giorgio, et al. European urology 82.4 (2022): 411-418.

EP-0296

Initial clinical experience with ^{99m}Tc-MIP-1404 SPECT/CT for assessment of disease extent and eligibility for ^{177}Lu-PSMA RLT

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Aim/Introduction: Recently, there has been increased interest in development of 99mTc-labelled radiotracers targeting the prostate-specific membrane antigen (PSMA) to broaden access to PSMA imaging. We report our initial clinical experience with 99mTc MIP-1404, a novel PSMA-targeted ligand for SPECT, in patients with advanced metastatic castration-resistant prostate cancer (mCRPC) undergoing baseline staging and assessment of eligibility for PSMA-targeted radioligand therapy (RLT). ***Materials and Methods:*** Data of 36 mCRPC patients referred for evaluation of PSMA-targeted RLT who underwent baseline 99mTc-MIP-1404 planar scintigraphy and single-photon emission computed tomography/computed tomography (SPECT/CT) for staging and assessment of RLT eligibility were retrospectively analyzed. Administration-related adverse events were recorded. Images were visually analyzed for presence and anatomic localization of lesions with pathological uptake, and compared with results of 177Lu-PSMA scans following administration of PSMA-targeted RLT. Uptake in tumor lesions was visually scored using a three-point scale, and overall image quality was rated. Finally, the usefulness of uptake intensity in 99mTc-MIP-1404 scans to predict early biochemical response according to Prostate Cancer Working Group criteria was determined following 2 cycles of RLT. ***Results:*** No adverse effects were noted after administration of 99mTc MIP-1404 . 99mTc-MIP-1404 identified metastatic PSMA-expression in all patients. 98.6% of tumor localizations were concordantly classified by both 99mTc MIP-1404 and 177Lu-PSMA SPECT/CT (rs=0.9682 (95% CI: 0.9583-0.9758), P<0.0001). 3 of 216 tumor localizations in 3/36 (8.1%) patients were better depicted using 177Lu-PSMA (1 hepatic, one adrenal and one lymph node metastasis). Uptake intensity in metastatic lesions was higher with 177Lu-PSMA (higher than liver in 32 vs 16 patients, P<0.0001; higher than salivary gland uptake in 25 vs 7 patients; P<0.0001). Tumor uptake higher than salivary gland uptake in 99mTc MIP-1404 scans was associated with early treatment response (OR 11.56 (95% CI, 1.799-91.61; P=0.0123), and demonstrated prognostic significance for PFS (median PFS of 133 vs 65 days in patients with tumor uptake higher vs lower or equal to salivary gland uptake; P=0.0485). ***Conclusion:*** Mapping of disease extent using 99mTc-MIP-1404 SPECT/CT demonstrates high concordance with post-therapeutic 177Lu-PSMA RLT scans in terms of accurate classification of organ involvement. Uptake intensity above salivary gland uptake shows promise for early prediction or treatment response to targeted RLT, and may have prognostic significance for PFS.

EP-0297

Bone Scan Index and Quantitative Bone SPECT/CT - a Comparative Analysis in the Follow-up of Metastatic Prostate Cancer Patients

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Aim/Introduction: The most common site of dissemination in patients with prostate cancer (PCa) is represented by bones. Early detection of malignant lesions is essential to facilitate favorable prognosis as metastases severely compromise patient quality of life, thus the role of imaging has become decisive in initial detection and treatment response evaluation. The Bone Scan Index (BSI) serves as an imaging biomarker of disease progression, by estimating the volume of malignant bone lesions on planar images as percentage value. Automated BSI (aBSI) is independently associated with the prediction of overall survival rates in prostate cancer patients with bone metastasis. ***Materials and Methods:*** Our retrospective study included 32 patients diagnosed with metastatic prostate cancer, who underwent at least two consecutive bone scans and SPECT/CT using 99mTc-

hydroxydiphosphonate within a 6-12-month interval. aBSI values were calculated using EXINI aBSI 3.4 software, with manual correction in case of benign foci initially classified as malignant. We assessed a maximum of five lesions with the highest maximum standardized uptake values (SUVmax) in patients with multiple metastases both on the baseline (T0) and follow-up (T1) examinations; in patients with less than five foci, all lesions were analyzed. A total of 221 metastases were assessed and the values of summed SUVmax between the two studies were compared to determine disease status. Changes in BSI results (ΔBSI) were correlated with differences of summed SUVmax (ΔsumSUVmax) using Spearman's rank coefficient. ***Results:*** The median and interquartile range (IQR) SUVmax for T0 were 28.75 (17.62-47.02) and for T1 25.50 (13.90-41.45), while the median and IQR BSI were 0.45 (0.10-1.47), respectively 0.35 (0.10-1.87). The correlation between ΔBSI and ΔsumSUVmax presented a strong positive result ($r=0.797$, $p<0.01$). We appraised 4 patients presenting less than 5 lesions and BSI values equal to 0.0 on both studies; in these patients, SUVmax ranged from 8.82 to 47.90, due to the localization of the metastases in the vicinity of organs with high physiological radiotracer uptake. Manual adjustments were necessary for hotspots such as urinary catheters, degenerative lesions, and known traumatic injuries that were initially classified as bone metastases. ***Conclusion:*** This preliminary study highlights a strong correlation between the two examinations, suggesting that BSI could serve as a surrogate marker in monitoring treatment effectiveness and disease status. BSI exhibits limitations in accurately detecting hotspots that represent malignant lesions, while SPECT/CT offers improvements in minimizing false positives. More extended studies are required to confirm the clinical utility.

EP-0298

Robotic PSMA-targeted surgery - a preliminary evaluation of 60 patients wherein the DROP-IN gamma probe was used

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Aim/Introduction: The adoption of PSMA-PET as a staging tool has been paradigm changing for prostate cancer (PCa) management. Not only does PSMA-PET offer highly accurate staging, it also allows urologists to personalize the therapy plan. For example, patients that express local disease with limited nodal spread can benefit from PSMA-targeted surgery [1]. A surgical strategy that, following the clinical introduction of the DROP-IN gamma probe technology, has been made compatible with robotic treatment strategies. Earlier studies report on relatively small patient cohorts that focus on either de novo or salvage surgery [2,3]. Here we report an interim analysis of a mixed study that has included 60 patients thus far. ***Materials and Methods:*** Patient with primary diagnosed PCa and patients with recurrent disease after previous curative-intent therapy were included with up to three PSMA PET avid pelvic PCa lesions (nodal or local recurrences). Robot-assisted PSMA-radioguided surgery using the CE-marked re-sterilizable DROP-IN gamma probe was carried out 19-23 h after intravenous injection of 99m-technetium PSMA-Investigation & Surgery (99mTc-PSMA-I&S). To confirm successful intraoperative removal of the lesion, ex vivo gamma probe measurements were used as control. Following surgery, the nodal specimens were analysed at pathology and the patients were monitored for complications. ***Results:*** 60 patients were included, 7 (11.7%) men underwent a 99mTc-PSMA guided lymph node dissection for primary diagnosed PCa and 53 (88.3%) men underwent 99mTc-PSMA guided resection of pelvic PCa recurrences (nodal or local). The DROP-IN probe helped in realizing robot-assisted PSMA-RGS, providing autonomy for the surgeon and facilitating great manoeuvrability during lesion localization. In general, with respect to preoperative PSMA-PET, using the DROP-IN probe, 71/74 (95,9%) PSMA-avid lesions could be resected robotically. Interestingly, a learning curve was observed in both patient selection, as well as intraoperative DROP-IN probe use, where the detection rate raised to 100% after 25 patients. This underlined the best parameters for successful robotic radioguided PSMA-targeted surgery. One patient suffered from a Clavien-Dindo grade >III complication. ***Conclusion:*** Extending earlier reports on its use during sentinel lymph node procedures, recent findings indicate the DROP-IN gamma probe technology also provides a reliable tool for 99mTc-PSMA-targeted robotic PCa surgery. The optimizations in this field pave the way for the exploration of other receptor-targeted DROP-IN applications. ***References:*** [1] Anne-Claire Berrens et al., Eur J Nucl Med Molecular Imaging, 2023[2] Hilda de Barros et al., Eur Urol, 2022[3] Giorgio Gandaglia et al., Eur Urol, 2022.

EP-0299

PRIMARY SCORE of Ga^{68} PSMA-11 PET/CT in evaluation of suspected Carcinoma Prostate - A retrospective study

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Aim/Introduction: Ga68 PSMA-11 PET/CT is the imaging modality of choice in staging and recurrence evaluation of patients with primary prostatic malignancy. A novel approach regarding the utilization of a five point scoring system named PRIMARY scoring system based on intraprostatic pattern was established and evaluated by Emmett et.al, (2022). In the present study, we aim to evaluate the diagnostic accuracy of the PRIMARY scoring system in a cohort of suspected prostatic malignancy and association between PRIMARY score and Risk group among the patients with biopsy proven prostatic malignancy. ***Materials and Methods:*** A total of 56 patients who underwent Ga68 PSMA -11 PET CT between October 2023 and April 2024 were collected retrospectively. Ga68 PSMA 11 uptake in prostate scored from 1 - 5 based on PRIMARY scoring system. A PRIMARY score of 1 and 2 were considered negative for malignancy and a PRIMARY score of 3,4,5 were considered positive for malignancy. Diagnostic accuracy parameters (sensitivity, specificity, positive predictive value, negative predictive value) were calculated with biopsy as gold standard. Association between PRIMARY score and Damico risk classification was evaluated in patients with biopsy proven malignancy. ***Results:*** Among 56 patients, PRIMARY score was 1 in 3 (5.3%), 2 in 11 (19.7%), 3 in 6 (10.7%), 4 in 11 (19.7%), 5 in 25 (44.6%) patients. Histopathologically, 40 (71.6%) patients had Castration sensitive Prostate carcinoma (CS PCa) and 16 (28.6%) were negative for CS PCa. The sensitivity, specificity, Postive Predictive value, Negative predicitive Value were 87.5%, 68.75%, 87.5%, 68.75% respectively. In the cohort of biopsy proven malignancy, 17/24 (70.8%) patients with PRIMARY score 5 were of high risk, 1/24 (6.2%) and 6/24 (25%) patients with PRIMARY score 5 were of low and intermediate risk respectively. ***Conclusion:*** PRIMARY scoring system can be considered in interpretation of Ga68 PSMA uptake in prostate with a sensitivity and positive predictive value

of 87.5% each. Among the cohort of biopsy proven prostatic malignancy, a higher PRIMARY score was associated with high risk group. ***References:*** Emmett L, Buteau J, Papa N, Moon D, Thompson J, Roberts MJ, Rasiah K, Pattison DA, Yaxley J, Thomas P, Hutton AC. The additive diagnostic value of prostate-specific membrane antigen positron emission tomography computed tomography to multiparametric magnetic resonance imaging triage in the diagnosis of prostate cancer (PRIMARY): a prospective multicentre study. European urology. 2021 Dec 1;80(6):682-9.

EP-0300

Imaging screening with [68Ga]-Ga-PSMA-11, [18F]F-FDG, and [18F]-FCholine PET/CT for [177Lu]-PSMA radioligand therapy eligibility in metastatic castration-resistant prostate cancer

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Aim/Introduction: To assess [18F]F-FDG (FDG) and [18F]-Fcholine (Fcholine) performance for discordant lesion detection with [68Ga]-Ga-PSMA-11 (PSMA) PET/CT for [177Lu]-PSMA (LuPSMA) radioligand therapy eligibility in metastatic castration-resistant prostate (mCRPC). ***Materials and Methods:*** This multicenter retrospective study included adults who performed FDG, FCholine and PSMA PET/CT before LuPSMA (I&T or 617) radioligand therapy in mCRPC. PSMA and FDG PET/CT were performed within 30 days and FDG and FCholine within 45 days. During this time, the French regulatory agency required the use of Fcholine prior to performing a PSMA PET/CT. Imaging analysis on a lesion-based level was performed by two groups of readers with different imaging reading order (Group 1: PSMA, FDG and Fcholine. / Group 2 : PSMA, Fcholine and FDG). The primary outcome was the percentage rate of patients with discordant findings between PSMA- and FDG-PET (PSMA-FDG) and between PSMA- and Fcholine-PET (PSMA-Fcholine). The secondary outcome was the concordance and discordance rate between FDG and Fcholine PET. ***Results:*** A total of 60 patients (median age, 74 years [IQR, 68-79 years]) were included between May 2021 and June 2022. 57/60 (95%), 35/60 (57%), 20/60 (33%) patients had bone, lymph node, and visceral disease on PSMA PET/CT. PSMA-FDG discordance was found in 16/60 (26%) patients and discordant lesions were detected in viscera, lymph nodes and bone in 5/16 (31%), 8/16 (50%), 9/16 (56%) patients, respectively. PSMA-Fcholine discordance was found in 18/60 (30%) patients. None of the patients had discrepant visceral lesions (0/18), while 8/18 (44%), 13/18 (72%) patients presented discordant findings for lymph nodes and bone metastases on Fcholine. Among patients with PSMA-FDG discordance, 8/16 (50%) also showed discordance in PSMA-Fcholine analysis. PSMA-Fcholine discordance not detected by PSMA-FDG analysis was observed only in bone in 8/18 (44%) patients and in lymph nodes in 2/18 (11%) patients. ***Conclusion:*** Compared to FDG , Fcholine PET/CT did not detect discordant visceral lesions in patients with mCRPC being considered for LuPSMA radioligand therapy. Prognostic significance of bone-only lesions detected by Fcholine PET/CT requires further evaluation.

EP-0301

Can [18F]DCFPyL PET/CT replace [18F]Fluorocholine PET/CT in all the diagnostic settings of prostate cancer

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Aim/Introduction: PSMA ligands PET/CT have shown higher diagnostic accuracy in several clinical scenarios for prostate cancer (pCa) patients than choline analogues PET/CT. However, whether PSMA ligands should completely replace choline analogues has yet to be determined. The aim is to assess the need for [18F]DCFPyL PET/CT after a previous [18F]Fluorocholine PET/CT and to evaluate the diagnostic and therapeutic impact of [18F]DCFPyL PET/CT compared with [18F]Fluorocholine PET/CT. ***Materials and Methods:*** A retrospective review of all [18F]Fluorocholine PET/CT performed on patients diagnosed with pCa in half of 2022. [18F]Fluorocholine PET/CT (first step) served various purposes: initial staging, detection of biochemical recurrence post-radical prostate treatment, non-metastatic castration-resistant prostate cancer (CRPC-M0), and metastatic (CRPC-M1), in some cases, as a previous step for a requested [18F]DCFPyL PET/CT (second step). [18F]DCFPyL PET/CT under compassionate use, authorized by the SAMHP, approved by a multidisciplinary committee, and with informed, signed consent from patients. The criteria for administering [18F]DCFPyL PET/CT included: (i) previous [18F]Fluorocholine PET/CT that was negative, doubtful for extraprostatic disease, or indicative of oligometastatic disease; and (ii) the patient's clinical eligibility for various alternative treatments based on [18F]DCFPyL PET/CT results. Oligometastatic disease was defined as having ≤3 lesions, potentially involving lymph nodes in the pelvis and/or retroperitoneum, with one lesion possibly in the bone. Data from [18F]DCFPyL PET/CT was gathered from a consecutive and prospective dataset started in August 2021 for biochemical recurrence, January 2021 for CRPC, and March 2021 for staging purposes. ***Results:*** Out of 243 patients, those referred for [18F]DCFPyL PET/CT following [18F]Fluorocholine PET/CT included: 1/3 from the biopsy guide group, 39/79 from initial staging, 2/2 from PSA persistence after prostate resection, 48/65

from biochemical recurrence, 8/36 from CRPC-M0, and 1/58 from CRPC-M1. The therapeutic impact of [18F]DCFPyL PET/CT relative to the findings from [18F]Fluorocholine PET/CT was notable in the first four diagnostic groups: 1 case in biopsy guide, 7 in initial staging (5 treatment up-escalations and 2 down-escalations), 1 up-escalation in PSA persistence, and 19 in biochemical recurrence (18 up-escalations). No treatment modifications were observed in the CRPC-M0 and CRPC-M1 groups. ***Conclusion:*** [18F]Fluorocholine PET/CT appears effective in evaluating disease in patients with CRPC, both M0 and M1 stages, reducing the necessity for [18F] DCFPyL PET/CT in these cases.This allows the latter to be reserved for scenarios where it has a greater diagnostic and therapeutic impact, such as in cases of biochemical recurrence and staging, which show therapeutic impacts of 40% and 18%, respectively.

EP-0302

A Translational Pilot Study of FAP and PSMA Expression by Immunohistochemistry and PET in Castration-resistant Prostate Cancer

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Aim/Introduction: PSMA-targeted PET imaging and radionuclide therapy are a mainstay in the management of advanced prostate cancer. Yet, metastatic castration-resistant prostate cancer (CRPC) may lose PSMA expression following exposition to systemic treatments. Cancer-associated fibroblasts of various cancer types express fibroblast activation protein (FAP). The aim of this study was to assess if FAP can be a viable theranostic target for CRPC, particularly for PSMA-negative CRPC. ***Materials and Methods:*** We evaluated FAP expression in CRPC, using PSMA as a comparison. In a total of 116 CRPC tumors (78 adenocarcinoma, 11 small cell carcinoma (SmCC), and 27 "anaplastic carcinoma"), FAP expression was assessed using immunohistochemistry (IHC). Tissue microarray cores of n=62 CRPC (including n=9 locally advanced CRPC, and n=53 metastatic CRPC) served for paired FAP and PSMA IHC analysis. Expression positivity was arbitrarily defined by IHC score ≥10. A preliminary analysis of 4 patients included in the trial NCT0445723 was performed to explore the correlation of PSMA/FAP PET imaging and IHC. ***Results:*** Overall, FAP expression in CRPC was significantly lower compared to PSMA expression (median immunoscores 14 vs 72, p<0.001). The level of PSMA expression distinctly varied across different histological subtypes of CRPC, while all subtypes consistently showed low FAP expression. Among the 19 PSMA-negative tumors, 11 (58%) exhibited FAP positivity. FAP expression leves in nodal metastases were significantly lower than in non-nodal metastases (p=0.021), whereas FAP expression levels in hepatic metastases were significantly higher compared to extra-hepatic metastases (p=0.016). In 4 patients with CRPC, uptake intensity on FAPi PET was lower compared to PSMA PET (median SUVmax 9.6 vs. 14.5), consistent with the lower FAP expression than PSMA expression in the corresponding biopsied tumors (median immunoscores 30 vs 160). ***Conclusion:*** The utility of FAPi PET imaging may be limited due to overall lower levels of FAP expression in CRPC. FAPi PET imaging should be tested for its ability to detect PSMA-negative tumors, such as small cell carcinoma of prostatic origin, as they express variable levels of FAP expression.

EP-0303

[64Cu]Cu-PSMA-Q PET/CT in late stage Prostate Cancer: a Diagnostic and Dosimetric Study

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Aim/Introduction: [64Cu]Cu-PSMA-Q is a novel radiopharmaceutical targeting prostate-specific membrane antigen (PSMA), which has been proven to exhibit a high specific uptake in prostate cancer(PCa) lesions and an excellent tumor-to-background ratio [1]. In this study, we first aimed to compare the diagnostic performance of [64Cu]Cu-PSMA-Q and [18F]F-FDG in the same group of PCa patients. The secondary aim was to perform dosimetry analysis. ***Materials and Methods:*** With institutional review board approval and informed consent, a total of 29 histopathological confirmed PCa patients were enrolled. All of the 29 patients underwent paired [64Cu]Cu-PSMA-Q and [18F] F-FDG PET/CT. The activity of tracer accumulation in lesions was assessed by maximum standardized uptake value (SUVmax) and tumor-to-background (TBR). The imaging data were used for calculation of dosimetry using OLINDA/EXM 2.1 (male phantom). ***Results:*** To date (Dec 26th, 2023), 29 patients were included. The median age was 72.0 years (range, 58-87), their median baseline prostate-specific antigen was 265.0 ng/mL (range, 4.0-2747.0). The radiotracer uptake of primary and metastatic lesions in [64Cu]Cu-PSMA-Q was significantly higher than those in 18F-FDG (Median SUVmax: primary tumors, 18.4 vs. 4.9, P<0.001; regional lymph nodes, 7.4 vs. 3.7, P=0.007; distant metastases, 11.0 vs. 6.3, P=0.081. Median TBR: primary tumors, 8.3 vs. 2.3, P=0.002; regional lymph nodes, 4.9 vs. 1.7, P=0.001; distant metastases, 5.5 vs. 3.1, P=0.135). [64Cu]Cu-PSMA-Q had a higher detection rate for primary and lymph node lesions. In 21 patients with primary lesions, [64Cu] Cu-PSMA-Q detected primary tumor in 95.2% (20/21), while [18F] F-FDG detected primary tumor in 66.7% (14/21). In 16 patients with peripheral lymph node metastases, 50% (8/16) showed more peripheral lymph node lesions on [64Cu]Cu-PSMA-Q than on [18F] F-FDG, 12.5% (2/16) showed the opposite, and the remaining 37.5% (6/16) showed identical results. In 11 patients with distant lymph node metastases, 72.7% (8/11) detected more lymph node lesions on [64Cu]Cu-PSMA-Q, whereas 27.3% (3/11) showed comparable results with both tracers. In 20 patients with bone metastases, no significant difference of trunk and limb bone metastases were observed between [64Cu]Cu-PSMA-Q and [18F] F-FDG PET/CT. However, [64Cu]Cu-PSMA-Q detected more cranial bone metastases. Nine patients were included for dosimetric studies. The median total body effective dose of [64Cu]Cu-PSMA-Q was 0.0284 mSv/MBq. No IMP related adverse events were observed. ***Conclusion:*** [64Cu]Cu-PSMA-Q is a promising new diagnostic PET tracer for detection and characterization of PCa, it may aid physicians in patient management decision making. ***References:*** [1] Wu Y et al. Eur J Nucl Med Mol Imaging. 2022 Jul;49(8):2774-2785.

EP-0304

Optimising the use of 18F-Fluorodeoxyglucose Positron Emission Tomography (FDG PET) imaging in patients with metastatic castration-resistant prostate cancer (mCRPC) in the era of Radioligand Therapy (RLT)

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Aim/Introduction: In the era of RLT, understanding how to select mCRPC patients eligible for this treatment is crucial. The combination of FDG and prostate-specific membrane antigen (PSMA) PET imaging has been proposed to enhance patient selection, even within clinical trials. However, using both tracers entails higher costs for public healthcare systems and potential issues related to the availability and allocation of resources. Given these considerations, we aimed to evaluate the presence of clinical or imaging parameters that could predict the occurrence of FDG-positive/PSMA-negative mismatch in a single-centre retrospective cohort of mCRPC patients. ***Materials and Methods:*** We retrospectively identified mCRPC patients who underwent FDG and PSMA PET/CT within 30 days without treatment changes between 2021 and 2024. Univariate and multivariate logistic regressions for FDG+/PSMA- mismatches were performed, considering various clinical (primary treatment, ISUP grade group, previous lines and types of treatments for mCRPC), biochemical (prostate specific antigen [PSA], alkaline phosphatse [ALP], lactate dehydrogenase [LDH]), and PSMA PET/CT-derived parameters (standardized uptake value [SUV]max, PSMA tumour volume [PSMA-TV], and total lesion PSMA [PSMA-TL]). Eligibility for RLT according to the imaging selection criteria of the VISION phase III trial was also assessed. ***Results:*** Among the 46 patients (median age was 72.3 years, range: 55-87), 67% had previously undergone more than two lines of therapy for mCRPC. Univariate analysis revealed that previous treatment with enzalutamide (OR 0.25, 95%CI 0.06-1.1, p=0.05), eligibility for RLT as per the VISION trial criteria (OR 0.14, 95%CI 0.02-0.76, p<0.05), and a PSMA-TL above 2282 (OR 0.07, 95%CI 0.008-0.62, p<0.05) were significant predictors of the absence of FDG-positive/PSMA-negative mismatched lesions. Notably, in the multivariate analysis, both PSMA-TL and previous treatment with enzalutamide remained significant predictors (p<0.05 for both). ***Conclusion:*** Previous treatment with enzalutamide and high PSMA-TL emerged as significant and independent predictors of the absence of FDG-positive/PSMA-negative mismatched lesions. The ability of enzalutamide to upregulate PSMA expression, combined with the lower PSMA expression observed in patients with undifferentiated FDG-avid mCRPC, may explain these results. If these findings are confirmed by further studies, they could help identify patients who are more likely to benefit from dual-tracer PET/CT imaging, thereby guiding treatment decisions more effectively.

EP-0305

Is there any added value of radiomics analysis in the interpretation of focal bone uptakes in prostate cancer patients imaged with [18F]PSMA-1007 PET/CT?

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Aim/Introduction: Recent advancements in logistics and availability of [18F]PSMA-1007 have significantly increased its use in PET imaging for prostate cancer (PCa). However, its propensity for non-specific bone uptakes (UBUs) presents a notable clinical challenge. Our study aimed to investigate whether radiomic features could enhance the interpretation of bone focal uptakes and assess their potential additive value to the visual interpretation by PET readers with varying levels of prior expertise. ***Materials and Methods:*** We retrospectively analysed [18F]PSMA-1007 PET/CT scans from 102 patients with histology-proven hormone-sensitive PCa performed at IRCCS Ospedale Policlinico San Martino, exhibiting at least one focal bone tracer uptake, as jointly determined by two nuclear medicine physicians. To differentiate between PCa bone metastases and UBUs, we employed a composite reference standard that included follow-up histopathology, biochemistry, and imaging data. Using matRadiomics, 1781 radiomic features were extracted from PET and CT images of each bone uptake. Features were elaborated through a machine-learning pipeline (30 repetitions), incorporating an 80%/20% split for training/testing, Least Absolute Shrinkage and Selection Operator (LASSO) feature selection, and model building using six classifiers (Discriminant Analysis, DA), Support Vector Machines (SVM), K-Nearest Neighbors (KNN), Neural Networks (NN), Random Forests (RF), AdaBoost (Boost). Iterations included 5-fold cross-validation and models testing, the results were averaged over the 30 repetitions. Moreover, ensemble versions of each classifier were built, computing their performance. In parallel, PET readers with low experience (n=2, < 30 previous PSMA PET readings) and high experience (n=2, > 300 previous PSMA PET readings), and blinded to the clinical history of PCa patients, rated each bone uptake as either UBU or bone metastasis. ***Results:*** Out of the 178 bone [18F]PSMA-1007 focal uptakes, 74 (41.5%) were identified as PCa metastases according to the reference standard. Two radiomics features, "log_sigma_4_5_mm_3D_glszm_SmallAreaEmphasis" and "wavelet_HLH_ngtdm_Contrast1" showed robustness to training/testing splitting greater than 70%. Overall, the highest accuracies were reached by the ensemble classifiers, ranging from 78.65% to 82.58%. However, the accuracy of radiomics did not surpass that of expert PET readers, as both achieved a diagnostic accuracy of 92.1%. In contrast, the diagnostic accuracy for low-experienced readers was lower, at 83.7% (p=ns compared to experts and radiomics) and significantly lower at 54.4% (p<0.05 compared to experts and radiomics). ***Conclusion:*** While the performance of radiomics in interpreting bone [18F]PSMA-1007 focal uptakes did not surpass the visual assessment by expert PET readers, it potentially improves the interpretative accuracy of readers with less experience.

EP-0306

[68Ga]GaPSMA617 PET-based radiomics model to identify candidates for active surveillance amongst patients with Gleason GradeGroup 1-2 prostate cancer at biopsy

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Aim/Introduction: Current inclusion criteria for active surveillance (AS) may results in some patients carrying with adverse pathology

(AP) at final pathology receiving an AS regimen. By enrolling these patients in AS, they may miss the opportunity for curative treatment due to disease progression. Additionally, the flexibility of inclusion criteria may limit the number of patients with pathologically indolent PCa who are eligible for AS, increasing the risk of overtreatment. Several models based on the clinical and MRI features have been developed to overcome these limitations but aren't ideal. Our study aims to develop a [68Ga]Ga-PSMA PET-based radiomics model to predict postoperative AP in patiens with biopsy Gleason Grade Group (GGG) 1-2 PCa, aiding in the selecting patients for AS. ***Materials and Methods:*** Seventy-five men with biopsy GGG 1-2 PCa who underwent radical prostatectomy (RP) were enrolled. The presence of AP at RP, defined as non-organ confined disease and/or lymph node invasion and/or GGG ≥ 3, represented the study's outcome, which means that the patient wasn't suitable for AS. All patients were divided into training group (70%) and testing group (30%) randomly. Radiomics features were extracted from [68Ga]Ga-PSMA PET scans and selected by the minimum redundancy maximum relevance algorithm and the least absolute shrinkage and selection operator regression model. The clinical model based on the clinical features and conventional [68Ga]Ga-PSMA PET/CT features, radiomics model based on the radiomics features, and combined model based on all above features were developed using logistic regression analyses. ROC curve was used to assess the diagnostic value of those models. ***Results:*** Thirty of seventy-five patients had AP confirmed by RP. The clinical model showed an AUC of 0.821 in the training set and 0.795 in the testing set. The radiomics model achieved AUC values of 0.830 and 0.829 in the training and testing set. The combined model, which incorporated the Radiomics score and FPSA/TPSA, demonstrated higher diagnostic efficacy than both the clinical and radiomics models, with AUC values of 0.875 and 872 in the training and testing set. decision curve analysis showed that the net benefits of the combined model and radiomics model exceeded the clinical model. ***Conclusion:*** The combined model shows potential in stratifying men with biopsy GGG 1-2 PCa based on the presence of AP at RP and outperforms models based solely on clinical or radiomics features. It may be expected to aid urologists in better selecting suitable patients for AS.

EP-0307

A new SPECT agent for PSMA visualization, [^{99m}Tc]Tc-BQ0413: preclinical evaluation and preliminary results of Phase I clinical study

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Aim/Introduction: Radionuclide imaging using radiolabelled inhibitors of PSMA can be used for staging of prostate cancer (PCa). We have designed a molecule BQ0413, which contains Glu-urea-Lys binding moiety, optimized linker structure including 2-napththyl-L-alanine and L-tyrosine [1], and mercaptoacetyl-triglutamate chelator for labelling with Tc-99m. The purpose of this study was to evaluate the imaging properties of [99mTc]Tc-BQ0413. ***Materials and Methods:*** Synthetically produced pseudo-peptide was labeled with technetium-99m. [99mTc]Tc-BQ0413 was studied on target specificity, affinity and in vivo biodistribution. A whole body planar scintigraphy and SPECT/CT imaging were performed 2, 4, and 6 h after injection of 50, 100, or 150 µg (680±140 MBq) of [99mTc]Tc-BQ0413 in five PCa patients for each dose (NCT05839990). ***Results:*** [99mTc]Tc-BQ0413 bound specifically to PSMA-expressing cells with affinity 33±15 pM. In tumor-bearing mice, the tumor uptake of [99mTc]Tc-BQ0413 (38±6 %IA/g in PC3-pip 3 h after injection of 40 pmol) was dependent on PSMA expression (0.9±0.3 %IA/g in PSMA-negative tumors). The co-injection of 5 nmol of unlabeled BQ0413 blocked [99mTc]Tc-BQ0413 uptake in normal PSMA-expressing tissues without blocking the uptake in tumors that resulted in an appreciable increase in the tumor-to-organ ratios. In patients, all injections of [99mTc]Tc-BQ0413 were well tolerated, no adverse events were registered. The elimination of [99mTc]Tc-BQ0413 was predominantly renal. The stable physiological uptake of [99mTc]Tc-BQ0413 was observed in the lacrimal and salivary glands, liver, spleen, and kidneys for all tested peptide doses. Activity uptake in clinicaly relevant organs (bones and muscles) was low and decreased with time (SUVmean<1). An average effective doses were 0.007 ± 0.001, 0.0049±0.0003, and 0.0062±0.0008 mSv/MBq for 50, 100, and 150 µg/injection. With the given activity, the radionuclide-associated dose burden per patient was 4-7 mSv/study. Uptake of [99mTc]Tc-BQ0413 in primary tumors was identified in all patients (SUVmean increased from 3.4±1.4 [1.15-4.82] for 50 µg/dose to 5.1±1.2 [3.86-7.01] for 150 µg/dose). Uptake in LN and BM was the highest at 100 µg/dose (SUVmean 29.6±28.9 [12.34-62.99] and 20.0±12.3 [6.41-30.29]). Physiological uptake and uptake in cancer lesions did not changed significantly with time or with injected peptide dose. ***Conclusion:*** [99mTc]Tc-BQ0413 demonstrated specific binding to PSMA with binding affinity in low picomolar range. The results of the Phase I study show that injections of [99mTc]Tc-BQ0413 are well-tolerated, safe and associated with low absorbed doses. Imaging using [99mTc]Tc-BQ0413 enables visualization of primary prostate cancer lesions, as well as metastases in lymph nodes and bones. ***References:*** 1. Lundmark et al. Pharmaceutics 2022, 14, 1098.

EP-0308

Effect of post-injection acquisition time on the qualitative evaluation of whole-body [^{68}Ga]Ga-PSMA PET/CT scans

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Aim/Introduction: Post-injection (p.i.) acquisition time may originate different interpretations of whole-body [68Ga]Ga-PSMA PET/CT scans due to radiopharmaceutical kinetics in tumor lesions and/or radiopharmaceutical decay. This work aims to compare visual interpretation in the same patients on whole-body [68Ga]Ga-PSMA PET/CT scans acquired in three consecutive p.i. times. ***Materials and Methods:*** Eighty-two patients with prostate cancer were included. 18% were referred for disease staging and the remaining for re-staging or assessment of therapy response. Patients were injected once with approximately 2.0±0.25 MBq/kg of [68Ga]Ga-PSMA. Each patient underwent three consecutive PET scans in the same equipment (Philips Gemini TF16): approximately 56±10min, 89±9min, and 124±11min p.i. (T1, T2, T3, respectively). Each scan duration was approximately 65±9, 75±6, and 86±8 seconds/AFOV, respectively. All scans (246 in total) were evaluated independently and anonymously by two experienced nuclear medicine physicians, unaware of any patient clinical information. Scans were randomly shuffled and anonymized. The evaluation was based on overall image quality (1: low; 5: excellent); and the presence of suspected malignant lesions (yes/no), namely in the prostate or prostate site, bones, and lymph nodes (supra and/or infradiaphragmatic). ***Results:*** Inter-

reader image quality was rated as 3.3±0.5, 3.3±0.5, and 3.2±0.5 for the T1, T2, and T3 scans, respectively. Regarding the detection of suspected malignant lesions, reader 1 identified 36-32-34 scans with prostate lesions, 19-18-18 scans with bone lesions, 9-13-11 scans with supradiaphragmatic lymph node lesions, and 27-27-26 scans with infradiaphragmatic lymph node lesions for times T1-T2-T2, respectively. Reader 2 identified 45-40-41, 26-22-23, 11-12-14, and 33-32-31, respectively. Intra-reader agreement varied between 85% (T1 vs T2, for the detection of prostate lesions) to 100% (T2 vs T3, for the detection of bone lesions), for reader 1; and between 82% (T1 vs T2 and T2 vs T3, for the detection of prostate lesions) to 96% (T2 vs T3, for the detection supradiaphragmatic lymph node lesions) for reader 2. There were no statistically significant differences among the detection of lesions for the three acquisition times. Now, regarding the inter-reader agreement, it varied between 77% (T1 vs T1, for the detection of prostate lesions) to 99% (T2 vs T2, for the detection of supradiaphragmatic lymph node lesions). There was no statistically significant difference among the three acquisition times. ***Conclusion:*** Overall, this study did not demonstrate a significant effect of the post-injection time (from 1 to 2 hours p.i.) in the detection of suspected malignant lesions with [68Ga]Ga-PSMA PET/CT.

EP-0309

PSMA-PET: is there something we can do to facilitate the interpretation of the image?

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Aim/Introduction: Some modifications to standard (SD) 68Ga-PSMA-11-PET protocol seems to facilitate image interpretation: 1) iv contrast at the excretory phase (50 ml of Omnipaque® 10-15 minutes before PET acquisition) to define the ureteral anatomy 2)Dynamic pelvic acquisition (0-8 minutes post-injection) to visualize the prostate bed before bladder excretion of 68Ga-PSMA, in patients with radical prostatectomy (RP) 3)Late images (100-180 minutes post-injection) to further increase detectability of low-uptake-lesions at SD. Nevertheless, as their use can increase both the costs and complexity of the study, we tried to define if these modifications have a real impact on PSMA-PET interpretation. ***Materials and Methods:*** PSMA-PET performed for both recurrence detection and initial staging were prospectively analysed. For each patient we evaluated the improvement of these modifications respect to the SD (at 60-100 minutes without contrast). Moreover, their potential increase in the 5-point-scale reader confidence when using EANM standardized report e-PSMA (ePSMACR)1 in comparison with just the use of SD. ***Results:*** Thirty-six patients were included (70 years [53-82], PSA at PET=0.84 ng/ml [0.1-125]; 33/36 for recurrence detection (23/33 after RP; 7/33 under antiandrogen deprivation). -Dynamic acquisition was performed in 23 patients. It helped to detect local recurrence not seen on SD in 2/23(8%), switching from 2 to 4 in ePSMACR; in 3/23(13%) to define that the uptake was not due to local recurrence but rather to anatomical changes post-RP (switching from 3 to 1-2 in ePSMACR). -In 32 patients iv contrast was used. In 5/32 (15%) it avoided the potential pitfall of uretral diverticulum post-RP (from 5 to 1-2 in ePSMACR) and in 4/32 (12.5%) it discriminated between positive lymph nodes and ureteral excretion (2 without change in ePSMACR; 1 patient from 3 to 4 and another from 4 to 1). -In 32 patients late images (159 minutes±40) were obtained. In 2/32(6%) it better define focal uptake in seminal vesicles indeterminate at SD (switching from 3 to 5 in ePSMACR) and in 11/32(34%) it helped to discriminate between malignant (increase in uptake) and physiological/benign lymph nodes (switching from 3-4 to 5 in 7 patients and from 2-4 to 1 in 4 patients) ***Conclusion:*** Modifications to SD protocol have been shown to have a real impact on 68Ga-PSMA-11-PET interpretation and ePSMACR reader confidence. When used, dynamic acquisition modified final diagnosis in 21% of patients, iv contrast in 27.5% and late images in 40%. ***References:*** 1. Ceci F et al. Eur J Nucl Med Mol Imaging. 2021.

EP-0310

Preoperative Volumetric PSMA-PET Parameters for Risk Assessment and Predicting Biochemical Recurrence in Prostate Cancer Patients.

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Aim/Introduction: The aim of this study is to describe the distribution of volumetric parameters of PET-PSMA in patients with intermediate and high-risk prostate cancer, along with the histopathological characteristics of the tumor after radical prostatectomy, as well as the differences in patients who developed biochemical recurrence during follow-up. ***Materials and Methods:*** One hundred and thirteen patients referred for PSMA-PET/CT for initial staging and scheduled for radical prostatectomy (RP) were included. PET parameters, including tumor SUVmax, tumor SUVmean, Prostate Molecular Tumor Volume (pMTV), Prostate Volume (pV), Prostate Total Lesion Activity (pTLA), and Prostate Disease Burden % (pDB), were recorded. pV was obtained by automated segmentation of the prostate gland on CT images. pDB was calculated using the formula (pMTV x 100 / pV). The Mann-Whitney U test was used for comparing groups. A p-value <0.05 was considered statistically significant. ***Results:*** Fifty-four intermediate-risk (IR) and fifty-nine high-risk (HR) PCa patients were included in the study. The median SUVmax was 9.89 (range: 6.23-13.13) in the IR group and 10.10 (range: 6.70-18.66) in the HR group. Volumetric parameters were significantly higher in the HR group compared to the IR group. Specifically, the median values for pMTV, pTLA, and pDB in the HR group were 4.6 cc, 29.5%, and 9.3%, respectively, whereas the median values in the IR group were 3.6 cc, 19.1%, and 6.8%, respectively. Furthermore, significantly higher values of pMTV, pTLA, and pDB were observed in patients with positive margins after surgery, those with seminal vesicle infiltration, and patients with Gleason Scores ≥ 8. In the context of biochemical recurrence (BCR), volumetric parameters of PSMA-PET were found to be statistically higher in patients who developed BCR compared to those who maintained undetectable PSA levels ($p < 0.05$), as indicated in Table 1. However, no significant differences were found in terms of SUVmax or SUVmean between risk groups or among histopathological or biochemical recurrence status. ***Conclusion:*** The inclusion of volumetric PSMA-PET parameters such as pMTV, pTLA, and pDB could enhance preoperative risk assessment and provide valuable insights into tumor aggressiveness based on PET imaging data. These parameters offer additional information that aids in better understanding the tumor's behavior before surgery. In terms of predicting biochemical recurrence (BCR), PSMA-PET parameters emerge as promising tools for stratifying patients at higher risk. However, further studies are necessary to validate these findings and elucidate the precise role of PSMA-PET parameters in predicting BCR.

EP-0311

Optimal PSMA-metrics for clinically significant prostate cancer detection in patients with previously negative biopsy.

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Aim/Introduction: The detection of clinically significant prostate cancer (csPCa) can represent an imaging challenge in patients with previously negative biopsy. In the current study we aimed to define the optimal PSMA-metrics for the detection of csPCa derived from two prospective trials. ***Materials and Methods:*** Overall, we enrolled 127 patients complying with the inclusion criteria and derived from two prospective trials. Inclusion criteria were: [68Ga]PSMA PET/CT, target fusion biopsy, PSA>4.0ng/ml, free-to-total PSA ratio <20%, progressive rise of PSA levels in two consecutive samples, at least one previous negative biopsy, negative digital rectal examination. Target lesions were defined by computing Primary score, SUVmax and SUVratio to contralateral prostatic background, and statistically correlated to pathology findings. ***Results:*** Median age was 63 years (range 50-82), median PSA 9.7 ng/ml (range 4.3-35), median PHI 46 (range 34-59) and median prostatic volume 73cc (range 17-190). Most patients (96; 76%) had one previous negative biopsy, while the remaining >1. According to re-biopsy results, 23 patients presented with csPCa (18%), 14 with GS 3+3, while the majority had a negative biopsy (90; 71%). Primary scores were: 103 score 1-3 (81%), and 24 score 3-5. Median SUVmax and SUVratio were 4.1 and 1.6, respectively. Optimal cut-off points for the detection of csPCa were: SUVmax >6.12 (AUC 0.792; 95%CI 0.711-0.859) and SUVratio >2.4 (AUC 0.773; 95%CI 0.690-0.842), while the best correlation was set for Primary score >3 (AUC 0.796; 95%CI 0.716-0.863). Sensitivity and specificity for the detection of csPCa resulted as follows: SUVmax cut-off 70% and 87%, SUVratio cut-off 70% and 91%, while Primary score 65% and 91%, respectively. On logistic regression, all above mentioned PET-metrics were significantly correlated to biopsy results (p<0.0001), with SUVratio cut-off >2.4 resulting an independent predictor (p=0.0197) of csPCa detection. ***Conclusion:*** [68Ga]PSMA PET/CT metrics predict the detection of csPCa in patients candidate to rebiopsy, with the SUVratio cut-off granting the best correlation to pathology results. ***References:*** The study was financially supported by the Ministry of Health (Ministero della Salute) with the Grant GR-2018-12366240.

EP-0312

Comparison of [^{68}Ga]PSMA PET/CT vs. mpMRI in patients with suspicion of prostate cancer and previous negative biopsy.

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Aim/Introduction: Primary trial has proven the added role of [68Ga]PSMA PET/CT compared to mpMRI for the detection of prostate cancer (PCa) in biopsy-naïf patients. Herein, we present the results of our study, designed to compare [68Ga]PSMA PET/CT with mpMRI in men with a high suspicion of PCa after at least one previous negative biopsy. ***Materials and Methods:*** Overall, we enrolled 109 patients complying with the inclusion criteria and derived from two prospective trials. Inclusion criteria were: [68Ga]PSMA PET/CT, mpMRI, target fusion biopsy, PSA>4.0ng/ml, free-to-total PSA ratio <20%, progressive rise of PSA levels in two consecutive samples, at least one previous negative biopsy, negative digital rectal examination. Target lesions were defined based on PI-RADS v2.1 for mpMRI and Primary Score, SUVmax and SUVratio to contralateral prostatic background for [68Ga]PSMA PET/CT, then correlated to pathology findings. ***Results:*** Median age was 65 years (range 50-82), median PSA 10 ng/ml (range 4.3-35), median PHI 46 (range 34-59) and median prostatic volume 73cc (range 17-197). Most patients (83; 65%) had one previous negative biopsy, while the remaining >1. According to re-biopsy results, 21 patients (19%) presented with clinically significant PCa (csPCa), 12 with GS 3+3, while the majority had a negative biopsy (76; 70%). mpMRI results were: 63 patients with PI-RADS 1-2 (58%), 12 with PI-RADS 3 (11%), 26 with PI-RADS 4 (24%), and 8 with PI-RADS 5 (7%). Primary scores were: 90 score 1-3 (83%), and 17 score 3-5. PI-RADS and Primary scores were significantly correlated to each other (p=0.0001), with optimal cut-offs for csPCa set in both cases for scores >3. Median SUVmax and SUVratio were 4 and 1.5, with optimal cut-off values set at 6.12 and 2.4, respectively. Sensitivity and specificity resulted as follows: PI-RADS 71% and 78%, Primary score 65% and 91%, SUVmax cut-off 70% and 87%, SUVratio cut-off 70% and 91%, respectively. All imaging parameters were significantly correlated to csPCa detection on biopsy, with PI-RADS resulting an independent predictor (p=0.0058). When combining [68Ga]PSMA PET/CT with mpMRI, the specificity reached 98% for csPCa, leading to a potential change in patient management in 18% of the cases. ***Conclusion:*** [68Ga]PSMA PET/CT parameters predict biopsy results in patients candidate to re-biopsy, with a complementary role compared to mpMRI; the combination of both modalities can spare most unnecessary re-biopsies, by potentially changing management in 18% of the cases. ***References:*** The study was supported by the Ministry of Health (Ministero della Salute) with the Grant GR-2018-12366240.

EP-0313

Preliminary Pharmacokinetic Results of ^{18}F-PSMA-1007 in Prostatic Oncological Lesions Using the SRTM Compartmental Model

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Aim/Introduction: The Simplified Reference Tissue Model (SRTM) offers a promising and less invasive alternative for the study of prostatic oncological lesions with 18F-PSMA-1007, as it does not require arterial input curves, unlike traditionally used models. Although it is not the conventional approach for this type of analysis, the goal is to evaluate the SRTM and analyze the behavior of its pharmacokinetic constants. ***Materials and Methods:*** In a preliminary study, six patients with Ca. Prostate were injected with dose mean of 4.53 mCi of 18F-PSMA-1007. Imaging was performed using PET-CT and PET-MR scanners with dynamic 45-minute protocols. Volumes of interest (VOIs) were delineated in areas of bone metastases, lymph node metastases, local recurrence, and normal prostatic tissue, using gluteal tissue as a reference for the SRTM model. Temporal activity curves were analyzed, and Monte Carlo modeling was applied to reduce noise-related errors, using a compartmental model to derive the pharmacokinetic constants: ligand uptake (R1), specific receptor density (BPnd), ligand clearance rate to plasma (k2), ligand clearance rate to reference tissue (k2'), and undifferentiated ligand clearance rate (k2a). ***Results:*** R1 values were significantly higher in lymph node metastases (average of 3.30) compared to normal

prostatic tissue (average of 1.59). BPnd also showed elevated values in lymph node and bone metastases (averages of 14.16 and 12.83, respectively). In contrast, the k2 constant was lower in bone metastases, with a value (average of 0.3). It was also observed that ligand uptake (R1) was 80.9% higher and the clearance rate (k2) was 38.6% lower in patients with confirmed recurrence compared to those with undifferentiated pathology, indicating greater ligand retention and a significantly higher receptor density (BPnd increased by 156.1%). Additionally, the elimination rates of the ligand from the reference tissue (k2′) and undifferentiated ligand (k2a) decreased by 62.9% and 60.2%, respectively. ***Conclusion:*** According to the SRTM model, lymph node and bone metastases show significantly higher metabolic activity and receptor availability than normal prostatic tissue. Moreover, in patients with confirmed recurrence, there is an observed increased retention of the ligand and a higher receptor density, accompanied by a significant decrease in the ligand elimination rates, which reflects changes in the pharmacokinetic dynamics associated with advanced prostatic pathology.

EP-16

e-Poster Area

B: Imaging Clinical Studies -> B1 Oncological Imaging Clinical Study -> B19 Thyroid

EP-0314

Strong correlation between intuitive and standardized evaluation of radioiodine therapy whole-body scintigraphy in thyroid cancer

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Aim/Introduction: In patients with differentiated thyroid carcinoma, whole-body scans (WBS) are usually assessed 48 h after radioiodine administration. Aim of this study is to correlate the intuitive assessability after different time points with a standardized diagnostic algorithm. ***Materials and Methods:*** Data were available from 35 consecutive, prospectively treated (97% exogenous TSH stimulation) patients in whom WBS were acquired at up to 6 time points (6, 24, 48, 72, 98 and 168 h). Blinded reading of WBS was done by to three experienced observers regarding diagnostic quality. After one year of latency, the whole-body scintigraphies were re-evaluated using a standardized Likert scale (Van Nostrand criteria). The qualitative ranking was determined intuitively, the standardized quality was determined using a predefined scale (1 to 5 points) for 10 parameters (max. 50 points). ***Results:*** The intuitive ranking of the three observers was consistent in terms of the best scan after 24 h (average rank 1.76), followed by 48 h (rank 2.27), 6 h (rank 2.77) and 72 h (rank 3.48). Using the standardized evaluation criteria, all observers had the same ranking, only one observer rated 4 and 48 h scans on average as equivalent (31.66 vs. 31.32 points). The standardized score and the intuitively perceived score correlate strongly with each other according to Spearman (rS=-0.69, P<0.001, n=504). The time of admission "24h" achieves a significantly (P<0.001) better score compared to all other scans. The time points 6 and 48h are not significantly different from each other. ***Conclusion:*** There was a high concordance in the intuitive versus standardized assessment of the diagnostic value of the whole-body scans and between the investigators. The diagnostic performance of the scans after 24 h (rank 1; 39.52 points) is comparable to that after 48 h (rank 2; 34.73 points); for radiation protection reasons, a preference for the 48 h scan is advisable.

EP-0315

Diagnostic accuracy of ^{18}F-FDG-PET/CT for incomplete biochemical response with possible refractoriness differentiated thyroid cancer, exploring the same patient with and without thyrotropin stimulation

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Aim/Introduction: Up to 15-20% of differentiated thyroid cancer patients(p) with incomplete biochemical response have negative 131INa(RAI) WBS. Different causes explain it and can lead to iodine refractoriness(R-RAI). With stimulated Tg≤10ng/ml, ^{18}FDG-PET/TC has low sensitivity (<10%-30%), then guidelines recommend ^{18}FFDG-PET/CT with stimulated Tg≥10ng/ml. Our objective is to evaluate ^{18}-FDG-PET-CT localizing disease in R-RAI patients, comparing the results by patients without(NO-rhTSH) and with(YES-rhTSH), valuing profitability of the test. ***Materials and Methods:*** Recruited 74p in a prospective study (2020-2022) with progressive increase in serum Tg levels (suppressed >2ng/ml) and negative131INa-WBS(with TSH>30mIU/L). Sixteen (16/74) patients were explored by ^{18}F-FDG-PET/CT suppressed (NO-rhTSH) and YES-rhTSH, separated by 3-14days. The mean follow-up duration was 22±4 months. No patient belonging to double examination group (NO-rhTSH/YES-rhTSH) was anti-Tg antibodies positive (15p/74p). ***Results:*** Disease was detected in 5p/16p NO-rhTSH ^{18}F-FDG-PET/TC and 15p/16p NO-rhTSH/YES-rhTSH. In YES-rhTSH group PET was positive in 15p/16p and 1p/16p negative, 60 focus were pathologically confirmed, sensitivity:98%(0.93 -1.02 95%CI) and specificity: 50% (0.27-0.73 95%CI), PPV: 82%; NPV: 90%. In NO-rhTSH group, positive PET on 5/16 and negative 11/16, S:33.33%, Sp:100%, PPV:100% and NPV:9.09%. Localization of YES-rhTSH-^{18}F-FDG-PET/CT: 21 cervical lymphadenopathies, 1 thyroid bed, 5 skeletal and 5 lung nodules, showing coincidence the lesions found in 5 positive NO-rhTSH-PETp. Positive-PET in 5 NO-rhTSH had meanSUV:2.65g/ml, and meanSUV:9.25 g/ml in YES-rhTSH. Exploration performed on NO-rhTSH-PET had mean Tg-value:7.6 ng/ml (1.2-23ng/ml). Global cut-off of serum Tg:15ng/ml achieved S:58%; Sp:76%; PPV:75%; NPV:59%, accuracy: 66%, with Tg:20ng/ml: S:52%; Sp:88%; PPV:84%; VPN:59%, accuracy:68%. With significantly greater sensitivity (p<0.05) in YES-rhTSH. ***Conclusion:*** Although a small group was explored without rhTSH, the sensitivity decreased to 33.33%, patients with FN results who were tested without rhTSH, had an average serumTg: 7.6ng/ml, which is relatively low, less than current guidelines. Although the sample size is small and further research is needed, the use of rhTSH may have been crucial in increasing the test's diagnostic yield. Specifically, in patients with low Tg values, the use of rhTSH appears to improve the sensitivity, particularly for those with serum Tg levels below (<10ng/ml), incomplete biochemical response, and possible R-RAI. ***References:*** 1.Qichang W,et al. Diagnostic performance of ^{18}F-FDG-PET/CT in DTC patients with thyroglobulin elevation and negative iodine scintigraphy: A metaanalysis. Eur J Endocrinol 2019;181(2):93-1022.Jin J, et al. The diagnostic efficacy of ^{18}F-FDG PET/CT for differentiating

high-grade from low-grade papillary thyroid cancer. Int J Clin Pract. 2019;73:e132973.Haslerud T, et al. F^{18}-FDGPET for recurrent differentiated thyroid cancer: A systematic meta-analysis. Acta Radiol 2016;57(10):1193-1200.

EP-0316

THE IMPORTANCE OF GA68 DOTA-TATE PET/CT IMAGING IN MEDULLARY THYROID CANCER AND ITS CONTRIBUTION TO THE CLINICAL DECISION

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Aim/Introduction: Ga68 DOTA-TATE PET/CT, a somatostatin receptor imaging method in the clinical management of medullary thyroid cancer, a parafollicular cell-derived neuroendocrine tumor, is a proven method for both recurrence metastasis research and radionuclide treatment options that may contribute to the next stage. ***Materials and Methods:*** Images of a total of 32 patients, 18 women and 14 men, with an average age of 57 years (range 22-84) diagnosed with medullary thyroid cancer, were retrospectively examined. After Ga68 DOTA-TATE was administered at an appropriate dose according to weight, PET/CT images of the skull base and mid-thigh were obtained 50-60 minutes later. Pathological lesion areas on CT sections with increased DOTA-TATE activity, which was detected to be different from the physiological activity distribution, were evaluated. The cases were evaluated together with the available clinical and radiological findings. ***Results:*** From the images of the total patients participating in our study, findings of lesions with activity involvement at a level that could be evaluated in favor of local recurrence in 7 patients, lymph node metastasis in 17 patients, skeletal system in 5 patients and visceral metastasis in 5 patients, and pathologically evaluated on CT sections were detected. No pathological activity involvement was detected in the images of eight patients. DOTA-TATE negative lesions evaluated as metastasis were detected in the liver parenchyma in two patients. In addition, lesions that were clinically proven to be pheochromocytoma were observed in 2 other patients. Additional evaluation could not be made in cases with missing data in terms of laboratory findings. ***Conclusion:*** Somatostatin receptor imaging methods provide great benefit in the clinical management of patients with medullary thyroid cancer. While it determines the chance of surgery in cases of local recurrence, areas of activity involvement with distant metastasis are an important step in determining the prognosis. In addition, the physiological high activity involvement in the liver parenchyma and the need to be careful in metastatic lesions were evaluated as important data in terms of our clinical experience. It was also observed that it made an additional contribution to the detection and management of multiple endocrine neoplasia cases.

EP-0317

Imaging after ^{131}I treatment combined with preoperative CECT to assess imaging features and implications of massive remnants after total thyroidectomy for DTC

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Aim/Introduction: Using 131I-NaI Rx-SPECT/CT as the gold standard, to clarify the relationship between the extent of remnants after total thyroidectomy for DTC and 131I treatment outcome, and to investigate the preoperative CECT imaging characteristics of massive residual sites. ***Materials and Methods:*** Retrospective collection of patients with intermediate or high risks DTC who were postoperatively treated with 131I and underwent preoperative CECT at our institution from 2023.1.30 to 2023.9.30. Patients with significant photon scattering in the neck were defined as the massive residual group based on Rx-WBS. The chi-square test was used to evaluate the difference in initial efficacy response between the two groups of massive and trace residues. To assess the presence and extent of remnants on either side of the thyroid cartilage (region I), cricoid cattilage (region II), tracheal cartilage (region III) and adjacent to the anterior median line (region IV) using 131I-NaI Rx-SPECT/CT. Then analyzing the imaging characteristics of massive residual sites on preoperative CECT and their impact on assessing 131I uptake in adjacent lymph nodes. ***Results:*** A total of 82 DTC patients were enrolled. The mean 131I dose administered was 119.8 ± 26.3 mCi. 131I-NaI Rx-SPECT/CT showed that the good sites for residues were in the order of regions IV, III, I and II. Regions II (71%) and IV (43%) were prone to massive remnants, the former corresponding to preoperative CECT with parathyroid or supraglottic/recurrent laryngeal nerve > pyramidal lobe > capsule, the latter to pyramidal lobe > thyroglossal duct remnants. 33 (40%) patients had massive thyroid reside, and the initial efficacy response assessment after 131I treatment was not statistically different with trace residual group. 53% of massive remnants interfered with 131I uptake assessment in adjacent lymph nodes, of which 21% were pyramidal lobe or thyroglossal duct remnants, and 71% were in parathyroid or nerve regions. ***Conclusion:*** Massive remnants tend to occur on either side of the cricoid cartilage or in the anterior median line after total thyroidectomy for DTC, and preoperative CECT may suggest pyramidal lobe or thyroglossal duct remnants that are easily missed during surgery.

EP-0318

^{99m}Tc scintigraphy predicts a successful of thyroïd remnant radioiodine ablation in patients with differentiated thyroid carcinoma

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Aim/Introduction: 99mTc scintigraphy indicates absence or small volume of thyroid remnant. The aime of this study is to evaluate the diagnostic value of post surgical 99mTc scintigraphy to predict radioiodine ablation success of thyroid remnant in patients with thyroid carcinoma. ***Materials and Methods:*** Prospective study including patients with differentiated thyroid carcinoma at low or

intermediate risk of recurrence and eligible for radioiodine therapy with 1,1 GBq of iodine 131. 99mTc scan with determination of cervical uptake and stimulating thyroglobulin level (sTg) were performed before treatment. The ablation success was evaluated nine months later by cervical ultrasound and sTg. In the absence of visualisation of thyroid remnant, the software attributes an uptake value of 0,01% and the scan was considered negative. ***Results:*** Ninety-six patients were included and evaluated, 95% were females and the average age was 47,78 years. The mean uptake rate was 0,07% (ranging from 0,01% to 0,48%). The 99mTc scan was positive in 63%. The uptake rate was strongly correlated with the sTg before ablation, therefore with the remnant volume (r= 0,943 , p<0,001). We found also a significant and negative correlation between the uptake rate and the ablation success rate (r = - 0,258 , p=0,01%). The uptake threshold which predict ablation success was 0,065%. Giovanella et al found that a visually negative 99mTc scintigraphy confers a strong prediction value for ablation success (p=0,008). A visually positive scan with uptake rate less than 0,09% also predict ablation success (p=0,01). ***Conclusion:*** 99mTc scintigraphy is aa simple and reliable method allowing thyroid remnant evaluation. Post surgical scintigraphy is more effective to predict ablation success. Visually negative scan as well as positive scan with uptake rate less than 0,065% correctly predict the successful of thyroid remnant ablation with low activities of iodine 131 in patients with differentiated thyroid carcinoma at low or intermediate risk of recurrence. ***References:*** Giovanella L, Usuriano S, Ricci R, Cerini L, Verburg F.A. Postsurgical thyroid remnant estimation by (99m)Tc-pertechnetate scintigraphy predicts radioiodine ablation effectiveness in patients with differentiated thyroid carcinoma. Head neck. 2011;33(4):552-6. Giovanella L, Pane G, Ruberto T, Certain L, Trimboli P. 99mTc-pertechnetate scintigraphy predicts successful postoperative ablation in differentiated thyroid carcinoma patients treated with low radioiodine activities. Endocrinology Metab. 2019;34(1):63-69.Wang C et al. Efficacy and affecting factors of 131I thyroid remnant ablation after surgical treatment of differentiated thyroid carcinoma. Front Oncol. 2018;8:640.

EP-0319

131I-SPECT/CT may provide prognostic information regarding the time to complete response and progression-free survival in patients with differentiated thyroid cancer and known lymph node metastases

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Aim/Introduction: To investigate whether the detection of persistent lymph node metastases (LNM) on cervical posttherapeutic 131I-SPECT/CT in patients with differentiated thyroid cancer (DTC) has a prognostic impact on time until complete response (CR) and progression-free survival (PFS). ***Materials and Methods:*** This retrospective, monocentric study included 194 patients with DTC and histological proven LNM who underwent adjuvant radioiodine (RAI) therapy. On posttherapeutic cervical 131I-SPECT/CT, four groups were defined: CT0/S0 (anatomical normal LN and no visual 131I-uptake), CT0/S1 (anatomical normal LN and increased 131I-uptake), CT1/S0 (enlarged LN (≥1cm in short axis diameter) without 131I-uptake), and CT1/S1 (enlarged LN with increased 131I-uptake). The chance of achieving CR in the different groups was analyzed at 9, 18 and 36 months after RAI therapy using the exact Fischer test. PFS was evaluated using Kaplan-Meier curves and log-rank comparisons. CR was defined as undetectable TSH-stimulated thyroglobulin (Tg) and the absence of clinical and ultrasonographic evidence of residual disease, alongside with the absence of 131I-uptake on a diagnostic whole-body scan during TSH-stimulation. Progression was defined as either a 2-fold increase in Tg levels in the period before CR or any new Tg rise following CR, as well as the identification of new lesions on diagnostic imaging or fine needle aspiration. ***Results:*** Patients classified CT0/S0 (n=140) showed a significant higher chance to reach CR 9 months after ablative RAI therapy (chance 2.16, 95% CI 1.24 - 3.97; p<0.01) than patients with persistent LNM (CT0/S1, CT1/S0 and CT1/S1, n=60). No significant differences were observed at either 18 months (p=0.42) or 36 months (p=0.19). A comparison between CT0/S0 (n=140) and CT0/S1 (n=31) revealed no significant difference at 9 months (chance 1.38, 95% CI: 0.82 - 2.56; p=0.31). A significant reduction in the risk of disease progression was observed in patients classified CT0/S0 compared to patients classified CT1/S1 (median PFS not reached in both groups; HR 0.27, 95% CI 0.06 - 1.16, p=0.0027). No significant difference in PFS was observed between patients classified CT0/S0 and patients classified CT0/S1 (median PFS not reached in both groups; HR 2.2, 95% CI 0.73-6.651, p=0.2743). ***Conclusion:*** In patients with DTC and histological proven LNM, the detection of small but RAI-positive LNM on posttherapeutic 131I-SPECT/CT does not provide prognostic information regarding an early complete response or a longer PFS. In contrast, patients with posttherapeutic enlarged RAI-positive LNM are at a higher risk for disease progression.

EP-0320

Predictive value of quantitative indexes of FDG PET in the evaluation of thyroid nodules

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Aim/Introduction: With increasing use of 18F-fluorodeoxyglucose positron emission tomography (FDG PET) in the clinical field, thyroid nodules are one of the common incidental findings. It is reported that about one third of these nodules are proven to be malignant nodule. In this study, efficacy of quantitative PET indexes in predicting the cytopathology of thyroid nodules was evaluated. ***Materials and Methods:*** A total of 338 patients with thyroid nodules detected on FDG PET from 2019 to 2024 were retrospectively enrolled. The nodules were further examined with fine needle aspiration (FNA). Quantitative PET indexes such as maximum standardized uptake value (SUVmax), metabolic tumor volume (MTV), total lesion glycolysis (TLG), were measured in the thyroid nodule. Their efficacies in predicting the cytopathologic nature of the nodule by FNA were evaluated along with other clinical variables such as age, gender, size, thyroid function test values. ***Results:*** SUVmax and TLG of thyroid nodule were statistically significant in predicting cytopathology based on Bethesda scoring system (p value of 0.001 and 0.005, respectively). SUVmax and TLG tended to increase as the category escalated, with highest value in the malignant category (Bethesda VI). SUVmax was able to discriminate the group with higher risk of malignancy (Bethesda IV, V, VI) from lower risk group (Bethesda II, III) with optimal cutoff value set as 4.8 (sensitivity 70.5, specificity 64.2, AUC 0.718). Other variables were not statistically significant in predicting malignant groups. ***Conclusion:*** Quantitative indexes of FDG PET are well associated with Bethesda scoring system in thyroid nodules. Measuring SUVmax of thyroid nodule on FDG

PET can aid in predicting the cytopathology and thus guiding the optimal treatment for the patient.

EP-0321

Clinical importance of thyroid involvement in ^{18}F-FDG PET/CT imaging: correlation with USG and pathology

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Aim/Introduction: This study aimed to reveal the importance of focal or diffuse increased FDG uptake seen in the thyroid gland in patients who underwent FDG PET/CT imaging for any reason, by correlating it with ultrasonography imaging and pathological results, and to determine a cut-off value for the SUVmax value in malignant lesions. ***Materials and Methods:*** 900 patients who underwent F^{18} FDG PET/CT imaging at Kayseri City Hospital Nuclear Medicine clinic between June 2018 and February 2023 and were found to have focal or diffuse increased FDG uptake in the thyroid gland were included in the study. F^{18} FDG PET/CT studies, USG reports and histopathological results of the patients were evaluated retrospectively. ***Results:*** Focal increased FDG uptake was detected in 731 (81.2%) of 900 patients, and diffusely increased FDG uptake was detected in 169 (18.8%). The number of patients who underwent histopathological examination was 86, and all of these patients had focal FDG uptake. In lesions showing FDG uptake in the thyroid gland, the SUVmax value was between 1.0 and 48.4, and the average value was found to be 5.2 ± 4.6. Malignant lesions were included in the n1 group, and benign lesions were included in the n2 group. The difference in SUVmax between the two groups was evaluated with the Mann Whitney U test, and the SUVmax value of the malignant lesions was found to be statistically higher (n1: 13; n2: 24; p: 0.001, p<0). .05). ROC analysis was performed to determine the cut-off value for SUVmax and the cut-off value was determined as 6.1 . The specificity of this value was calculated as 71.4% and the sensitivity was calculated as 66.7% . Of the 207 patients who underwent USG, 37 patients had diffuse FDG uptake and 170 patients had nodular FDG uptake. Groupings were made taking into account the echogenicity and nodule internal structure defined for the nodules on USG. The difference between the groups in terms of benign/malignant cytopathology was evaluated with the Pearson Chi-square test and no statistically significant difference was found (p=0.277; p>0.05). ***Conclusion:*** Although it has been statistically demonstrated that the SUVmax value is higher in malignant lesions in the evaluation of incidental thyroid lesions detected on PET imaging, there is no common opinion for the cut-off value. It was concluded that more multicenter and well-designed studies are needed to obtain a cut-off value with higher sensitivity and specificity values.

EP-0322

F^{18} FDG PET/CT Results Before I-131 Ablation Treatment in Patients with Post-Operated Thyroid Cancer with Lymph Node or Suspicious Distant Metastasis

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Aim/Introduction: Thyroid cancers are the most common endocrine cancers. Radioactive iodine (RAI) treatment can be given after surgery. Residual disease extent, the presence of local or distant metastases are some of the factors determining RAI dosage. Our aim in this study is to present the F^{18} PET/CT results we performed before RAI ablation treatment and their relationships with other parameters. ***Materials and Methods:*** Patients with post-operative thyroid cancer with and underwent F^{18} FDG PET/CT between 2018 and 2023 were included in our study. The patients' demographic data, pathology reports, postoperative PET/CT images and post-ablative whole body iodine scan (TVT) image evaluations were analyzed in the SPSS program. Chi-Square and Fisher's exact test were used for categorical data, and Student T test and Mann Withney U test were used for numerical data. ***Results:*** Of the 106 patients included in the study, 72 (67.9%) were women and 34 (32.1%) were men. While 47 (44.3%) of the patients had no lymph node metastasis, 59 had metastatic lymph nodes. Post-operative PET/CT imaging results of the patients are summarized in Table 1. In the post-ablative screening of 75 patients, 29 (38.7%) had metastatic lymph nodes, while 46 (61.3%) did not. The relationship between other parameters in patients with/without distant metastasis detected on PET/CT is summarized in Table 2. There was no significant difference between the patient groups with and without distant metastasis detected on PET/CT in terms of gender, tumor location, and presence of metastatic lymph nodes in post-op pathology (p=0.280;0.411;0.676). In the patient group with distant metastasis detected on PET/CT; Age, tumor size, and Tg values were significantly higher than the undetected patient group (p<0.001;0.021;0.003). As expected in the post-ablative TVT results, the number of patients with metastasis was significantly higher in the patient group with metastasis detected on PET/CT (p<0.001). ***Conclusion:*** The results show that FDG PET/CT provides meaningful information in the determination of distant metastasis in patients with suspected metastasis, especially with unexplained high Tg levels. However, the information it provides in terms of lymph node metastasis is more limited, and pathological confirmation may be preferred, keeping in mind that there may be false positivity. ***References:***
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EP-0323

Role of ^{18}F-FDG PET/CT in differentiated thyroid carcinoma

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Aim/Introduction: Treatment with iodine-131 (I-131) is a well documented and efficient therapy in differentiated thyroid carcinoma. Following surgery and radioiodine therapy, residual disease can persist in certain patients. This study focuses on patients with negative I-131 post-therapy "whole body" scintigraphy (WBS) and clinical or biochemical persistence of the disease. In these patients ^{18}F-fluorodeoxyglucose ($^{[18F]}$FDG) PET-CT can be a useful tool for the purpose of identifying local recurrences and distal metastases. ***Materials and Methods:*** We performed a retrospective analysis of 29 consecutive patients that underwent $^{[18F]}$FDG PET-CT scan with an established diagnosis of differentiated thyroid carcinoma. All

patients performed [18F]FDG PET-CT after surgery and at least one cycle of I-131 therapy and all patients had clinical or biochemical persistence of the disease: palpable enlarged lymph node and/or high level of thyroglobuline (Tg) or anti-thyroglobulin antibodies (ATG). Images were evaluated visually and semi-quantitatively using the maximum value of the radiotracer uptake, corrected for body mass without adipose tissue and injected activity (SULmax). ***Results:*** Of the 29 patients, 23 were women and 6 were men, with a median age of 60 years; the average dose of I-131 previously administered to the patients was 340 mCi. The histopathological types were 83% papillary thyroid carcinoma (n=24) and 17% follicular thyroid carcinoma (n=5). [18F]FDG PET-CT detected glucose avid lesions suggestive of local disease recurrence and/or lymph node metastases or other organs metastases in 69% of cases (n=20): 15 lymph node metastases and/or local recurrences, 5 pulmonary metastases and 2 bone metastases. In some cases, patients with elevated SULmax values also exhibited higher levels of thyroglobulin, exceeding the reference range by more than double. This observation is consistent with findings from other studies, although this correlation lacks specificity [1]. ***Conclusion:*** The findings of this study align with the literature, showing the value of PET-CT with [18F]FDG in monitoring patients with recurrent thyroid carcinoma with clinical or biochemical markers indicative of recurrence and negative scintigraphy with I-131. ***References:*** Larg M. 18F-FDG PET/CT in Differentiated Thyroid Carcinoma. Acta Endocrinologica (Bucharest). 2019;15(2):203-8.

EP-0324

Effectiveness of 131I iodine under rhTSH stimulation in treatment of advanced, non-operable thyroid cancer

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Aim/Introduction: Differentiated thyroid cancer (DTC) is the most common malignancy of the endocrine glands. Treatment with radioactive iodine (131I) for advanced thyroid cancer is a therapy that significantly improves time to progression and overall survival. The prerequisite for 131I treatment is adequate stimulation with endogenous TSH. However, data on treatment with exogenous stimulation (rhTSH; Thyrogen) are scarce and rhTSH stimulation is not wieldy used in this settings. Retrospective evaluation of rhTSH stimulated 131I treatment of metastatic DTC in patients with at least 5 years of follow-up from last 131I treatment. ***Materials and Methods:*** The analysis includes 189 patients treated with 131I after total thyroidectomy in the rhTSH-stimulated setting between 2008 and 2011. In 81 (42%) (rhTSH group) all cycles of 131I treatment were after rhTSH stimulation (rhTSH-group, in remaining 108 at least one therapy was after TSH withdrawal (mix-group). Patients in mixt were younger, had longer follow-up and had less macrometastases that in the rhTSH-group. The majority (64%) of the treated patients were women, with a median age of 58 (41-86) years. Patients were treated with 3.7-5.5 MBq 131I activity every 3-6 months. Follicular thyroid cancer was diagnosed in 61 (32%) patients, while papillary carcinoma was diagnosed in 99 (52%), and low-differentiated carcinoma in 29 (15%). All patients had distant metastases, including 94 (50%) to the lungs, 35 (19%) to the bones, the remaining patients had at least two locations of metastatic lesions. Radiological evaluation of response to treatment was performed every 6-12 months (RECIST 1.1 criteria). All patients received adequate TSH stimulation before 131I administration. This is the preliminary analysis of radiological response and progression ***Results:*** Complete or partial remission was found in 77 (41%) and stable disease in 93 (49%) patients. During follow-up, radiological progression of disease occurred in 96 (51%) patients. The median time to progression was 29 (16-50), months and the median time to death was 52 (33-78). In multivariate analysis only type of metastases (micro vs. macro) and best radiological response and has significant impact on progression free survival. Treatment with 131I during rhTSH stimulation was well tolerated, and none of the patients showed signs of hyperthyroidism. ***Conclusion:*** Compared with a historical group of patients with advanced RHT, rhTSH stimulation appears to be as effective as endogenous TSH stimulation in preparation for 131I treatment and is well tolerated.

EP-0325

The value of functional [18F]F-DOPA PET/CT parameters in patients with medullary thyroid cancer

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Aim/Introduction: The purpose of this study was to evaluate the diagnostic and prognostic value of functional [18F]F-DOPA PET/CT parameters in patients with medullary thyroid cancer (MTC). ***Materials and Methods:*** MTC patients who underwent [18F]F-DOPA PET/CT from June 2008 to November 2023 were investigated. Clinical characteristics, follow-up data, and the following [18F]F-DOPA PET/CT parameters were recorded: maximum standardized uptake value (SUVmax), mean standardized uptake value (SUVmean), metabolic tumour volume (MTV), and SUVmean of multi-organs. Receiver operating characteristic (ROC), Kaplan-Meier and Cox regression analyses were performed. ***Results:*** 109 patients (50 women, 59 men; average age, 55 ± 14 y) were included in the analysis. Significant positive correlations were found between basal calcitonin (bCt), stimulated calcitonin (sCt) and CEA with SUVmax, SUVmean and MTV of [18F]F-DOPA PET/CT ($P<0.001$). [18F]F-DOPA PET/CT results and MTV may be useful for evaluation of prognosis of patients with recurrent MTC, while MTV and age were independent prognostic factors in patients with primary MTC. For all patients, SUVmean of the left kidney, liver, aorta, and pancreas might be used to independently predict overall survival (OS). ***Conclusion:*** Functional [18F]F-DOPA PET/CT parameters may be important for diagnostic and prognostic assessment in patients with MTC. The DOPA PET/CT parameter SUVmean and MTV showed significant association to OS.

EP-0326

MIBI SPECT is a powerful tool to exclude malignancy in hypofuntioning thyroid nodules - long-term study > 1500 patients

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Aim/Introduction: The value of thyroid SPECT using 99mTc-sestamibi (MIBI) in risk assessment of hypofunctioning thyroid nodules is discussed controversially. In current guidelines it is not integrated in routine assessment. We propose that MIBI SPECT is a powerful tool to non-invasively exclude malignancy. ***Materials and Methods:*** In a single center study, 1527 patients with hypofunctioning thyroid nodules were examined within 9 years and 4 months using 398 MBq ± 42 MBq MIBI by local scintigraphy 10 min and 120 min p.i. and SPECT 130 min p.i. Fine-needle biopsy

was performed in high-risk nodules (EU-TIRADS 5), in patients with symptomatic nodules and in asymptomatic patients with MIBI SPECT positive nodules. Long-term follow-up ranged from 12 to 112 months with a mean of 35.4 months. ***Results:*** MIBI SPECT was positive in 107 cases. In 13 % of these patients, the suspected nodule was MIBI negative but another small nodule, an isthmus nodule or a primarily inconspicuous part of a multinodous goiter was MIBI positive. Surgery was performed in 125 patients with negative MIBI SPCET because of severe local symptoms or high-volume multinodous goiter. Retrospectively histological diagnosis was concordant with positive MIBI SPECT and FNP in 67 % of cases, whereas in 32 % MIBI was superior and in 3 % FNB was superior.In long-term follow up MIBI negative patients revealed malignancy in 0,6 %. Histological diagnosis were papillary microcarcinoma or medullary carcinoma with low Ki-67 < 5%. %. Statistical analysis for MIBI SPECT showed an overall sensitivity of 73%, specificity of 95%, negative-predictive value of 99% and positive predictive value of 24%. MIBI SPECTs were positive benign neoplasia like hürthle cell adenoma, follicular adenoma and parathyroid adenoma. In follicular adenoma and hürthle cell adenoma, invasive growth only can be excluded by surgery. Parathyroid adenoma require surgery, too. Assessing these patients as true-positive, the adapted predictive values were 80%, 98%, 76% and 99%. ***Conclusion:*** MIBI SPECT is a powerful tool in the assessment of hypofunctioning thyroid nodlues with low to intermediate risk of malignancy. Given a negative predictive value of 99% after up to 112 months of follow-up, MIBI SPECT has proven an excellent non-invasive screening tool. Surgical resection of only MIBI positive and FNB positive hypofunctioning nodules may reduce the frequency of thyroidectomies significantly.

EP-0327

Comparison of the diagnostic performance of [18F] F-DOPA PET/CT and [18F]F-choline PET/CT in patients with recurrent medullary thyroid cancer

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Aim/Introduction: Curative approach for medullary thyroid cancer (MTC) is surgery involving central and optionally lateral cervical compartment(s). Recurrence after initial surgery is common, typically detected biochemically by increase in calcitonin as a tumour marker, as is progressive disease. Molecular imaging using [18F]F-DOPA PET/CT improves detection of recurrent/progressive disease over conventional imaging (CT, US), but its availability is limited. The use of [18F]F-choline PET/CT was recently introduced for molecular imaging of MTC. The aim of the work was to compare the diagnostic performance of [18F]F-DOPA PET/CT and [18F]F-choline PET/CT in patients with recurrent/progressive MTC. ***Materials and Methods:*** Medical records of patients with MTC recurrence were retrospectively reviewed and patients with both imaging modalities performed were identified; time interval between both studies was noted. PET/CT imaging with both modalities was compared for the number, distribution and visual impression of detected lesions; [18F]F-DOPA PET/CT was used as a reference imaging method. Clinical data (calcitonin, CEA, genetic status) was noted at [18F]F-choline PET/CT and correlated with imaging findings. ***Results:*** Seven patients (two male) with both imaging modalities performed were found. The average time interval between imaging studies was 35 (1-72) months. Average calcitonin level was 1404 (33-8739) ng/L and CEA level 23 (4-120) ug/L; two patients had MEN2. The number of detected lesions ranged from 0 to 15 for [18F]F-DOPA and 0 to 7 for [18F]F-choline PET/CT. In patient-based comparison, the number of detected lesions was comparable between both tracers, with overall higher lesion-to-background ratio favouring [18F]F-DOPA; in one patient with multiple liver metastases, a significantly higher number of lesions was detected with [18F]F-DOPA (15 vs 3) due to the high physiological uptake of [18F]F-choline PET/CT. Higher number of lesions were found on [18F]F-choline PET/CT in 3 patients (additional head/neck lymph node). ***Conclusion:*** [18F]F-choline appears to offer comparable diagnostic performance to [18F]F-DOPA in patients with MTC recurrence/progression with the exception of liver lesions due to the high physiological uptake of [18F]F-choline in the parenchyma. Direct comparison of the tracers and further validation of the method is warranted.

EP-0328

Accuracy of ^{18}F DOPA PET-CT in the assessment of medullary thyroid cancer recurrence

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Aim/Introduction: PET/CT with ^{18}F-DOPA is considered first-line in the diagnosis of midgut G1-NET. It is also indicated in medullary thyroid cancer (MTC) with suspected cervical relapse with calcitonin levels >150 pg/mL and/or doubling time of less than two years. Although false positives have been described, its ratio is lower than other radiopharmaceuticals such as ^{18}F-FDG.AIMTo evaluate the diagnostic performance of ^{18}F-dihydroxyphenylalanine (FDOPA) positron emission tomography/computed tomography (PET/CT) in the detection of suspicious clinical recurrence in patients already diagnosed with medullary thyroid carcinoma (MTC). ***Materials and Methods:*** The patients who had undergone ^{18}F-FDOPA PET/CT imaging for increasing/elevated calcitonin levels after primary surgery of MTC were included in the study. All the patients have at least one follow-up ^{18}F-FDOPA PET/CT, and the results were compared with histopathological findings and/or follow-up in a retrospective study. The sensitivity and diagnostic performance of ^{18}F-DOPA PET/CT were analyzed.Calcitonin levels were registered, and other nuclear medicine imaging techniques are included. ***Results:*** A total of 17 patients (8F and 9M) were included in the analysis. 3 patients had MEN IIA syndrome, 3 had RET + mutation and 11 patients had a diagnosis of sporadic MTC. Median calcitonin levels of the patients were calculated as 1913.19 (min-max: 22-10476) pg/mL. ^{18}F-FDOPA PET/CT was positive in 11 out of 17 patients. All patients had a calcitonin level higher than 150 pg/ml but one. Five underwent surgery that confirmed the positivity. Four were clinically followed up and 2 received medical treatment (Vandetanib.) In 6 cases ^{18}F-FDOPA PET/CT was negative (calcitonin levels were between 22-978 pg/ml, and only in 2 cases those levels were higher than 150 pg/ml). All of them were clinically followed upThe sensitivity of ^{18}F-FDOPA PET/CT in the detection of recurrent disease was calculated as 76%, due to 13 of 17 accurate results, yet positive or negative. ***Conclusion:*** The ^{18}F-FDOPA PET/CT prove the accuracy of the results in three quarters of the patients who were tested. In addition, the superior availability of ^{18}F-FDOPA PET/CT results in a suitable candidate to role out a suspicious clinical recurrence.

EP-17

e-Poster Area

B: Imaging Clinical Studies -> B1 Oncological Imaging Clinical Study -> B20 Gynaecological

EP-0329

A novel nanocarrier system for precise delivery of ^{68}Ga to tumors

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Aim/Introduction: The construction of PET nanoprobes by labeling positron nuclides on the surface of nanocarriers is a common strategy to enhance the internalization and retention of positron nuclides in tumors. However, traditional nanocarriers are limited by their lack of active targeting, low tumor penetration, poor biocompatibility, and reproducibility. Therefore, there is a critical need to develop nanocarrier systems that are both efficient and safe for the precise delivery of positron nuclides to tumors. This study describes a novel enzyme- instructed self-assembled nanofiber drug delivery system and evaluates its application in delivering 68Ga to tumors, aiming to facilitate the clinical translation of PET nanoprobes. ***Materials and Methods:*** The probe precursor NAYp-DOTA was synthesized in a one step by solid-phase peptide synthesis. The self-assembly performance of the probe was evaluated using alkaline phosphatase, and the microstructure of the self-assembled product was analyzed using transmission electron microscopy, as well as its rheological properties were evaluated using a rotational rheometer. In the micro-PET imaging experiments, HeLa tumor-bearing nude mice were divided into two groups: the experimental group, which received [68Ga]NAYp-DOTA intravenously, and the blocking group, which was pretreated with an L-phenylalanine inhibitor before injection. Finally, the toxicity of the probe in cells and tissues was evaluated using CCK-8 assays and hematoxylin-eosin staining. ***Results:*** Under the catalysis of ALP, the probe was rapidly digested and self-assembled into nanofibers with an average diameter of 24.33 ± 2.81 nm. Micro-PET imaging results revealed that the signals in the experimental group were clearly visible and gradually increased from 3.54 ± 0.41 %ID/g at 0.5 h to 4.72 ± 0.27 %ID/g at 3 h. In contrast, the signal in the blockade group remained below 0.72 %ID/g throughout the process. Cytotoxicity testing demonstrated that HeLa cell viability remained above 98% after 24 h of incubation with samples at a concentration of 500 μM. Additionally, hematoxylin-eosin staining indicated that the morphology of major organs (heart, liver, spleen, lungs, and kidneys) and tumor tissues remained normal and unaffected by the probe. ***Conclusion:*** In this study, we developed an enzyme-instructed self-assembled nanofiber drug delivery system that achieved rapid delivery of 68Ga to tumors. Through its unique in situ self-assembly mechanism, the retention of 68Ga was significantly prolonged, resulting in a sustained elevation of tumor signals. Meanwhile, this system demonstrated good adaptability and low toxicity to the biological environment, providing an important guarantee for long-term application and clinical translation.

EP-0330

PET imaging of [^{68}Ga]PATTYp: a novel peptide probe targeting tumor-associated enzymes

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Aim/Introduction: A novel PET probe [68Ga]PATTYp targeting tumor-associated enzymes was designed based on an enzymatic peptide self-assembly strategy. After verifying the stability and safety of the probe, the PET imaging of the probe in HeLa tumor-bearing nude mice was systematically studied. ***Materials and Methods:*** The PET probe was injected into the blood through the tail vein, and after reaching the tumor site, it was dephosphorylated by alkaline phosphatase secreted by tumor cells to form hydrophobic peptides. These hydrophobic peptides could self-assemble into nanofibers through non-covalent forces such as hydrogen bonding. Naturally, the probe molecules were enriched at the tumor for enhanced PET imaging. The probe precursor PATTYp was first synthesized using solid-phase peptide synthesis. MTT assay was employed to evaluate the cytotoxicity of the probe on Hela cells. After fully analyzing the in vitro properties of the probe, the probe was injected into the tail vein of HeLa tumor-bearing nude mice, and micro-PET imaging was performed for 10 min at 1 and 2 h after injection, respectively. The tumor and muscle in micro-PET imaging were delineated for five consecutive layers, and the tumor uptake and in vivo distribution performance of the probe were studied by calculating the percentage injection dose rate (%ID/g) per gram of tissue. ***Results:*** Radioactive HPLC of 68Ga labeled reaction solution showed that the radiochemical purity of the probe more than 98%, which meets the requirements of subsequent in vivo experiments without purification. The stability test results show that the radiochemical purity of the probes is unchanged within 3 h. MTT assay indicated that the cell survival rate was 98 % at the concentration of 500 μM probe precursor. The tumor is clearly visible in micro-PET imaging. The tumor uptake values at 1 h and 2 h were 2.32 ± 0.31 %ID/g and 3.45 ± 0.23 %ID/g, respectively. ***Conclusion:*** The probe precursor has the advantages of simple preparation process, mild reaction conditions, and low raw material cost. The probe has good stability and safety performance, meeting the requirements of animal experiments. Micro-PET imaging results showed that the probe imaged well in HeLa tumor-bearing nude mice after 2 h with a high tumor/muscle ratio. The use of different enzyme-targeting molecules to replace the phosphate group in the probe holds promise for the development of a variety of tumor-specific PET probes.

EP-0331

A preliminary report: [^{68}Ga]Ga-Prostate-specific membrane antigen PET/CT in endometrial cancer.

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Aim/Introduction: Endometrial cancer is the most common cancer of the female reproductive system. Prostate-specific membrane antigen (PSMA) is expressed in prostate cancer cells but can be found in other cancers, including endometrial cancer, during angiogenesis. The aim of this pilot study was to

evaluate the feasibility of using [68Ga]Ga-PSMA-11 PET/CT in endometrial cancer patients before surgical treatment. ***Materials and Methods:*** We have included in the study seven women with a mean age of 58±7.9 years. All patients underwent standard imaging studies involving transvaginal ultrasound, ceCT scans of the chest, abdomen and pelvis, and magnetic resonance imaging (MRI) as qualified for surgery. Additionally, PET/CT was performed on a Siemens Biograph scanner 60 min after the injection of 2 MBq/kg [68Ga]Ga-PSMA-11. ***Results:*** Positive [68Ga]Ga-PSMA-11 PET/CT images had six of seven patients, and histopathology confirmed endometrial cancer. One patient also exhibited uptake in the left ovary, and final histopathology revealed a hemorrhagic cyst. One patient with lymph node involvement was also visible in [68Ga]Ga-PSMA-11 after fusion with ceCT. The consensus of histopathological staging of endometrial cancer and ceCT, MRI and [68Ga]Ga-PSMA-11 PET/CT was 4/7, 6/7, and 5/7, respectively. All methods were consistent in terms of staging in 3/7 patients. ***Conclusion:*** The initial experience showed the possibility of using [68Ga]Ga-PSMA-11 in endometrial cancer patients. However, prospective large studies are needed to explore the real diagnostic role of radiolabelled PSMA in this field.

EP-0332

Role of ^{18}F-FDG PET-CT in the Detection & Disease Extent Evaluation in Ovarian Carcinoma

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Aim/Introduction: The aim of this retrospective study was to highlight the utility of ^{18}F-FDG PET-CT in the workup of patients of ovarian carcinoma of various histological variants who presented to our institute for staging work-up. ***Materials and Methods:*** The data from a total of 15 patients was collected and analyzed retrospectively for the purpose of this study. Descriptive statistics were generated based on the data that was collected. ***Results:*** Of the 15 patients, 73% had serous adenocarcinoma, 13% had mucinous adenocarcinoma and the remaining 14% had been diagnosed with endometrioid adenocarcinoma of the ovary. Recurrent disease was detected on PET-CT in 20% of the patients with the remaining 80% being evaluated for staging purposes of a treatment naïve ovarian malignancy. Of the patients who had recurrent disease, 33% had serous ovarian carcinoma, 33% had mucinous ovarian carcinoma and 33% had endometrioid ovarian carcinoma. Only 13% of the patients had metastatic disease with all the metastatic lesions being located in the liver. Approximately 47% patients that had ovarian cancer, had peritoneal disease as well. 40% patients had lymph nodal disease, with 100% of the patients have infra-diaphragmatic lymph nodal metastasis and approximately 17% of them having supra-diaphragmatic lymph nodal metastasis. The mean CA-125: 364.5±426.3 IU/ L (95% CI: 148.8 - 580.3), SUV max of all the infra-diaphragmatic metastatic lymph nodes: 11.9±1.2 (95% CI: 10.9 - 12.9), SUV max of the peritoneal deposits: 9.2±2.9 (95% CI: 6.9 - 11.3), SUV max of distant metastatic lesions: 16.2±6.4 (95% CI: 7.2 - 25.1) and SUV max of the recurrent disease: 14.2±7.1 (95% CI: 6.2 - 22.2). The sensitivity (Sn), specificity (Sp), positive predictive value (PPV), negative predictive value (NPV) and accuracy of ^{18}F-FDG PET-CT were 92.8%, 100%, 100%, 50% and 93.3%, respectively. ***Conclusion:*** ^{18}F-FDG PET-CT is an excellent imaging modality for detecting and staging of ovarian adenocarcinoma.

EP-0333

Lymphatic Mapping: Cervical vs. Myometrial in Endometrial Cancer

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Aim/Introduction: European guidelines recommend cervical injection of tracers for sentinel lymph node (SLN) detection in endometrial cancer (EC); however, intramyometrial injection better reflects the natural drainage of the myometrium. The aim was to compare lymphatic drainage according to the tracer injection route, cervical vs. myometrial. ***Materials and Methods:*** Patients with intermediate to high-risk EC were included in the randomized clinical trial with two-arms, HYBRID ENDONODE. All patients underwent injection of radiotracer ([99mTc]Tc-albumin nanocolloid) or hybrid tracer ([99mTc]Tc-albumin nanocolloid-ICG) via cervical and transvaginal ultrasound-guided myometrial (TUMIR) routes the day before surgery, with no more than a 14-day difference between them. After each injection, early and late planar images and abdominopelvic SPECT/CT were acquired. ***Results:*** Fifty-seven patients were included with a median age of 65 years, 30 in the radiotracer group and 27 in the hybrid tracer group. For the cervical injection, drainage was observed in 89.5% of patients (51/57). Of these, drainage was bilateral in 36/51 (71%) and para-aortic in 6/51 (12%). For the TUMIR injection, drainage was observed in 70% of cases (40/57), which was bilateral in 23/40 (57.5%) and para-aortic in 12/40 (30%). Exclusive para-aortic drainage was not observed in any case. No differences were observed according to tracer. The mean detection of sentinel lymph nodes by lymphoscintigraphy was 3.27 ± 2.27 after cervical injection and slightly lower, although not significantly, for myometrial injection: 2.69 ± 2.55. ***Conclusion:*** The lymphoscintigraphic drainage rate in endometrial cancer after cervical tracer injection is higher than that of the myometrial route, although it shows a lower rate of para-aortic drainage.

EP-0334

Validation of a Short Dynamic [18F]FDG PET/CT Acquisition Protocol for Parametric Imaging in Endometrial Cancer

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Aim/Introduction: Dynamic positron emission/computed tomography (PET/CT) with Patlak compartment modelling, has the potential to improve quantitative cancer imaging, but is prone to elongated scanning times. The aims of this study were 1) to validate a published population-based arterial input function (PIF)1 in an endometrial cancer cohort undergoing dynamic [18F]fluoro-deoxy-glucose (FDG) PET/CT, and 2) to compare quantitative tissue values in parametric FDG metabolic rate (MRFDG) images with corresponding values in conventional standardized uptake value (SUV) images. ***Materials and Methods:*** Preoperative FDG PET/CT was performed in 24 consenting patients with histologically confirmed endometrial carcinoma. Nine (9/24) patients (subcohort A) underwent dynamic 80-minute scans from the time of FDG injection. Fifteen (15/24) patients (subcohort B)

underwent shorter dynamic 20-minute scans, starting 50 minutes post-injection. In A), MRFDG images were reconstructed using both a patient-specific image-derived input function (MRFDG,IDIF) and the individually scaled PIF (MRFDG,PIF). Percentage differences in area under PIF and IDIF (AUC) were derived and compared with differences in quantitative tissue values measured in the resulting MRFDG,IDIF and MRFDG,PIF images. In B), MRFDG images were only reconstructed using the individually scaled PIF (MRFDG,PIF). For all patients (A and B) conventional SUV images were reconstructed. From volumes of interest placed in the primary tumour, liver, and spleen, mean SUV and MRFDG,PIF values were measured and compared using Spearman's rank correlation coefficients (ρ). ***Results:*** In A) the mean (standard deviation (sd)) AUC was 4 (3)% higher for PIF than for IDIF. The differences were similar (with opposite sign as expected from the Patlak equation) when comparing quantitative MRFDG,PIF and MRFDG,IDIF values. The mean (sd) differences were -4 (3)% for tumour, -2 (2)% for liver and -2 (2)% for spleen. For all patients, mean tumour SUV was strongly correlated with mean tumour MRFDG,PIF values (ρ=0.93, p<0.001). No significant correlations were seen between mean SUV and mean MRFDG,PIF values in the liver and spleen (ρ≤0.33, p≥0.11 for both). ***Conclusion:*** A shortened 20-minute dynamic FDG PET/CT protocol utilizing a PIF, seems feasible and yields only a small (4%) difference in AUC and a corresponding small (-2 to -4%) difference in mean MRFDG values compared with using an IDIF and the 80-minute acquisition protocol. SUV and MRFDG values are strongly correlated in endometrial tumour tissue, but not significantly correlated in liver and spleen. ***References:*** [1] Dias, et al: 'Clinical validation of a population-based input function for 20-min dynamic whole-body ^{18}F-FDG multiparametric PET imaging', EJNMMI Phys(2022) doi: 10.1186/s40658-022-00490-y.

EP-0335

Prognostic value of pretreatment ^{18}F-FDG PET metabolic distribution pattern in advanced high grade serous ovarian cancer

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Aim/Introduction: To evaluate the prognostic value of pretreatment 18F-FDG PET metabolic distribution pattern in patients with advanced high-grade serous ovarian cancer. ***Materials and Methods:*** A review of 50 patients(p) diagnosed of advanced high grade serous ovarian cancer between January 2012 and September 2020 was made, evaluating the following pretreatment 18F-FDG-PET abdominal metastatic metabolic pattern: Single mass (SM), multiple peritoneal bulky masses (MBM), miliary/disperse peritoneal carcinomatosis, retroperitoneal lymph nodes without peritoneal carcinomatosis or retroperitoneal lymph nodes with peritoneal carcinomatosis. The images were visually assessed. Clinical data of relapse/progression and final status (exitus/alive) was collected. Disease-free survival (DFS) and overall survival (OS) were calculated. Correlation between the metabolic distribution pattern and DFS/OS was calculated using univariate Cox regression analysis. ***Results:*** Mean DFS was 22.7 months (17.9-27.5) and OS 55.1 months (43.5-66.7). From the 50p, 15p have a single abdominal mass, 22p multiple peritoneal bulky metastases, 9p have miliary/disperse peritoneal carcinomatosis pattern, 3 patients have retroperitoneal lymph nodes without peritoneal carcinomatosis and only 1p have retroperitoneal lymph nodes with peritoneal carcinomatosis. Subgroup analysis with SM+MBM vs the rest of patterns was made because of the small sample (tendence of better survival in SM and MBM patients in a preliminary analysis). A statistically significant association was found between SM+MBM pattern with OS. Patients with SM or MBM pattern have a better survival than the rest of patterns (p=0.002) with OS of 64.7 months (±6.7) vs 27.8 months (±4.2). The risk of dead (1-HR) was reduced by 75.4% (HR=0.246 p=0.003 IC05%=0.096,0.627). None correlation was found with DFS. ***Conclusion:*** In patients with high-grade advanced serous ovarian cancer, abdominal metabolic distribution pattern in pretreatment 18F-FDG PET has prognostic value: patients with single mass or multiple peritoneal bulky masses have better prognosis, with a higher overall survival.

EP-0336

Endometrial cancer: predictive value of ^{18}F-FDG Digital PET/CT in post-operative restaging and response to adjuvant chemotherapy assessment

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Aim/Introduction: To assess the value of 8F-FDG Digital PET/CT in the post-operative restaging and response to adjuvant therapy of endometrial cancer patients. ***Materials and Methods:*** 50 consecutive patients with histological diagnosis of primary high-risk endometrial cancer, who underwent PET/CT with [18F]FDG at least 2 months after surgery and 2 weeks after adjuvant chemotherapy, were retrospectively evaluated. After therapy [18F]FDG PET/CT findings were correlated with other imaging, clinical oncological notes and 6 months follow-up as standard reference. The diagnostic accuracy of [18F]FDG PET/CT for local relapse, lymph nodal involvement and distant metastases was assessed. Changes in functional and molecular imaging parameters after chemotherapy were compared between responders and non-responders with the Mann-Whitney U test. The significance threshold was set at a P value of less than 0.05. The impact on clinical management was also evaluated. ***Results:*** [18F]FDG PET/CT was negative in 12/50 patients but could correctly detect primary residual disease in 8/50 patients, nodal disease in 21/50 and distant mestastasis in 9/50. The overall [18F]FDG PET/CT patient-based sensitivity, specificity, positive predictive value, negative predictive value and accuracy were 91.6, 88, 88, 92, and 94%, respectively, for revealing lymph nodal neoplastic involvement, and 88.8, 97,4, 88.8, 92.6, 92%, respectively, for detecting distant metastases. Responders showed a significantly greater reduction in metabolic tumor volume (P = 0.02) and total lesion glycolysis (P = 0.04) after chemotherapy than non-responders. PET findings, compared to conventional imaging, changed the therapy management in 32% of patients. ***Conclusion:*** 18F]FDG PET/CT confirms its ability to accurately detect nodal disease and distant metastases in the restaging of endometrial cancer. Our preliminary data indicate that the [18F]FDG PET/CT-derived metabolic tumour volume and total lesion glycolysis, acquired after adjuvant chemotherapy, are predictive biomarkers for response to therapy. A potential role is intrinsic in PET imaging as a therapy management driver in the clinical setting.

EP-0337

Exploring the utility of ^{18}F-FDG PET/CT in detecting ovarian cancer recurrence with elevated CA-125 levels

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Aim/Introduction: Worldwide, ovarian cancer is the fourth leading cause of cancer death in women, often diagnosed in advanced stages, leading to a poor prognosis. Despite certain effective treatments, recurrence occurs in 50-80% patients, that underscores the importance of early detection of disease. CA-125, a glycoprotein expressed on epithelial cells, is the reference method for detecting ovarian carcinoma recurrence with a high positive predictive values, however it is not specific and sensitive for small-volume disease. 18F-FDG PET/CT stands out as a non-invasive imaging method, highly accurate in staging and follow-up for numerous cancers, including ovarian cancer. With a high sensitivity rate, it proves invaluable in detecting recurrence in ovarian cancer cases. Thus, the present study aimed to investigate the role of ^{18}F-FDG PET/CT in detection of recurrence in ovarian cancer patients with increased CA-125 levels. ***Materials and Methods:*** Thirty one (31) patients, mean age 50.77±12.52 years, underwent 18F-FDG PET/CT for restaging due to high CA-125 levels (Normal range: 0-35 U/mL) were retrospectively evaluated. All patients had undergone surgery and chemotherapy or radiotherapy prior to PET/CT imaging. Further, 18F-FDG PET/CT findings were compared with histopathological, radiological and clinical follow-up findings. All 18F-FDG PET/CT imaging were evaluated visually and semi-quantitatively by two nuclear medicine physicians. For semi-quantitative evaluation, maximum standardized uptake values (SUVmax) were calculated for all pathological lesions. The lesions with a SUVmax greater than background liver uptake at the site of pathologic changes on CT imaging were accepted as malignant lesions. ***Results:*** CA-125 levels ranged between 45-1301 U/mL (N: 0-35 U/mL). Recurrent disease was detected in all 31 patients on PET/CT imaging. Two (2) of 31 patients showed normal values of CA-125 level (<35 U/mL), however, PET/CT showed recurrent disease with metastasis to lungs, liver and deposits in serosa and omentum, that were consistent with radiological findings. In addition to abdominal and pelvic lesions, 13 patients showed distant metastatic lesions (breast, lung, liver and bone metastasis) identified correctly on PET/CT imaging. The sensitivity and positive predictive value of 18F-FDG were calculated as 93.5%, and 100%, respectively. ***Conclusion:*** 18F-FDG PET/CT proves to be a valuable imaging asset in identifying ovarian cancer recurrence among individuals with elevated CA-125 levels. As a whole body scan, it enables the detection of distant metastases in addition to abdominal and pelvic lesions, thus assisting in patient care.

EP-0338

Evaluation of Inter-Observer Variability in Metabolic Parameters for Cervical Neoplasms Staging with [18F] FDG PET-CT

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Aim/Introduction: The amount of tissue affected by cervical neoplasms affects its therapeutic management and prognosis. Metabolic Tumour Volume (MTV) and Total Lesion Glycolysis (TLG) on an [18F]FDG PET-CT have been identified as good baseline prognostic factors, but standardization of the methodology to evaluate both is crucial. The aim of this study has been to assess inter-observer variability in metabolic parameters, as well as MTV and TLG measurements, in patients with cervical uterine neoplasms in an initial staging [18F]FDG PET-CT. ***Materials and Methods:*** We retrospectively reviewed data from 18 patients with cervical neoplasms who underwent initial staging [18F]FDG PET-CT. Two independent observers reviewed the images and processed them using PETVCAR software (GE Healthcare). The metabolic parameters evaluated included MTV and TLG, SUVmax, SUVmean and SUVpeak, for cervical lesions, lymphadenopathies and metastatic lesions. Total MTV and TLG were calculated. Statistically significant differences in the parameters studied between observers were assessed using a Wilcoxon paired test. Finally, we used the Intraclass Correlation Coefficient (ICC) and Bland-Altman Plot analysis with R studio 2023.09.0 to calculate the statistical significance of the inter-observer differences. ***Results:*** Eighteen patients with cervical neoplasms and initial staging [18F] FDG PET-CT were included. There were no statistically significant differences between observers in any of the parameters studied. There was low concordance for the lymphadenopathies' MTV (0.457), good for cervical MTV, lymphadenopathies' TLG and total MTV, and excellent for the rest of the parameters. The Bland-Altman Plot reported a bias in lymphadenopathies' MTV of -1.39. Although there were no significant differences, we identified some gaps in the results of local lesions due to the difficulties that the software presents in some patients in separating urinary activity in the bladder from the lesion, which forced us to solve it manually. Also, urinary activity can explain our biggest differences in the evaluation of lymphadenopathies, which can be mistaken for the ureters. ***Conclusion:*** There were no statistically significant differences between observers in any of the parameters of interest, with mostly good to excellent concordance. However, potential interferences like urinary activity (both in the primary lesion and in the evaluation of lymphadenopathies) need to be considered to avoid inaccurate measurements.

EP-0339

Selective sentinel lymph node biopsy after cryoablation in patients with early breast cancer

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Aim/Introduction: To examine the reliability of selective sentinel lymph node biopsy (SSLNB) and assess potential factors impacting its detection in cryoablated patients. ***Materials and Methods:*** Retrospective analysis of 45 cryo-ablated patients between 02/2021 and 01/2023, previously evaluated by a Multidisciplinary Committee and meeting inclusion criteria for cryoablation, initially with small tumors and negative axilla. Subsequent consent was obtained. The variables collected included: age, affected breast, tumor location, time between cryoablation and lymphoscintigraphy, pre-cryoablation tumor size measured by ultrasound or MRI, size of tumor resection and cryoablation area, presence and location of residual tumor, margin enlargement, histological grade (G), presence of Her2, progesterone and estrogen receptors (RP and RE), ki67%, prior hormone therapy and treatment duration until surgery. Lymphoscintigraphy data encompassed drainage presence, location, number of sentinel nodes, and post-surgery histology. Analysis was performed using absolute frequencies and percentages. ***Results:*** Mean age: 63 years (range 50-78). Five patients received prior hormone therapy, administered on average 61 days preoperatively. Tumor size before

cryoablation averaged 9.75 mm, assessed by ultrasound (32) and MRI (13). Breast cancer was predominantly located in the left breast in 47% of cases. Tumor distribution included 15 superolateral-quadrants, 2 superomedial-quadrants, 3 inferomedial-quadrants, 6 junctions of outer-quadrants, 8 junctions of inner-quadrants, and 11 junctions of upper-quadrants. Histological findings revealed 41 infiltrating ductal carcinomas (IDC), 2 lobular carcinomas, and 2 tubular carcinomas, with 22 G1, 22 G2, and 1 G3. Mean PR: 23%, ER: 79%, and Ki67%: 9.3. Mean cryoablation area, determined by histological analysis: 16 mm. Mean size of surgical specimens: 44 mm. Residual tumor was observed in 20% of patients, predominantly IDC nests (G2-G3) adjacent to the cryoablated area, with margin enlargement performed in three cases. Mean interval from cryoablation to lymphoscintigraphy: 16 days (range 6-77). 69 sentinel nodes were identified (mean 1.33 nodes/patient). Two nodes tested positive for metastasis in two patients. Axillary lymphadenectomy was not performed in either case, with patients receiving chemotherapy, radiotherapy, and subsequent hormonotherapy. Additionally, 4/45 patients showed drainage to the ipsilateral internal mammary region without specific surgical intervention, and 4/45 had intramammary drainage (removed intraoperatively). All cryoablated patients exhibited visualized sentinel nodes, achieving a surgical detection rate of 100%. ***Conclusion:*** In our series, SSLNB after cryoablation in early breast cancer presents a high detection rate. Cryoablation does not appear to influence radiotracer migration. Larger samples and longer follow-ups are needed to detect potential limitations and determine extrapolation to the general population.

EP-0340

Role of PET-CT in the Staging of Squamous Cell Carcinoma of the Cervix (A Study of 100 Cases)

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Aim/Introduction: Worldwide, in 2018, approximately 570,000 cases of cervical cancer and 311,000 deaths were reported. In Morocco, it ranks as the third most common cancer in women after breast and thyroid cancer. The aim of this work is to highlight the usefulness of the ^{18}FDG PET/CT in cervical cancer in Moroccan patients. ***Materials and Methods:*** This is a retrospective study of a series of one hundred patients with cervix squamous cell carcinoma, collected over 15 months from January 2023 to April 2024, at the Nuclear Medicine Department of Ibn Rochd University Hospital in Casablanca. After fasting for at least 6 hours and ensuring blood glucose levels were <1.1g/L, patients received an injection of 2.5 to 4 MBq/kg of FDG. After a resting period of 45 to 60 minutes, patients underwent a PET-CT scan from mid-skull to mid-thigh, along with a CT scan for anatomical localization and attenuation correction. ***Results:*** The average age was 53 years [37 to 71 years]. The PET-CT scan was positive in 87% of cases with the highest SUV max being 14. The PET-CT was negative in 6% of cases, and equivocal in 7%. Regarding staging, PET-CT scan with ^{18}FDG revealed localized disease in the cervix in 25% of cases, locally extended disease in 25% of cases, pelvic lymph node involvement in 13% of cases, lombo-aortic lymph node involvement in 27% of cases,and hepatic metastasis in 4% of cases For therapeutic response evaluation, the examination showed hypermetabolic foci limited to the cervix in 25% of cases, extended to adjacent anatomical structures in 38% of cases, inguinal lymph node involvement in 25% of cases, iliac lymph node involvement in 23% of cases, lombo-aortic lymph node involvement in 20% of cases, and hepatic involvement in 16% of cases. For therapeutic response evaluation during treatment, PET-CT favored persistent disease in 60% of cases and progressive disease in 40% of cases. For therapeutic response evaluation at the end of treatment, PET-CT favored persistent disease in 55% of cases, progressive disease in 35% of cases, and residual disease in 10% of cases. ***Conclusion:*** PET-CT is recommended for the initial staging of N and M-stage disease, as it also allows for the detection of extension of disease outside of the pelvis. It has prognostic value and aids in defining the target volume in radiotherapy. The PET CT scan may also help to evaluate response to radiotherapy and chemotherapy.

EP-0341

Preliminary study of the diagnostic capacity of dynamic F^{18} fluorodeoxyglucose PET scan in the differential diagnosis of ovarian masses

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Aim/Introduction: This prospective study assessed the diagnostic capacity of dynamic F^{18} fluorodeoxyglucose (FDG) positron-emission tomography (PET)/computed tomography (CT) comparing with 1-h early scan in the differentiation between benign ovarian lesion and malignant ovarian tumour. ***Materials and Methods:*** Dynamic scans (5-15 min [1st phase], 15-25 min [2nd phase], 25-35 min [3rd phase] postinjection) and consecutive 1-h early scan (60 min postinjection) were undergone in nine patients with nine ovarian masses (4 endometrioid carcinomas; 1 high-grade serous carcinoma; 1 mucinous carcinoma; 1 granulosa cell tumor; 1 mature teratoma; 1 hemorrhagic ovarian cyst). For the calculation of maximum standardized uptake values (SUVmax) of the ovarian lesion, the placement of the region of interest (ROI) was decided by consensus between two nuclear medicine physicians. We statistically compared the diagnostic capacity of SUVmax for each phase in the discrimination between benign ovarian lesion and malignant ovarian tumour using receiver operating characteristic (ROC) curve analysis. ***Results:*** SUVmax gradually decreased or remained similar with minimal fluctuations in two cases of benign ovarian lesions and two cases of malignant ovarian tumours. In contrast, SUVmax had been increasing tendency over time in five cases of malignant ovarian tumours. In ROC analyses, the areas under the curve (AUC) are higher than 0.786 in all analyses and AUC yielded the highest values at 0.929 on dynamic 1st phase and 1-h early phase for differentiating benign ovarian lesion from malignant ovarian tumour. ***Conclusion:*** Dynamic F^{18} FDG PET scans have the potential to be good predictors of discriminating benign ovarian lesion and malignant ovarian tumour in clinical practice.

EP-0342

^{18}F-FDG PET/CT imaging combined with serum CA-125 test in the follow-up of treated epithelial ovarian cancer

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Aim/Introduction: The aim of this study was to use 18F-FDG PET/CT imaging combined with laboratory testing of CA125 to

evaluate patients after comprehensive treatment of epithelial ovarian cancer, and to provide evidence for subsequent clinical management. ***Materials and Methods:*** A total of eligible 83 patients with treated epithelial ovarian cancer were enrolled. Including 50 cases of ovarian cancer who underwent primary cytoreductive surgery plus 6 cycles of chemotherapy with complete clinical response of variable duration, and 50 ovarian patients received 3 cycles of chemotherapy preoperatively plus intermediate tumour cytoreduction plus 3 courses of postoperative chemotherapy with complete clinical remission periods of varying duration. All enrolled patients were performed CA125 test within two weeks before whole-body 18F-FDG PET/CT imaging, and whole-body tumour burden of recurrent or metastatic foci were calculated using multi-foci segmentation software. ***Results:*** Among 83 cases of treated epithelial ovarian cancers, 77 (92.8%)cases was positive and 6 cases was negative on PET imaging while tumor markers CA125 presented positive. Laboratory tumour markers CA125 were within normal range in 13(15.7%) patients, while they showed positive PET/CT imaging . There were 8 cases of clear cell carcinoma, among which 2 (25.0%) cases had elevated CA125 with positive PET/CT findings and 6 (75.0%) cases had CA125 in the normal range with 1 (16.7%) case of negative PET/CT image and 5 (83.3%) cases of positive PET/CT image.The diagnostic sensitivity of 18F-FDG PET/CT for recurrence or metastasis of treated ovarian cancer was 92.77% and the diagnostic sensitivity of CA125 for recurrence or metastasis of treated ovarian cancer was 83.13%. ***Conclusion:*** There was a strongly positive correlation between whole-body tumour burden and the tumour marker CA-125. The combination of CA125, which can predict the recurrence or metastasis of treated ovarian cancer, and PET/CT, which can locate the recurrence and metastasis of treated ovarian cancer and evaluate the tumour burden, could improve the diagnostic accuracy of the recurrence and metastasis of treated ovarian cancer and provide the guidance for the later clinical treatment.

EP-18

e-Poster Area

B: Imaging Clinical Studies -> B1 Oncological Imaging Clinical Study -> B21 Lymphoma

EP-0343

Quantitative [18F]FDG PET metabolic parameters as prognostic indicators in pediatric Hodgkin lymphoma: a comprehensive analysis

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Aim/Introduction: Pediatric Hodgkin lymphoma (HL) presents with high survival rates; however, there is an imperative need to minimize long-term treatment morbidities. This study assesses the prognostic significance of baseline and interim [18F]FDG PET parameters in pediatric HL for enhancing risk-adapted treatment strategies. ***Materials and Methods:*** This retrospective, single-center study encompassed pediatric HL patients diagnosed and treated according to EuroNet-PHL-C1 and DAL/GPOH-HD protocols. Eligibility criteria included patients under 18 with newly diagnosed HL, availability of baseline and interim PET/CT scans, and a minimum follow-up period of six months. Exclusion criteria were absence of baseline or interim PET/CT scans and incomplete data on treatment or clinical outcomes. [18F]FDG PET/CT imaging and analysis were standardized, with quantitative PET metrics evaluated by two nuclear medicine experts. We assessed SUVmax, metabolic tumor volume (MTV) and total lesion glycolysis (TLG) at two segmentation thresholds (SUV 2.5 and 41% SUVmax). Cox regression analysis was utilized to evaluate survival outcomes. The primary endpoint was event-free survival (EFS). ***Results:*** The study included 115 pediatric HL patients, with a median follow-up of 35 months (16 cases [13.9%] of relapse or progression were noted). Event-free survival (3 years) was 86.3±3.3%. Elevated baseline and interim MTV and TLG values were significantly associated with poorer EFS (hazard ratios from 3.15 to 9.95) in univariate analysis. Interim SUVmax ≥2 was also associated with unfavorable outcomes (hazard ratio 15.11, p = 0.009). However, pre-therapy SUVmax was not significantly associated with EFS (p = 0.223). ***Conclusion:*** Baseline and interim [18F]FDG PET parameters are significant prognostic indicators for pediatric HL. Incorporating these quantitative measures can refine individualized treatment approaches, aiming to balance therapeutic efficacy against long-term health risks. Future research should focus on validating these parameters in larger, prospective studies to confirm their utility in clinical practice.

EP-0344

Deauville score and event-free survival in children with Hodgkin lymphoma

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Aim/Introduction: Pediatric Hodgkin lymphoma (HL) is characterized by high survival rates. However, optimizing treatment to minimize long-term morbidities remains a challenge. The Deauville score (DS), derived from [18F]fluoro-2-deoxy-2-d-glucose positron emission tomography ([18F]FDG PET), is used for response assessment, but its prognostic value for event-free survival (EFS) in children with HL remains to be fully elucidated. ***Materials and Methods:*** This single-center, retrospective study examined pediatric HL patients treated between 2016 and 2023 according to EuroNet-PHL-C1 and DAL/GPOH-HD protocols. Patients underwent [18F]FDG PET/CT at diagnosis and after two chemotherapy cycles. The study aimed to evaluate the prognostic significance of the interim DS for EFS. Patients were categorized based on their DS, and analyses were performed using Cox regression models and receiver operating characteristic (ROC) analysis. ***Results:*** A total of 115 pediatric patients with HL were included, with a median follow-up of 35 months, during which 16 patients experienced relapse or progression (13.9%) and one patient died (0.9%). In the study, 19 patients (16.5%) were assigned a DS of 2, 66 patients (57.4%) a DS3, 23 patients (20.0%) a DS4, and 7 patients (6.1%) a DS5. The higher DS was found to be significantly associated with worse EFS (hazard ratio 2.63, 95% confidence interval 1.47-4.68, p = 0.001). Patients with scores of 4-5 showed a notably higher risk of relapse or progression compared to those with scores of 2-3 (hazard ratio 3.09, 95% confidence interval 1.16-8.22, p = 0.024). ***Conclusion:*** The Deauville score is a significant independent prognostic factor for EFS in children with HL. This finding supports the use of the Deauville score for risk stratification and guiding treatment decisions in pediatric HL. Implementing the Deauville score in clinical practice could

help identify patients at higher risk of adverse outcomes, thereby optimizing individualized treatment approaches. Further prospective studies are needed to validate these findings and refine treatment protocols accordingly.

EP-0345

Tumor Necrosis and Ascites on Baseline FDG PET/CT as Independent Prognostic Markers for Double-hit and Triple-hit Lymphoma: A Multi-center Retrospective Study of Rare Cases

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Aim/Introduction: Double and triple hit lymphoma (DHL/THL) is a rare genetic subtype of diffuse large B-cell lymphomas (DLBCL) characterized by extremely aggressive behavior. This study aimed to assess the potential prognostic markers on baseline FDG PET/CT in DHL/THL patients. ***Materials and Methods:*** A total of 36 DHL/THL patients, with MYC and BCL2 and/or BCL6 rearrangements from 3 independent medical centers, were retrospectively studied. These patients all underwent baseline PET/CT scans between November 2012 and February 2023. Presence of tumor necrosis and ascites were visually assessed at PET and CT, as necrosisPET and ascitesCT, respectively. Survival analyses were performed using Cox regression and Kaplan-Meier methods. Progression-free survival (PFS) and overall survival (OS) were used as endpoints. Time-dependent receiver operator characteristics (ROC) curves were used to assess the predictive power of necrosisPET and ascitesCT. ***Results:*** Of the 36 patients, 14 experienced recurrences, and 12 died during the follow-up period. Multivariate analysis revealed that necrosisPET (HR=9.802, P=0.006; HR=6.723, P=0.026) and ascitesCT (HR=8.177, P=0.036; HR=8.027, P=0.045) were independently prognostic factors for PFS and OS. Time-dependent ROC analysis showed that necrosisPET and ascitesCT had good performance in predicting PFS (accuracy:0.671-0.758) and OS (accuracy:0.686-0.769) occurring within 1-4 years. The risk model, incorporating necrosisPET and ascitesCT, can effectively stratify patients for PFS ($\chi2$=11.804, P=0.003 and $\chi2$=15.754, P<0.001, respectively) and OS ($\chi2$=20.599, P<0.001 and $\chi2$=18.369, P<0.001, respectively) in subgroup analyses of patients treated with R-CHOP and intensive regimens, respectively. ***Conclusion:*** NecrosisPET and ascitesCT independently predict survival in DHL/THL patients and may improve risk stratification, potentially guiding personalized therapeutic strategies.

EP-0346

The effect of EARL-harmonization and scan time reduction on Deauville score in patients with lymphoma

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Aim/Introduction: Deauville score (DS) is a standard tool for treatment response assessment in patients with Hodgkin's lymphoma and aggressive non-Hodgkin's lymphomas. PET images assessment involves measuring the SUVmax (Maximum Standardized Uptake Value) in target lesions, the blood pool, and the liver. SUVmax is dependent on many biological and technical factors. The EARL program, developed by the EANM, aims to reduce SUV variability in multicenter studies. The aim of the study was to assess the impact of EARL-harmonization and scan time reduction on DS in patients with lymphoma. ***Materials and Methods:*** $^{[18F]}$FDG PET/CT scans were performed for 20 patients with lymphoma both before and during therapy, according to the EANM guideline, with list mode acquisition. Two EARL1 (3D OSEM #1 - 9i12s Gaussian filter 7mm , #2 - 4i12s Gaussian filter 6mm) and four EARL2 reconstructions (BSREM, upper β=160, lower - β=400; 3D OSEM+PSF #1 - 9i12s Gaussian filter 7mm, #2 - 4i12s Gaussian filter 6mm) with different frame durations (180s/bp, 150s/bp, 120s/bp, 90s/bp, 60s/bp) were analyzed. Segmentation of the mediastinal blood pool and liver was performed semi-automatically, lesion segmentation was performed manually. SUVmax (normalized by lean body mass) were obtained and DS were determined for all reconstruction modes. The percentage of DS discordance was calculated for clinical acquisition time scans (180 s/bp) as the reference, and for shorter acquisition time scans obtained through the list mode. Additionally, the coefficient of variation (CoV) of DS was analyzed for each reconstruction timeframe dataset. ***Results:*** All and clinically significant DS discordances were determined for the reference 180s/bp scans (EARL1 - 5% and 5%, EARL2 - 8,75% and 5%) and the shorter acquisition time scans: 150s/bp (EARL1 - 7,5% and 7,5%, EARL2 - 10% and 6,25%), 120s/bp (EARL1 - 17,5% and 12,5%, EARL2 - 10% and 10%), 90s/bp (EARL1 - 32,5% and 20%, EARL2 - 21,25% and 15%), 60s/bp (EARL1 - 32,5% and 20%, EARL2 - 25% and 20%). Additionally, EARL1 appeared to be more sensitive to scan time reduction in Deauville scoring, as evidenced by the minimal coefficient of variation (CoV) for EARL1 (3D OSEM #1 - 26.9%) compared to EARL2 (BSREM β=160 - 14.7%). ***Conclusion:*** DS changed even when using EARL-harmonized PET reconstructions with the standard clinical acquisition time (180s/bp) on the same PET/CT-system. Reduction of scan time led to increased variability in DS. It might distort the treatment response assessment by DS, especially in multicenter studies.

EP-0347

Baseline FDG-PET Derived Texture Feature Entropy May Serve as an Imaging Biomarker for Treatment Outcome in Hodgkin Lymphoma Patients

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Aim/Introduction: Microscopically, Hodgkin lymphoma (HL) possesses a unique feature: tumor Reed-Sternberg cells comprise less than 1% of the total cell population, while the majority of cells actually belong to the bystander cells in the tumor microenvironment, as well as a high fibrosis component. On FDG-PET, HL lesions tend to demonstrate more heterogeneous uptake than other common lymphoma subtypes. In this retrospective study, our aim was to assess whether tumor heterogeneity, as assessed by baseline FDG-PET, can predict treatment outcome. ***Materials and Methods:*** Eighty-five newly-diagnosed HL patients with available pretreatment FDG-PET and at least 2 years of follow-up after completion of first-line therapy were included. For baseline tumor glycolysis characteristics, we analyzed maximum SUV (SUVmax) of the scan, SUVmax and the histogram-based

first-order entropy of the lesions at the biopsy region. Regions-of-interest were delineated slice-by-slice to encompass all lesions at the biopsy region, e.g., left neck. The low FDG uptake part was also included to ensure the evaluation of tumor heterogeneity. Among the 85 patients, 71 had an interim FDG-PET 2-4 months after initiation of chemotherapy, and a Deauville score of 4 or 5 was considered PET-positive. The performance of each parameter to predict unfavorable outcomes, i.e., refractory disease or relapse, was calculated using the receiver operating characteristic (ROC) curve. A P-value of less than 0.05 was considered statistically significant. ***Results:*** Out of the 85 patients, twenty-five (29%) experienced either a poor response to first-line therapy or disease relapse during the follow-up period. At diagnosis, the SUVmax of the PET scan measured 15.8 ± 5.3 (mean ± standard deviation, range 5.5-31.3). The SUVmax of all lesions at the biopsy region was measured at 13.9 ± 5.5 (range 2.6-30.0), with its corresponding 256-bit histogram-based first-order entropy calculated as 4.8 ± 0.3 (range 3.6-5.4). The areas under the ROC curve (AUC) to detect an unfavorable outcome were 0.420, 0.389, and 0.646, respectively, with the 256-bit entropy achieving the highest accuracy (optimal cutoff 4.9, P = 0.037). The prognostic value of a positive interim PET (n = 22) was confirmed in our subgroup of 71 patients (AUC = 0.789, P < 0.0001). ***Conclusion:*** Baseline tumor heterogeneity assessed by the histogram-based first-order entropy of FDG uptake may aid in identifying Hodgkin lymphoma patients with unfavorable outcomes. Our results, which focus on lesions at the biopsy region, offer the potential for correlation with the histological tumor microenvironment in future studies.

EP-0348

^{18}F-FDG Uptake Change in Liver, Mediastinal Blood Pool and Lymphoid Cell-rich Organs during PD-1 Immunotherapy in Lymphoma

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Aim/Introduction: To evaluate metabolism change in reference organs (liver and mediastinum) and lymphoid cell-rich organs (spleen and bone marrow) during PD-1 immunotherapy in relapsed or refractory lymphoma patients. ***Materials and Methods:*** Sixty-six patients with baseline and serial monitoring FDG PET/CT scans were retrospectively enrolled. SUVmean and SUVmax of evaluated organs were obtained by two reviewers, and their association with tumor burden and clinical response were evaluated. Immune-related adverse events (IRAE) detected by FDG PET/CT were also recorded. ***Results:*** The SUV values of reference organs and lymphoid cell-rich organs did not change significantly during the immunotherapy process. The intersubject variability of these values ranged from 13.0% to 28.5%. Meanwhile, metabolism of reference organs was affected neither by the tumor burden nor clinical response. SUV change of lymphoid cell-rich organs was associated with clinical response to immunotherapy. Responders showed decreased metabolism while non-responders showed a reverse trend (spleen SUVmax: -0.30±0.47 vs. 0.18±0.39, p=0.001, spleen SUVmean: -0.24±0.39 vs. 0.14±0.31, p=0.001, bone marrow SUVmax: -0.14±0.37 vs. 0.07±0.46, p=0.042, respectively). The influence of IRAE on the SUV change in evaluated organs was not significant. ***Conclusion:*** During PD-1 immunotherapy, metabolism change of reference organs is influenced neither by tumor burden nor by clinical response while FDG uptake change of lymphoid cell-rich organs is significantly associated with clinical response. ***References:*** 1. Xu-Monette ZY, Zhou J, Young KH. PD-1 expression and clinical PD-1 blockade in B-cell lymphomas. Blood. 2018;131:68-83. 2. Ansell SM, Lesokhin AM, Borrello I, et al. PD-1 blockade with nivolumab in relapsed or refractory Hodgkin's lymphoma. N Engl J Med. 2015;372:311-319. 3. Shi Y, Su H, Song Y, et al. Safety and activity of sintilimab in patients with relapsed or refractory classical Hodgkin lymphoma (ORIENT-1): a multicentre, single-arm, phase 2 trial. Lancet Haematol. 2019;6:e12-e19. 4. Song Y, Wu J, Chen X, et al. A Single-Arm, Multicenter, Phase II Study of Camrelizumab in Relapsed or Refractory Classical Hodgkin Lymphoma. Clin Cancer Res. 2019;25:7363-7369. 5. Tao R, Fan L, Song Y, et al. Sintilimab for relapsed/refractory extranodal NK/T cell lymphoma: a multicenter, single-arm, phase 2 trial (ORIENT-4). Signal Transduct Target Ther. 2021;6:365. 6. Armand P, Rodig S, Melnichenko V, et al. Pembrolizumab in Relapsed or Refractory Primary Mediastinal Large B-Cell Lymphoma. J Clin Oncol. 2019;37:3291-3299.

EP-0349

Development of a Multivariable Scoring Model for Prognostic Prediction in Hodgkin Lymphoma Patients Undergoing Anti-PD-1 Therapy

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Aim/Introduction: Hodgkin lymphoma (HL) is characterized by Reed-Sternberg (RS) cells expressing programmed death-1 (PD-1) receptors, contributing to a favorable response to immunotherapy. However, traditional assessment methods like the Lugano standards are inadequate for evaluating immunotherapy in HL. LYRIC criteria, while comprehensive, are complex for physicians to apply in clinical practice, and the extended assessment periods are relatively time-consuming1. This study proposes a novel prognostic scoring model integrating 18F-FDG PET/CT parameters and clinical variables for HL patients undergoing immunotherapy. ***Materials and Methods:*** We reviewed 54 HL patients (age ≥ 18) undergoing anti-PD-1 immunotherapy and 18F-FDG PET/CT scans pre- and during treatment (after four cycles) from 2017 to 2023. Patients were categorized into monotherapy (anti-PD-1 only) and combination therapy (usually involving a combination of immunotherapy and other treatment regimes) groups, ensuring baseline comparability. Imaging parameters were analyzed alongside Deauville score (DS) and LYRIC criteria. LASSO regression and multivariable Cox models assessed the prognostic value of PET/CT parameters in progression-free survival (PFS). A nomogram was then constructed for prognosis prediction model. ***Results:*** Significant differences were found only in delay since diagnosis and previous treatments between monotherapy and combination therapy groups. We assumed the difference to be reasonable since patient in monotherapy group are primarily enrolled in novel anti-PD-1 agent clinical trials, which are considered a lower priority option in the treatment regime. LASSO and Cox models identified age > 55, baseline SULpeak > 9.43, and SUVmean percentage change from baseline > 0.11 as key prognostic factors. The 5-point scoring model, simplified from nomogram, outperformed LYRIC standards in PFS prediction (C-index 0.781 vs. 0.649, p = 0.002). ***Conclusion:*** We developed a multifaceted prognostic scoring system for HL patients undergoing immunotherapy, statistically surpassing prevailing LYRIC and Deauville standards. ***References:*** 1. Lee AJ, Kim KW, Cho YC, et al. Incidence of Immune-Mediated Pseudoprogression of Lymphoma Treated with Immune Checkpoint Inhibitors: Systematic Review and Meta-Analysis. J Clin Med. 2021;10(11):2257.

EP-0350

The Role of F^{18} FDG PET/CT Metabolic Parameters in Predicting Bone Marrow Involvement in Lymphoma

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Aim/Introduction: Detection of bone marrow involvement in lymphoma is important for accurate staging and patient management. Although bone marrow biopsy (BMB) remains the gold standard, visual assessment and standardized uptake value (SUV) obtained with F^{18} FDG PET/CT are frequently used for this purpose. In this study, we aimed to investigate the effectiveness of the semiquantitative metabolic parameters of F^{18} FDG PET/CT as predictors of bone marrow infiltration (BMI) in lymphoma. ***Materials and Methods:*** We retrospectively analyzed the clinical data of 79 patients diagnosed with lymphoma and underwent F^{18} FDG PET/CT imaging for staging in our clinic between 2015-2023 and had bone marrow biopsy before treatment. SUVmax values obtained from the area of highest uptake in bone/bone marrow, liver, lumbosacral vertebrae, and posterior iliac crest were recorded. Volumetric parameters such as metabolic tumor volume (MTV) and total lesion glycolysis (TLG) were calculated for the average of 3 regions of interest drawn from lumbosacral vertebrae and posterior iliac crest. Pre-treatment hemoglobin (Hb) values were also noted. The cut-off value for the highest specificity and sensitivity to indicate bone marrow infiltration was determined according to the Youden index. ***Results:*** Twenty-five patients were diagnosed with Hodgkin lymphoma: 14 nodular sclerosis, 9 mixed cellularity and 2 nodular lymphocyte predominant subtypes. Fifty-four patients were diagnosed with Non-Hodgkin lymphoma: 12 marginal zone, 11 diffuse large B-cell, 8 follicular, 6 low-grade B-cell and others. BMB revealed infiltration in 49 patients. No statistically significant correlation was found between SUVmax measured in the areas of highest bone/bone marrow uptake or the ratio of this value to liver parenchymal SUVmax and the presence of BMI (p=0.31 and 0.80,respectively). However, there was a significant correlation between the presence of BMI and SUVmax measured from the posterior iliac crest (p=0.012), MTVaverage (p=0.002), MTVmax (p=0.010), TLGaverage(p=0.0049) and TLGmax(p=0.030). The highest sensitivity and specificity of the parameters for predicting BMI were as follows: MTVaverage: 69%, 76% (3.19 cm3), MTVmax: 74%,56% (3.60 cm3), TLGaverage: 89%, 53% (8.5 cm3), TLGmax: 91%, 46% (9.29 cm3). No significant relation or correlation was observed between SUVmax values measured from lumbosacral vertebrae or posterior iliac crest and pre-treatment Hb values. ***Conclusion:*** Although metabolic parameters have high sensitivity as a non-invasive method for predicting bone marrow infiltration, it was observed that their specificity is low. Semiquantitative metabolic parameters such as MTVaverage, MTVmax, TLGaverage, and TLGmax obtained with F^{18} FDG imaging may be helpful markers in predicting the presence of BMI.

EP-0351

Impact of metabolic tumor volume, total glycolysis and Deauville criteria in the assessment of treatment response in Hodgkin's lymphoma

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Aim/Introduction: Hodgkin lymphoma (HL) is a hematological malignancy that, when properly diagnosed and treated, has a good prognosis. However, some patients do not respond and fail chemotherapy. HL is classified using the Ann Arbor scale (AA) and response to treatment with the Deauville criteria (DC), but this approach is insufficient to predict outcomes in some patients. Our objective was to evaluate the impact of tumor burden through PET parameters based on metabolic tumor volume (MTV), total lesion glycolysis (TLG), and Deauville criteria (DC) as predictors of response to treatment in Hodgkin lymphoma (HL). ***Materials and Methods:*** Patients with HL evaluated with initial and subsequent positron emission tomography/computed tomography (PET-CT) with ^{18}F-FDG were retrospectively included from November 2022 to April 2023. Information of clinical and tomographic markers was obtained. Percentages, median, interquartile range (IQR), Fisher exact, Mann-Whitney U with statistically significant p value <0.05 and relative risk (RR) with 95% confidence interval were calculated. ***Results:*** A total of 101 patients with HL were evaluated; 58 patients (53.4%) were men. The median age was 35 years (4-79 years). Higher MTV and TLG were significantly associated with unfavorable therapeutic response. Patients with favorable therapeutic response had initial median MTV of 24.68 mL, with IQR 54.55. Patiens with unfavorable therapeutic response had a median MTV of 38.86 mL, with IQR 168.36, p=0.03. In a subsequent study the median MTV was 5.67mL (IQR 30.42) and 41.04mL (IQR 191.64), p=0.002, respectively. Patients with favorable response, initial median TLG was 79.73 (IQR 215.59) and patiens with unfavorable response had a median TLG 113.97 (IQR 860.0), p=0.03). In the subsequent study, patints with favorable response TLG 16.49 (IQR 77.89) and with unfavorable response TLG 123.88 (IQR 634.38), p=0.002. For a favorable response, Deauville D2 had RR 2.97 (1.23-7.15), p=0.001. ***Conclusion:*** We conclude that MTV and TLG associated with Deauville criteria could be parameters to predict response to treatment in HL. Patients with low initial median MTV and TLG and low Deauville criteria will have a favorable therapeutic response. Higher MTV and TLG will be significantly associated with an unfavorable therapeutic response. ***References:*** Kanoun S, Rossi C, Berriolo RA. Baseline metabolic tumour volume is an independent prognostic factor in Hodgkin lymphoma. Eur J Nucl Med Mol Imaging. 2014; 41: 1735-1743. Santos DF, Takahashi ME, Camacho M, Lopes de Lima MC, Juarez AB, Rohren EM, et al. Wholebody tumor burden in PET/CT expert review. Clin Transl Imaging. 2023; 11: 5-22.

EP-0352

Impact of a Deep Progressive Reconstruction (DPR) Algorithm on Low-Dose or Fast-Scan PET Image Quality and Deauville Score in Patients with Lymphoma

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Aim/Introduction: A deep progressive learning method for PET image reconstruction named deep progressive learning reconstruction method (DPR) is developed and evaluated it with phantom and patient studies[1]. This has been shown in previous study that the DPR with one-third duration can maintain the image quality as OSEM with standard dose (3.7 MBq/kg)[2].As the clinical trials of the Deauville Score(DS) to the international guidelines were based on SUVmax measurements made with the use of the OSEM reconstruction algorithm, we found it necessary to explore the impact of DPR on DS of lymphoma patients from two aspects of low dose and fast scan respectively,

in order to explore the impact of DPR on image quality and DS. ***Materials and Methods:*** A total of 77 lymphoma patients underwent [18F]FDG PET imaging for during or post-treatment follow-up were prospectively enrolled. Fourty-four patients were injected with 1/3 standard dose (1.23 MBq/kg) and scanned for 6 minute per bed and were reconstructed: ordered-subsets expectation maximization (OSEM) with 6 minute per bed (OSEM_6min_1/3), OSEM with 2 minute per bed (OSEM_2min_1/3), and DPR with 2 minute per bed (DPR_2min_1/3). Thirty-three patients were scanned according to the standard protocol (standard dose group) (3.7 MBq/kg) and were reconstructed: OSEM with 2 minute per bed (OSEM_2min_full), OSEM with 40 second per bed (OSEM_40s_full), and DPR with 40 second per bed (DPR_40s_full). Additionally, a 5-point Likert scale measurement analysis was performed and DS for lymphoma were determined in different groups. ***Results:*** No significant difference was found between the OSEM_6min_1/3 and DPR_2min_1/3 groups in terms of liver SUVmax, mediastinal blood pool (MBPS) SUVmax, and Likert scale. In all 44 cases, the DS results were concordant (100%). Similarly, there was no significant difference between the OSEM_2min_full and DPR_40s_full groups regarding Liver SUVmax, MBPS SUVmax, and Likert scale. In all 33 cases, the DS results were concordant (100%). ***Conclusion:*** DPR reconstruction demonstrated feasibility in reducing PET injection dose or scanning time, while ensuring the preservation of image quality and DS for during or post-treatment follow-up patients with lymphoma. ***References:*** [1] Lv Y, Xi C. PET image reconstruction with deep progressive learning. Phys Med Biol. 2021;66. http://doi.org/10.1088/1361-6560/abfb17.[2] Wang T, Qiao W, Wang Y, Wang J, Lv Y, Dong Y, et al. Deep progressive learning achieves whole-body low-dose ^{18}F-FDG PET imaging. EJNMMI Phys. 2022;9:82. http://doi.org/10.1186/s40658-022-00508-5.

EP-0353

Improving lymphoma diagnosis, treatment and follow-up with F^{18} FDG PET-CT imaging: Contribution of Artificial Intelligence and Radiomics Analysis.

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Aim/Introduction: Lymphoma,a wide spectrum of immune system malignancies, presents significant complexities in its early detection, management, and prognosis assessment since it can mimic post-infectious/inflammatory diseases. Although molecular imaging modalities, such as positron emission tomography/computed tomography (PET/CT), specifically 18F-FDG PET/CT, hold significant importance in the diagnosis of lymphoma, prognostication, and assessment of treatment response, they still face significant challenges. Recently Artificial Intelligence (AI) used for detecting subtle features that may not be easily discerned by visual assessment. Radiomics and AI capabilities seem to be promiosing. This review aims to provide a perspective on the current literature regarding the application of AI and radiomics applied/extracted on/from 18F-FDG PET/CT in the management of lymphoma patients. ***Materials and Methods:*** We undertook a comprehensive exploration of the PubMed database using a set of search phrases and keywords. These search terms included: 'lymphoma', 'artificial intelligence', machine learning', 'radiomics', 'deep learning', and 'radiogenomics'. Our search covered from the year 2000 to October 1st, 2023. We used the Boolean operators 'AND' and 'OR' to combine the main terms and keywords, refining the search results.Publications with a wide range of diseases, conference papers, literature reviews, and articles in non-English languages were excluded using specific criteria to narrow down our study selection. ***Results:*** 155 articles were selected. After applying the specified inclusion/exclusion criteria, a total of 78 articles that were considered relevant. Up to 95% of the research were retrospective.The predominant approach in lymphoma research was using radiomics or a combination of radiomics with AI for disease progression and outcome prediction.Radiomics and AI are used in diagnosis , risk assesment , possibility of Bone Marrow infiltration and differentiation of different lymphoma subtypes as well as outcome prediction. ***Conclusion:*** AI holds great promise in enhancing the quality of 18F-FDG PET imaging, particularly in cases where structural imaging is unavailable. Nevertheless there are still several formidable hurdles that must be overcome to practically implement AI-based physician assistant tools in clinical settings. One of the key challenges is the availability of large and diverse datasets. Efforts should be made to collect and curate datasets that encompass a wide range of patient demographics, disease stages, and image variations. Additionally, validation through multi-center studies is crucial. In light of the growing integration of AI and radiomics, it is rational to posit that the outcomes of these research endeavors will make substantial contributions to the enhancement of patient management in the foreseeable future.

EP-0354

Harmonisation of conventional and advanced methods of image reconstruction and analysis in the FDG-PET assessment of therapy response in lymphoma

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Aim/Introduction: In lymphoma, modern technology including advanced reconstructions give more 'positive' FDG-PET reads than established technology using the 5-point Deauville score (DS) for response and creates challenges for PET harmonisation. Alternatives to commonly used maximum standardised uptake value (SUVmax) measurements e.g. peak and mean SUV are being explored to improve harmonisation. Our aims were to: a) quantify the change in DS and tumour-to-liver ratio (TLR) moving from conventional iterative to advanced reconstructions and using alternative SUV measurements, and b) evaluate the relationship between standard and alternative methods across lymphoma subtypes. ***Materials and Methods:*** PET-CT scans were assessed from 3 clinical trials, with subtypes Hodgkin/HL, diffuse large B-cell/DLBCL and follicular/FL lymphomas. DS and TLR were determined, for the hottest residual lymphoma lesion,

in two ways for each scan, 'TLR1' - EARL1-compliant iterative reconstruction; SUVmax for lesion, liver and mediastinal blood pool (MBP), 'TLR2' - EARL2-compliant point spread function modelled reconstruction; SUVpeak for lesion and SUVmean for liver and MBP. TLR was categorised as ≤1, >1 to <2, ≥2 to <3, 3+ where a change of category reclassifies patient response. The relationship between TLR1 and TLR2 was evaluated using scans from 2 of the trials with the equation describing the relationship applied to measurements from the third trial to assess change in DS and TLR categorisation, with the process repeated three times. ***Results:*** 289 scans were included from 3 trials involving HL (n=45), DLBCL (n=114), and FL lymphoma patients (n=130). Moving from TLR1 to TLR2, 33% of patients changed DS and 30% changed TLR category, 20% from 'responders' (TLR≤1) to 'non-responders' (TLR>1). The relationship between TLR1 and TLR2 was linear with slopes of 1.42, 1.49, and 1.39 and intercepts of -0.09, -0.16, and -0.08 for the 3 evaluations, respectively. There was a near perfect correlation with R2 = 0.985, 0.985 and 0.9855 for the 3 comparisons. When TLR1 measurements were scaled using the equation describing the relationship between TLR1 and TLR2, they agreed very closely with the actual TLR2 measurements; in 93% of cases the TLR varied by ≤0.5 and in 89% HL, 93% DLBCL and 95% FL patients the TLR category was unchanged. ***Conclusion:*** Careful evaluation is required before adopting new methods for response assessment in lymphoma. Evidence-based criteria using the DS and TLR from large clinical trials using EARL1 technology remain valid with new EARL2 compliant technology by application of a simple scaling factor across lymphoma subtypes.

EP-0355

AI-based Automated Segmentation Algorithm Enables Total Metabolic Tumor Volume Estimation in Non-Hodgkin Lymphoma

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Aim/Introduction: The current lymphoma staging system might be improved by including Total Metabolic Tumor Volume (TMTV), but its clinical implementation is still challenging. This study aims to assess the ability of an AI-based automated segmentation algorithm to identify regions from which TMTV could be automatically calculated and to evaluate the ability of the resulting TMTVs in predicting patient outcome in NHL. ***Materials and Methods:*** This is a single-center retrospective study including newly diagnosed NHL patients who underwent FDG PET/CT using an EARL accredited digital scanner from March 2020 to January 2024. TMTVs were calculated using an AI-based automated segmentation algorithm (Siemens Healthineers; PERCIST-recommended liver-based threshold for lesion identification with 41%SUVmax and 4.0SUVmax thresholds for lesion segmentation). Two independent observers rated the success or failure of the tool to classify FDG-avid lesions and delineate visible tumor, adding new regions or removing erroneous regions such as sites of FDG excretion and physiologic uptake (sFEPU). Scans requiring no interaction or less than 2 editing steps were rated as a success while scans that missed more than 50% of the visible tumor or required more than 2 editing steps were rated as failure. Time to results calculated from lesion identification to TMTV computation was also noted. ROC curve analysis was used to investigate the discrimination performance of both SUV4.0 and SUV41% TMTVs for prediction of PFS and OS. ***Results:*** Seventy-four patients were finally assessed (43% males, median age 65 years; 55% DLBCL, 20% PMBL, 25% others). Interobserver agreement was 95% for SUV4.0 and 90% for SUV41%, respectively. Median time to results was 41sec and 69sec with SUV4.0 and SUV41% respectively (p=0.12). TMTVs were greater using SUV4.0 than SUV41% (p=0.016). A high correlation (r=0.93) was observed between TMTVs derived from the 2 thresholds. SUV4.0 performed better than SUV41% method with higher success and lower failure rates (34% vs 24% and 66% vs 76%, respectively). The most common reason for failure in SUV41% was the inclusion of sFEPU in 31 (55%) pts, while for SUV4.0 was the missing of lesions in 26 (53%) pts. High SUV4.0 and SUV41% TMTVs (>618 and >198 cm3 respectively) were associated with a worse PFS (p<0.002); high SUV4.0 and SUV41% TMTVs (>388 and >248 cm3 respectively) were also associated with a worse OS (p<0.01). ***Conclusion:*** AI-based automated segmentation algorithms may considerably simplify TMTV estimation, reduce observer variability, and facilitate the use of TMTV as a predictive factor in NHL.

EP-0356

Dmax or SDmax may help for prognostic stratification in DLBCL with interim PET Deauville Standard 3

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Aim/Introduction: iPET DS 3 patients are classified as complete metabolic response (CMR) in the guidelines, despite still having lesions with higher than background uptake. The prognostic assessment's value and significance remain controversial. This study aims to investigate the utility of ^{18}F-FDG PET imaging in risk stratification of DLBCL iPET DS 3 patients, with the goal of informing clinical treatment decisions. ***Materials and Methods:*** A retrospective analysis was conducted on patients who were diagnosed with DLBCL and underwent PET examination from January 2017 to December 2020. A total of 28 iPET DS 3 patients were included. The included clinical indicators: age, gender, Ann-Arbor stage, number of extranodal involvement, ECOG score, LDH, Hans classification, CD5, Bcl-2, C-Myc, and double expression. The included baseline PET metabolic indicators: metabolic tumor volume (MTV) and total lesion glycolysis (TLG) measured by threshold 41% SUVmax and 4. The included baseline tumor spread parameters: Dmax (the farthest distance between centroid of two lesions) and body surface area standardized Dmax (SDmax). The included iPET metabolic indicators: DS score, ΔSUVmax% and lesion-to-liver SUVmax ratio(LLR). The follow-up method used case collection and telephone follow-up, with a median follow-up time of 54 months. ***Results:*** In this study, 28 patients with DLBCL iPET DS 3 were analyzed, comprising 14 males and 14 females, with a median age of 46 years (range 19-74 years). The 3-year PFS and OS rates were 67.8% and 85.7% respectively, while the 5-year rates were 64.3% and 82.1% respectively. Univariate regression analysis identified MTV measured by threshold 4(P=0.047), Dmax(P=0.0048), and SDmax(P=0.0048) as risk factors for PFS in DLBCL iPET DS 3 patients. Furthermore, multivariate regression analysis indicated that Dmax or SDmax independently impacted PFS in these patients(P=0.02). ROC analysis showed that both SDmax(AUC:3-year-PFS 0.760 P=0.024; 3-year-OS 0.927 P=0.007) and Dmax (AUC:3-year-PFS 0.789 P=0.012; 3-year-OS 0.927

P=0.018)could predict PFS and OS in patients with DLBCL iPET DS 3, while IPI (AUC:3-year-PFS 0.678 P=0.104; 3-year-OS 0.869 P=0.018)had limited predictive value in PFS. ***Conclusion:*** In DLBCL iPET DS 3 patients, both Dmax and SDmax before treat are identified as independent risk factors. This implies that including SDmax and Dmax in clinical practice could provide added value in risk assessment and clinical decision-making for these patients. However, further validation of these findings is necessary in multiple centers and with larger sample sizes.

EP-0357

Prognostic value of pre-treatment ^{18}F-FDG PET/CT in non-Hodgkin's lymphoma patients receiving chimeric antigen receptor T-cell therapy

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Aim/Introduction: To evaluate the prognostic value of pre-treatment 18F-FDG-PET/CT in non-Hodgkin's lymphoma (NHL) patients undergoing chimeric antigen receptor T-cell (CAR-T). ***Materials and Methods:*** In this IRB-approved retrospective study, we reviewed patients treated with CAR-T between 2018 and 2023. The inclusion criteria were NHL patients with 18F-FDG-PET/CT prior to CAR-T infusion. Overall, 129 patients fulfilled the inclusion criteria. All had histopathology-proven diffuse large B-cell lymphoma and were diagnosed with relapsed/refractory disease. 18F-FDG-PET/CT was conducted based on the standardized protocol (EARL-compliant). Two expert physicians in consensus interpreted scans. Cases with Deauville scores IV/V were considered to have a significant disease burden. SUVs (max/mean/peak), whole-body metabolic tumour volume (MTV; 41%threshold) and whole-body total lesion glycolysis (TLG) were calculated. Additionally, the furthest distance between tumoral lesions throughout the body (Dmax) and their maximum distance from the spleen (spleen Dmax) were calculated. Progression-free survival (PFS) was defined as the time from CAR-T infusion until relapse, progression, death, or the last follow-up date. Overall survival (OS) was defined as the time from CAR-T infusion until patient death or the last follow-up date. Among 18F-FDG-PET/CT-derived variables with high collinearity (three main groups: "SUVs", "MTV/TLG", and "Distances"), we selected parameters with the highest prognostication (stepwise selection). The statistical significance level was set at a two-sided p-value <0.05. ***Results:*** Overall, 129 patients (mean age of 59y) with pre-CAR-T 18F-FDG-PET/CT (median interval of 12 days) were studied. Among them, 117/129 (91%) were positive for an 18F-FDG-avid significant residual disease. The median PFS and OS were 181 and 277 days after CAR-T, respectively. Notably, 35/117 (30%) deaths were documented during follow-up, with a median of 173 days. Among the baseline parameters, serum lactate dehydrogenase (LDH) level, SUVmax, SUVmean, SUVpeak, SUVmax-to-Liver background, SUVmean-to-Liver background MTV, TLG, Dmax and spleen Dmax were significant predictors of PFS (p-values<0.05). In a multivariate assessment, LDH (hazard ratio [HR]=1.69; 95%CI:1.00-2.85) and TLG (HR=4.55; 95%CI:1.06-19.61) retained their significance. Considering OS, the significant baseline parameters (p-values<0.05) were LDH, SUVmax-to-Liver background, MTV, TLG, Dmax and spleen Dmax. The only variable which retained its significance in the multivariate analysis was standardized Dmax (HR=3.28; 95%CI:1.16-9.34). ***Conclusion:*** Baseline 18F-FDG-PET/CT can provide valuable prognostic information in patients receiving CAR-T therapy. In particular, it may help clinical decision-making management by identifying patients with poor survival. The amount of whole-body glycolysis shown by 18F-FDG-PET/CT, as well as the extent of the disease on the scan, are of significant value in terms of survival prognostication.

EP-0358

Can we obtain prognostic information from healthy organ volume and uptake in baseline ^{18}F-FDG PET/CT imaging in Diffuse large B-cell lymphoma?

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Aim/Introduction: 18F-FDG PET/CT tumor uptake measures provide prognostic information in diffuse large B-cell lymphoma (DLBCL) patients. However, most studies so far focused on assessing tumor uptake and metabolic tumor volume only. Our objective is to explore if volume and 18F-FDG uptake of healthy organs contain added prognostic value. ***Materials and Methods:*** In this study, 264 newly diagnosed DLBCL patients from the HOVON 84 trial were included. Progression-free survival was assessed two years after starting treatment and dichotomized as either progression or no progression. Automatic segmentation of the anatomical structures was performed on the low-dose CT images using TotalSegmentator (1), followed by manual adjustments if needed. Tumor lesions were outlined using a semi-automated segmentation method (standardized uptake value ≥ 4) and subtracted from the organ segmentations. Volume, mean standardized uptake value (SUVmean), and total lesion glycolysis (TLG) were determined for the spleen, liver, kidneys, lungs, and brain and group differences between patients with and without progression were calculated. As half-body PET-scans were available, only the SUVmean was determined for fat, bone, and skeletal muscle and compared between groups. ***Results:*** Patients with progression (n = 45) showed significantly lower SUVmean and TLG values in the brain, and a lower SUVmean in skeletal muscle. However, the within-group variability hampered the discriminatory power between the two groups. No statistically significant differences of volume, SUVmean, and TLG were observed in any other investigated organ. Moderate negative correlations were found between the SUVmean of the liver and brain (r = -0.43, r = -0.50) and TLG of the tumor. We calculated an organ-to-blood ratio to adjust for 18F-FDG supply by dividing the SUVmean of the anatomical structures by the SUVmean of the metabolic blood pool. After this correction, patients with progression showed a significantly higher ratio in the spleen and fat tissue. ***Conclusion:*** Although there are group differences in 18F-FDG uptake in healthy organs between DLBCL patients with and without progression, the within-group variabilities are presumably too large to contribute to identifying patients at risk for progression. ***References:*** 1. Wasserthal et. al. DOI: https://doi.org/10.1148/ryai.230024.

EP-0359

Inter-observer agreement in the measurements of sarcopenia-related parameters (skeletal muscle and adiopse tissue area) with low-dose attenuation correction CT of ^{18}F-FDG PET/CT in elderly hodgkin lymphoma

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Aim/Introduction: Sarcopenia is defined as the loss of the skeletal muscle mass and function and it is mainly a phenomenon age-related. Currently, high dose computed tomography (CT) seems to be the most accurate, diffuse and reproducible tool to assess sarcopenia. The fluorine-18-fludeoxyglucose positron emission tomography/CT (^{18}F-FDG-PET/CT) scan includes a low-dose CT whose aim is the attenuation correction and the anatomical localization of radiotracer uptake. Preliminary evidence underline a potential usefulness of CT part of PET/CT to estimate sarcopenia-parameters. Our study aims to investigate the inter-observer agreement in the measurements of the skeletal muscle and adipose tissue area in elderly Hodgkin Lymphoma (HL) by low-dose CT of PET/CT. ***Materials and Methods:*** This is a prospective observational multicentric study enrolled into the Fondazione Italiana Linfomi (FIL). We recruited 69 patients with a confirmed histological diagnosis of HL and aged ≥65 at the time of diagnosis. Two readers (a radiologist and a nuclear medicine physician) measured skeletal muscle and adipose area using the software Coreslicer. An axial section at third lumbar vertebra was used to measure the skeletal muscle area (SMA) considering psoas, paraspinal, abdominal transverse rectum, internal and external obliques and visceral, subcutaneous and intramuscular adipose tissue (VAT, SAT, IMAT). CT HU thresholds were -29 to 150 for SMA, -190 to -30 for SAT and IMAT, and -50 to -150 for VAT. The intraclass correlation coefficient(ICC) and Bland-Altman plot were applied for the calculation of interobserver agreement. ***Results:*** For SMA, only in 3 (2%) scans the difference in the measurements between the two readers was higher than 10% (a value considered arbitrary as significant); for SAT in 5 (3%) scans and for VAT in 10 (6%) scans. For IMAT the difference was higher than 10% in most studies (n=74, 54%). Inter-observer agreement was very good for SMA (ICC=0.98), SAT (ICC=0.98) and VAT (ICC=0.95), while moderate for IMAT (ICC=0.68). Applying Bland-Altman analysis, the mean difference between the two readers was low, with 0.2% for SMA (limits of agreement -27.5 to 27.9), 1.4% for SAT (limits of agreement -16.6 to 16.7), 0% for VAT (limits of agreement -44.4 to 47.2), and 2.1% for IMAT (limits of agreement -5.2 to 9.3). ***Conclusion:*** CT of PET/CT is a safe, accurate and precise method for the measurements of skeletal muscle area, visceral and subcutaneous adipose tissue. Inter-observer agreement for the measurement of sarcopenia parameters assessed on low-dose CT of PET/CT was very good, except for IMAT.

EP-0360

Predictive Value of Radiomic Features Extracted on Baseline ^{18}F-FDG PET/CT in Follicular Lymphoma on Watchful Waiting

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Aim/Introduction: Patients with low tumour burden follicular lymphoma (FL) are managed with a watchful waiting (WW), starting chemotherapy after the onset of symptoms. Clinical prognostic models used at staging, including the follicular lymphoma international prognostic index (FLIPI), only poorly identify patients at elevated risk of progression. 18F-FDG PET/CT in FL is recommended for staging, particularly to determine disease extension and metabolic burden. This study investigated whether radiomic features extracted from baseline PET/CT could improve the prediction of starting treatment in FL patients on WW. ***Materials and Methods:*** Thirty-eight patients on initial WW (grade 1-3a), with a baseline PET/CT and a follow-up ≥24 months, were retrospectively included at Fondazione Policlinico A. Gemelli IRCCS of Rome from 2010 to 2019. Metabolic tumour burden was obtained using an automatic whole-body segmentation (LesionID, MIM-Software Inc.). Time to treatment (TTT) was calculated from the date of diagnosis until the date of starting the systemic therapy. Eighty-one morphological and first-level intensity radiomic features were extracted from the metabolic tumour burden, the lesion having the highest SUVmax and a reference region-of-interest (ROI) placed in the healthy liver. A linear regression (LR) model and an SVM classification model were constructed to assess the feasibility of using PET-derived radiomic features to predict TTT. We implemented four different models increasing the number of predictors from one to four for each model. A leave-one-out cross-validation approach was used to assess the model performance on an independent dataset. ***Results:*** For LR models, we found a root-mean-squared-error (RMSE) of 29.7, 28.4, 26.0, 25.3 and a R2 of 0.01, 0.09, 0.02, 0.28, computed over the test set, respectively using incrementally from one to four features. Accordingly, the best model was the last, using the following features: liver ROI minimum SUV value, suv-max ROI morphological asphericity, overall homogeneity in the tumour burden, elongation after principal component analysis of the suv-max ROI. For SVM models, an accuracy of 0.79, 0.76, 0.68, 0.63 and an AUC of 0.86, 0.81, 0.80, 0.75 were found incrementing the features from one to four. Thus, the best performing model used one feature, such as the overall centre of mass shift within the lesions. ***Conclusion:*** Some radiomic features obtained from baseline PET/CT could predict TTT of FL patients on WW. It is mandatory to explore the biologic mechanism underlying radiomic features in a larger and prospective assessment to

validate their integration with FLIPI and other clinical parameters. (Ricerca Finalizzata GR-2019-12370372)A.

EP-0361

White blood cell counts as a predictive marker to determine the pretest staging on ^{18}F-FDG PET/CT in Hodgkin's lymphoma patients.

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Aim/Introduction: ^{18}F-FDG PET/CT scan is used to stage Hodgkin's lymphoma with Ann Arbor stage 1 & 2 classified as low risk and stage 3 & 4 as high risk based on the prognosis. In this study we aimed to assess the predictive value of the WBC (White blood cell) counts to stage low and high risk Hodgkin's lymphoma. ***Materials and Methods:*** We conducted a retrospective study in a tertiary care centre of India, during the period of November 2023 to April 2024. 76 biopsy proven Hodgkin's lymphoma patients were included with baseline (pre-treatment) ^{18}F-FDG PET/CT data , out of which complete clinical data of 33 patients were not available. After staging the included patients, based on the ^{18}F-FDG PET/CT, the WBC counts of these patients were classified into two groups. Group 1 consists of WBC counts of the low risk lymphoma patients and group 2 consists of WBC counts of the high risk lymphoma patients. Statistical analysis was done using IBM-SPSS software version 26. ***Results:*** In this study, we included a total of 43 patients (14 low risk, 29 high risk), in which 11 (8 male, 3 female) were pediatrics (<18 years) patients with a mean age of 9.45 ± 4.63 years while 32 (22 male, 10 female) were adults (>18 years) patients with a mean age of 37.75 ± 13.7 years. The mean WBC count of group 1 and group 2 was (8.43 ± 2.8 x 109/L) & (11.43 ± 5.07 x 109/L). Unpaired T test was applied to look for significance of WBC counts between the two groups, which depicted significant (p=0.043) difference in the WBC counts of low risk and high risk Hodgkin's lymphoma patients staged by ^{18}F-FDG PET/CT. ***Conclusion:*** The WBC counts were significantly different between low risk and high risk groups of lymphoma patients, concluding that WBC counts can be used as a parameter to predict the pretest ^{18}F-FDG PET/CT staging of Hodgkin's lymphoma patients. However, Larger sample size studies are warranted to validate this study and pin point the cut-off level of WBC counts.

EP-0362

Prognostic value of massiveness parameters measured on baseline FDG PET in advanced-stage Hodgkin lymphoma

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Aim/Introduction: The prognostic value of radiomic quantitative features measured on pre-treatment 18F-FDG PET/CT was investigated in patients with advanced-stage Hodgkin lymphoma (HL). ***Materials and Methods:*** We conducted a retrospective study of 176 HL patients diagnosed between 2006-2017. A dozen of PET/CT-derived features were extracted via Oncometer3D from baseline 18F-FDG PET/CT images. The receiver operating characteristic (ROC) curves, Kaplan-Meier method and Cox analyses were used to assess the prognostic factors for Overall Survival (OS) and Progression-Free Survival (PFS) censored at 5 years. ***Results:*** Four different clusters were identified among the twelve PET parameters analyzed: activity, tumor burden, fragmentation-massiveness and dispersion. On ROC analyses, medEDGE, the median edge distance had the highest AUC for OS (0.72) and PFS (0.6). Patients with high baseline medEdgeD had a significantly worse PFS (HR=1.02; p=0.04) and OS (HR=1.03; p=0.003) in both Kaplan-Meier and Cox univariate analyses. Furthermore, medEdgeD remained statistically significant in a multivariate analysis including various TEP and clinical parameters used in daily routine. In addition, in sub-group analyses, we highlighted the significantly worst prognosis for patients with bulky disease, treated with ABVD and with high baseline medEdgeD value. ***Conclusion:*** PET parameters describing massiveness appeared to be significantly correlated with prognosis in HL patients for OS and PFS, notably the medEdgeD. ***References:*** Draye-Carbonnier S, Camus V, Becker S, et al. Prognostic value of the combination of volume, massiveness and fragmentation parameters measured on baseline FDG pet in high-burden follicular lymphoma. Sci Rep. 2024;14:8033.

EP-0363

Can metabolic parameters of ^{18}F FDG PET predict cell of origin classification of Diffuse Large B-cell lymphoma (DLBCL) ?

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Aim/Introduction: Depending on the cell of origin DLBCL can be broadly classified into two groups, Germinal center B -Cell like subtype (GCB) and nonGCB group or Activated B-cell (ABC) subtype. Non-GCB DLBCL is known to be associated with unfavorable prognosis (1). ^{18}F FDG PET is the investigation of choice for staging DLBCL. However, correlation between the COO classification and PET derived SUV parameters have rarely been investigated. In this study, we aim to see if there is any correlation between SUVmax and COO subtypes of DLBCL. ***Materials and Methods:*** This retrospective observational analysis includes 70 patients who have undergone pretreatment ^{18}F FDG PET/CT during the period of 2017-2021 and have complete histopathology report(HPR) available. The scans of the patient were reviewed by an experienced Nuclear Medicine Physician, who was blinded to the HPR data. The hottest lesion in each scan was selected and SUVmax was evaluated. Hans algorithm based on expression of three markers, CD10, BCL6 and MUM1 was used to differentiate between GCB and non-GCB DLBCL. Mann-Whitney U Test was used to assess the mean SUVmax between GCB and nonGCB DLBCL. ROC analysis and Youden Index was used to find a SUVmax cut off. Chi square test was used to further validate the cut off. ***Results:*** Of the 70 patients 18 were stage I, 19 stage II, 20 stage III, 13 stage IV. Patients were classified into GCB and non GCB subtypes equally, 35 each. The median SUVmax between the GCB and non GCB subtypes were 23.7 (range 5.48-50.45) and 29.1 (range 7.25-64.81) respectively. The mean SUVmax between the GCB and non GCB subtypes were 29.54 and 41.46(p value=0.014; r=0.3, moderate effect size). Using ROC analysis a SUVmax cutoff of 20 was found (sensitivity=83%, specificity 43%, AUC=0.670, p value=0.014). 73% of the cases with SUVmax <20 were correctly identified as GCB subtype and 60% of the cases with SUVmax > 20 were correctly identified as non GCB subtype (p value 0.019). ***Conclusion:*** SUVmax in GCB subtype of DLBCL was found to be significantly higher than that of nonGCB type DLBCL, however, the effect size was moderate. ***References:***

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EP-0364

The Role of Quantitative PET parameters in the identification of non-responsive patients withrelapsed/refractory large B-cell Lymphoma treated with chimeric antigen receptor T-cell therapy

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Aim/Introduction: CAR T-cell therapy has shown remarkably efficacy in treating relapsed/refractory large B-cell lymphomas (LBCLs). However, response to therapy varies among patients with approximately half of them progressing or relapsing within one year after treatment. F^{18} fluorodeoxyglucose positron emission tomography/computed tomography (PET/CT) is commonly used to assess treatment response, typically using Deauville score (DS), a visual scale. ***Materials and Methods:*** We investigated whether PET semiquantitative parameters (SUVmax, total lesion glycolysis [TLG], and metabolic tumor volume [MTV]) measured before CAR T-cell infusion (PET0) and one month after (PET1) could better identify non-responder patients. MTV, TLG, SUVMax, DS and variations of these parameters between the two scans were calculated and associated with the durationof response (DoR), overall survival and progression free survival. ***Results:*** We prospectively enrolled 61 consecutive patients with a diagnosis of LBCL treated at our institution. The median follow-up was 18 months (30% women, median age 59 years with 75.4% who received a bridging therapy to CAR T). Median PET0 parameters were 125 ml for MTV, 728.8 g for TLG and 17.6 for SUVmax, respectively, whereas at PET1 were 1.9 ml, 5.0 g, and 4.4, respectively. Twenty-eight (45.0%) patients died during follow-up with an overall survival of 51.6% at 3.5 years. Patients with SUVMaxPET0 >14.75, TLGPET0 > 571.768 g, PET1MTV > 60.8 ml, TLGPET1 > 97.0 g and DS PET1 ≥4 had a statistically significant increased risk of death (all $p < 0.05$). Patients with MTVPET0 > 109.9 ml, SUVMaxPET0 > 11.8, TLGPET0 > 571 g, MTV PET1 > 48.3 ml, TLG PET1 >v204 g and PET1 DS ≥4 had a statistically significant increased risk of disease progression (all $p < 0.05$). Patients with MTVPET0 > 225.7 ml and TLGPET0 > 728.8 g, were associated with a statistically significant reduced DoR. Also, MTVPET1 was associated with longer DoR. ***Conclusion:*** PET semiquantitative parameters measured both before and one month after CAR T-cell infusion demonstrate significant correlation with overall survival, progression free survival and DoR. These findings suggest that PET-based metrics should be considered for early treatment decisions in LBCL patients. overall survival, progression free survival and DoR.

EP-0365

Assessment of bone marrow involvement in patients with follicular lymphoma: Correlation between ^{18}F-FDG PET/CT and bone marrow biopsy

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Aim/Introduction: To analyse the correlation between the results of bone marrow (BM) biopsy and the findings of the 18F-FDG PET/CT in the assessment of BM involvement (BMI), as well as its diagnostic accuracy. ***Materials and Methods:*** Retrospective analysis of 105 consecutive patients with follicular lymphoma (FL) undergoing 18F-FDG-PET/CT staging scan between January/2017 and November/2020, and BM biopsy. Eight patients were excluded due to inconclusive results or absence of biopsy. Hypermetabolic foci higher than the hepatic pool with/without CT lesions and/or diffuse hypermetabolism in the BM greater than the hepatic pool (having ruled out other causes such as moderate/severe anaemia or active infectious process) were considered as suspicious of BMI in 18F-FDG-PET/CT. Statistical analysis was performed calculating kappa index, and sensitivity (S), specificity (E), positive predictive value (PPV), negative predictive value (NPV) and diagnostic accuracy (Ac) were calculated. ***Results:*** Ninety-seven patients (47 women), with a mean age of 59.6 years (13-86), were finally included. Forty-one BM biopsies were reported as positive and 56 as negative, whereas only 25 18F-FDG-PET/CT scans were considered having BMI (versus 42 negative). Statistical metrics were as follows: Kappa index of 0.362, statistically significant ($p<0.001$); S= 61%, E= 75%, PPV= 64.1%, NPV= 72.4%, and Ac= 69.1%. ***Conclusion:*** 18F-FDG-PET/CT showed a weak concordance with BM biopsy and only a moderate diagnostic Ac for BMI assessment in FL. Therefore, given the prognostic importance of a correct initial staging in patients with FL, the BM biopsy cannot be avoided based on a negative 18F-FDG-PET/CT scan.

EP-0366

Measuring maximum tumour dissemination (Dmax) in diffuse large B cell and follicular lymphoma in ^{18}F-FDG PET/CT. Which method is preferable in clinical practice?

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Aim/Introduction: To evaluate the differences between measuring maximum tumour dissemination (Dmax) from centre to centre (Dmax1) or from top to bottom margins (Dmax2) of the lesions in patients with diffuse large B cell and follicular lymphomas (DLBCL and FL) in staging PET-CT scans. And to analyse the role of normalizations for body surface area (BSA) and height in calculatingDmax. ***Materials and Methods:*** A retrospective observational study including consecutive patients diagnosed with DLBCL or FL between January/2016-May/2019 was conducted. The distance (in millimetres) between the two most distant lesions was measured from centre to centre (Dmax1) and from top margin to bottom margin (Dmax2) These distances were additionally normalized by height (HDmax) and BSA (SDmax), obtaining 6 different measurements in both DLBCL and FL: Dmax1, Dmax2,HDmax1, HDmax2, SDmax1 and SDmax2.The differences between Dmax1/2, HDmax1/2, and SDmax1/2 were assessed using paired sample analysis and their Hazard Ratio (HR) for disease free survival (DFS) was compared with a Cox regression

analysis. ***Results:*** One hundred and forty-three DLBCL patients with a mean age of 64.6 years were evaluated, obtaining the following mean distances: Dmax1 355.8, Dmax2 382.9, SDmax1 195.8, SDmax2 210.4, HDmax1 217.6, and HDmax2 234.1 mm. One hundred and seven FL patients were also studied, obtaining: Dmax1 480.2, Dmax2 496.7, SDmax1 263.1, SDmax2 272.0, HDmax1 290.9, and HDmax2 300.9 mm.The paired sample analysis showed statistically significant differences between Dmax1 and Dmax2, HDmax1 and HDmax2, SDmax1 and SDmax1 in both subgroups (DLBCL and FL) with a p-value <0.001, as expected. Nevertheless, Cox regression analysis for DFS showed very similar HR for all of them in both subgroups:- DLBCL: HR 1.002 in both Dmax1 and Dmax2, CI 95% [1.001-1.003]; HR 1.003 in the rest of distances (HDmax1 and HDmax2, SDmax1 and SDmax2), CI 95% [1.001-1.005].- FL: HR 1.001 in both Dmax1 and Dmax2 CI, 95% [0.999-1.003]; HR 1.002 inHDmax1 and HDmax2, SDmax1 and SDmax2, CI 95% [0.999-1.005].Although HR values obtained in FL subgroup were not statistically significant, a resembling trend was found in both subgroups. Furthermore, note that these values are HR per unit (millimetre). ***Conclusion:*** Despite the fact that significant differences were found between the differentmethods of measuring the Dmax (and their normalizations), the values of HR obtained are similar in DLBCL and FL allowing any of the 6 measurements to be used interchangeably in clinical practice.

EP-0367

Whole Body PET Parameters Predicting Progression after CAR-T Cell Therapy in Relapsed/Refractory Aggressive B-cell Lymphoma

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Aim/Introduction: Among patients with relapsed/refractory aggressive B-cell lymphoma treated with chimeric antigen receptor (CAR)-T cell therapy, only around 40% have long-term benefit. This study aims to identify prognostic biomarkers in patients treated with CAR-T cell for aggressive B-cell lymphomas. ***Materials and Methods:*** Consecutive pts treated with CAR-T cell infusion for aggressive B- cell lymphoma were retrospectively enrolled in this single centre study. All pts underwent FDG PET/CT before CAR-T, and at 1 (PET-1) and 3 months after cell infusion. Whole body PET metrics (TMTV and WB-TLG) were extracted using an AI-based automated segmentation algorithm (Lesion Scout with Auto ID, Siemens Healthineers; PERCIST- recommended liver-based threshold for lesion identification with 4.0 SUVmax threshold for lesion segmentation). Response to treatment was assessed using both clinical and imaging criteria every 3 months after CAR-T or anytime in case of clinical progression. ***Results:*** Forty pts were enrolled (median age 55 yrs, range 28-75), 50% were males. The stage was advanced (III-IV) in 26 (65%) pts. Parameters as IPI, LDH levels or extranodal sites were also analysed. Median baseline TMTV and WB-TLG were 28.34 cm3 (0-1306) and 222.36 (0-12318), respectively. Median PFS was 12 months, with an overall PFS of 48% at 2 yrs. Baseline TMTV and WB-TLG were predictive of PFS (p<0.001) with high baseline TMTV (≥48) and WB-TLG (≥407) being associated with a lower PFS (median PFS, 1.4 months vs. not reached and 2.5 months vs. not reached; p<0.001, respectively). On multivariate analysis baseline TMTV (cut-off 48.4) and LDH above upper normal limit were independent prognostic factors for PFS (p<0.001 and p = 0.003 respectively). We therefore assigned 1 point each for TMTV ≥48 and LDH above normal, discriminating 3 groups with 0 (15 pts), 1 (14 pts) or 2 (11 pts) points each. Pts with 0, 1 or 2 points had increasingly worse response to CAR-T cell therapy (median PFS not reached vs 12 months vs 1.5 months, p<0.001). In addition, TMTV and WB-TLG of PET-1 were predictors of PFS (p<0.001). On multivariate analysis PET-1 TMTV (cut-off 1.99) was an independent prognostic factor for PFS (p=0.008). ***Conclusion:*** Baseline PET metrics may allow for identification of patients who will benefit most from CAR-T cell infusion. The combination of clinical variables with baseline and PET-1 metrics could lead to a better patient selection and early adaptation of clinical management.

EP-0368

Exploring the Clinical Implications of LAFOV Digital PET Scanners: Does contrast enhanced CT affect quantification of FDG uptake?

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Aim/Introduction: The introduction of long axial field-of-view (LAFOV) digital PET scanners has significantly influenced clinical management by offering the potential to increase signal collection efficiency, improve spatial resolution and reduce the dosage of injected tracers. However, the heightened sensitivity of these PET systems—up to 20 times greater than traditional models—could lead to the identification of clinically irrelevant findings and deviations in tracer uptake quantification. While some scanners enable the use of contrast-enhanced CT for PET attenuation correction, its impact on FDG uptake quantification and the necessity of an additional low-dose CT for accurate assessment remain uncertain. In this work, we aim to measure the degree of deviation between LAFOV PET images reconstructed with contrast-enhanced CT and non-enhanced low-dose CT. ***Materials and Methods:*** Patients were scanned on a digital LAFOV PET/CT with a 106 cm axial field-of-view. Data from 8 tumor lesions from 3 patients were used. All patients received a diagnostic full-dose CT with administration of contrast agent and an additional low-dose CT for attenuation correction. PET images were reconstructed using the contrast-enhanced CT (cePET) and the low-dose PET (non-cePET) for attenuation correction with PSF-TOF and full acceptance angle. Tumor and liver uptake were quantified by using a 40% iso-contour volume-of-interest. Wilcoxon signed rank exact test was used for statistical analysis. Further analysis of additional 30 patients with verified lymphoma will be performed. ***Results:*** On a per patient basis, the maximum liver uptake (median kBq/ml + IQR) was significantly higher in cePET compared to non-cePET reconstructions (+7.8 %; 11.082 [3.517]

vs. 10.274 [3.591], p = 0.014). On a per lesion level, the maximum tumor uptake was significantly higher in cePET compared to non-cePET (+3.8 %; 18.470 [11.011] vs. 17.792 [10.935]; p = 0.008) and the ratio of maximum tumor uptake to liver was lower in cePET (-4.1 %; 1.538 [0.757] vs. 1.604 [0.811], p = 0.039). ***Conclusion:*** Preliminary findings indicate a significant impact of utilizing contrast-enhanced CT for attenuation correction in LAFOV PET/CT reconstruction. These results might have significant implications for response assessment frameworks such as the qPET (Deauville) criteria, which depend on comparing lesional uptake to liver uptake. Given these results, corroboration and assessment of clinical implications are warranted.

EP-0369

Role of [18F] FDG-PET/CT and assessment of basal metabolic parameters in mantle cell lymphoma

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Aim/Introduction: Mantle cell lymphoma (MCL) is a rare B-cell lymphoma subtype comprising 3-10% of non-Hodgkin's lymphoma, with aggressive behavior, poor prognosis and avidity to [18F]FDG on PET/CT. Several studies have demonstrated a predictive value of baseline [18F]FDG-PET/CT metabolic parameters in some lymphoma subtypes. In MCL there are few studies on the role and assessment of metabolic parameters. The aim of this study is to assess the prognostic value of baseline [18F]FDG-PET/CT metabolic parameters in MCL. ***Materials and Methods:*** Patients diagnosed as MCL were referred for [18F]FDG-PET/CT at initial staging. Pretreatment metabolic parameters SUVmax, SUVmean, metabolic tumor volume (MTV) and total tumor glycolysis (TLG) of PET/CT were measured, retrospectively, using MIM software. It was compared two segmentation methods (PERCIST and SUVmax2.5) with T-student analysis. The metabolic parameters MTV and TLG estimated by PERCIST and SUVmax2.5 methods were correlated with PFS and OS. Survival curves were determined with the Kaplan-Meier method. ***Results:*** Twenty-seven patients(p) were studied (24 men), mean age was 64 years (42-75), 22/27p had advanced disease (stage III/IV). Mean follow-up was 79 months (m), with a maximum of 160m. The histological subtype identified was: 10p pleomorphic (37%), 5p blastic (18.5%), 4p classic (14.8%), 1p small-cell (3.7%) and 7p unclassified (26%). The average SUVmax was 7.61 (1.66-17.4). Three patients were excluded due to the low uptake and the VOI were not identified. The MTV and TLG cut-offs that allowed significant differences, for PERCIST method: 265 and 1005. And for the SUVmax2.5 method: 568 and 2162, respectively. Patients with high MTV and TLG by both methods had worse prognosis than those with low MTV and TLG (PFS 42.2m vs 76.4m for SUVmax 2.5 and 44.1 vs 77.6 m for PERCIST, respectively), p<0.05. Fifteen patients had relapsed/progressed (R/P) disease, with a mean PFS 41m and mean OS of 77m. Nine of 27p died (6p related to lymphoma) with mean PFS of 20m (11d-61m). Relapsed patients had higher MTV for both methods than non-relapsed patients (443/711 vs 59/149: PERCIST/SUVmax 2.5). SUVmax and SUVmean were not related to outcome survival. ***Conclusion:*** Baseline [18F] FDG-PET/CT metabolic parameters MTV and TLG in MCL by different segmentation methods (PERCIST and SUVmax 2.5) were correlated with PFS. Patients with high MTV and TLG had significantly worse prognosis than those with low MTV and TLG. No relationship was observed between SUVmax and SUVmean with PFS. More studies are needed due to our limited number of patients.

EP-0370

Combined Application of Laboratory Prognostic Index and Baseline PET-Based Metrics in Diffuse Large B-Cell Lymphoma: Does It Have Any Impact On The Early Detection Of 'Non-Responders'?

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Aim/Introduction: Diffuse Large B-cell Lymphoma (DLBCL) is a heterogeneous disease with a 40% of patients resulting in progression to R-CHOP-like regimens. In this regard, it is essential to identify 'non-responders' so that an alternative treatment strategy can be considered. The revised International Prognostic Index (R-IPI) is used in daily practice, but does not optimally detect patients with a high probability of poor long-term outcomes. The recently validated Laboratory Prognostic Index (LABPI) has instead shown potential predictability in DLBCL. This study aimed to test a predictive model in DLBCL combining LABPI and baseline-PET features that allows better risk stratification and early detection of 'non responders'. ***Materials and Methods:*** DLBCL patients treated with R-CHOP-like regimens who had undergone a baseline 18F-FDG PET/CT were retrospectively reviewed. LABPI score was calculated in relation to three pretreatment laboratory parameters: beta-2-microglobulin, lactate dehydrogenase and hemoglobin. PET-based features were obtained from baseline images: Metabolic Tumor Volume (MTV) and Disease dissemination (Dmax). SUV4-Method was applied for automated segmentation of MTV using the Syngo. via software. Dmax was measured as the distance between the two farthest hypermetabolic lesions. PFS rate was calculated using the Kaplan-Meier method followed by log-rank tests and analyzed with multivariate Cox and logistic regressions. ***Results:*** A cohort of 154 patients (88 men) was selected, with a median age of 67 years (range:26-90) and PFS follow-up of 39 months (IQR:5-152). Patients were divided into three risk groups based on LABPI [0 (Low); 1-2 (Intermediate); 3-4 (High)]. Dichotomization was applied to MTV and Dmax (thresholds: 106.54 cm3 and 7.9 cm). Univariate Cox regression analysis for Dmax showed a HR of 7.3 (95% CI: 1.4 to 38.3; p=0.003). A multivariate regression was performed for LABPI and MTV, with HR resulting in 4.7 (95% CI: 1.2 to 18.7; p=0.026) and 2.8 (95% CI: 1.0 to 7.8; p=0.054). Statistical difference in MTV between two groups with Intermediate LABPI was considered for reclassification, demonstrating a PFS of 92% and 66% in 36 months. A 38% of the cohort was reclassified as good prognosis, which is higher than what R-IPI classifies as good (8%) (p<0.001). Multivariate logistic regression analysis showed considerable statistical predictiveness, with OR of 4.4 for LABPI and 4.0 for MTV, and an area under the curve of 0.73 (p<0.001). ***Conclusion:*** Our preliminary results suggest that combination of LABPI and baseline-PET features shows potential predictiveness in DLBCL. Further validation with larger series is requested.

EP-0371

[18F]FDG PET/CT biomarkers in patients with Relapsed/Refractory Diffuse Large B-cell Lymphoma treated with Loncastuximab tesirine

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Aim/Introduction: Loncastuximab Tesirine is a CD-19-directed antibody-drug conjugate approved by the FDA as a single-agent treatment for relapsed/refractory diffuse large B-cell Lymphoma. The association between PET/CT biomarkers and treatment response is increasingly studied, particularly for total metabolic tumor volume (TMTV). This work aimed to assess the predictive potential of TMTV for treatment response in r/r aggressive large B-cell Lymphoma (r/r LBCL) treated with Loncastuximab Tesirine. ***Materials and Methods:*** We retrospectively evaluated a series of 69 r/r LBCL (M:F = 44:25; median age 62 yrs, range 23-87). From March 2017 to June 2021, patients were treated at Humanitas Research Hospital with Loncastuximab Tesirine single agent (ADCT-402-101 and ADCT-402-202 trials) or in combination with Ibrutinib (ADCT-402-103 trial). TMTV was obtained by automatic method (Syngovia, Siemens) using the SUV 40% threshold and SUV ≥4.0 threshold, also used for the evaluation of the International Metabolic Prognostic Index (IMPI). Cox proportional hazards regression analysis and Kaplan-Meier curves were used to correlate PET/TC biomarkers and progression-free survival (PFS). An unpaired t-test was conducted using the Fisher method to compare the best response groups. Statistical analysis was performed using R software and GraphPad Prism software. ***Results:*** The median baseline TMTV value (90 mL) was used to separate the high vs low MTV cohorts (34 and 35 patients, respectively). Response rates according to high vs. low TMTV were 12% vs. 31% for complete response, 29% vs. 37% for partial response, 21% vs. 12% for stable disease, and 38% vs. 20% for progressive disease, respectively. PFS by median TMTV at baseline was 4.8 months for low TMTV (<90 ml) and 2.6 months for high TMTV (>90 ml) (HR: 2.7, P= .0003). Patients achieving a complete response as the best response exhibited a significantly greater reduction in TMTV at the first disease assessment, with a mean log10 fold-change of -1.709. In our series, IMPI demonstrated no significant correlation with PFS. ***Conclusion:*** Our results demonstrated TMTV's predictive potential for complete response and PFS in patients with aggressive large B-cell Lymphoma treated with Loncastuximab Tesirine.

EP-19

e-Poster Area

B: Imaging Clinical Studies -> B1 Oncological Imaging Clinical Study -> B22 Other Hemato-Oncology

EP-0372

Relationship between Metabolic Activity of Bone Lesions Assessed by SUVmax Detected by [18F]FDG PET/CT and Clinical Parameters in Newly Diagnosed Multiple Myeloma Patients

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Aim/Introduction: Accurate staging is pivotal for prognosis and treatment planning in newly diagnosed multiple myeloma (MM) patients. While the International Staging System (ISS) categorizes MM based on β2-microglobulin and albumin values, the variable survival in MM challenges the adequacy of current staging practices. This study aims to explore the correlation between [18F] FDG PET/CT findings and clinical parameters in newly diagnosed MM patients. ***Materials and Methods:*** Thirty-seven patients with histologically confirmed newly diagnosed MM were enrolled. All patients underwent [18F]FDG PET/CT before treatment initiation. Statistical analysis, including chi-square tests and Student's T-tests, aimed to uncover relationships between staging laboratory values and SUVmax. ***Results:*** Results revealed 13.2% with diffuse bone-marrow involvement and metabolically active osteolytic lesions in 86.8% of patients. Among these, 21.1% presented with up to 5 bone lesions, while 63.2% had more than 5 lesions. The average SUVmax was 4.29 (range 2.10-13.2). Laboratory findings included: anemia (64.9%), elevated serum creatinine (29.7%), elevated alkaline phosphatase (16.2%), elevated lactate dehydrogenase (70.3%), β2-microglobulin above 3.5 mcg/mL (43.2%), and elevated albumin (29.7%). No statistically significant relationships were found: paraprotein (p=0.632), albumin (p=0.654), β2-microglobulin (p=0.479), lactate dehydrogenase (p=0.904), alkaline phosphatase (p=0.705), hemoglobin (p=0.832), and creatinine (p=0.636). Additionally, one-way analysis of variance (ANOVA) did not yield statistically significant results. ***Conclusion:*** This study underscores the complexity of multiple myeloma staging, as conventional laboratory parameters did not correlate with SUVmax from [18F]FDG PET/CT. The absence of significant associations suggests that metabolic activity assessed by SUVmax may provide unique insights beyond traditional staging methods. Future studies with larger cohorts are warranted to validate these findings and explore the potential of SUVmax as a prognostic indicator in MM.

EP-0373

Correlation of Metabolic Activity in Bone Lesions by 5-Point Scale on [18F]FDG PET/CT with Clinical Parameters in Newly Diagnosed Multiple Myeloma Patients

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Aim/Introduction: Accurate staging is paramount in multiple myeloma (MM) to guide treatment decisions and predict patient outcomes. Despite the International Staging System's (ISS) use of β2-microglobulin and albumin, the heterogeneous nature of MM survival prompts a reevaluation of current staging methods. This study investigates the potential correlation between metabolic activity in bone lesions, assessed by 5-Point Scale (5-PS) on [18F]FDG PET/CT, and clinical parameters in newly diagnosed MM patients. ***Materials and Methods:*** Thirty-seven newly diagnosed MM patients were enrolled for [18F]FDG PET/CT examination prior to treatment initiation. Statistical analysis, including chi-square tests

and Student's T-tests, aimed to discover relationships between staging laboratory values and 5-PS. ***Results:*** Results revealed 13.2% with diffuse bone-marrow involvement and 86.8% with metabolically active osteolytic lesions. Notably, 21.1% had up to 5 bone lesions, while 63.2% had more than 5 lesions. Among the patients, 73% were categorized with 5-PS scores of 3 and 4, with the remaining 27% scored as 5. Laboratory findings included: anemia (64.9%), elevated serum creatinine (29.7%), elevated alkaline phosphatase (16.2%), elevated lactate dehydrogenase (70.3%), β2-microglobulin above 3.5 mcg/mL (43.2%), and elevated albumin (29.7%). Statistical analyses, comprising Student's T-tests and ANOVA, did not yield statistically significant relationships between 5-PS-assessed bone lesion metabolic activity and conventional laboratory values: paraprotein (p=0.185), albumin (p=0.116), lactate dehydrogenase (p=0.169), alkaline phosphatase (p=0.519), hemoglobin (p=0.336), and creatinine (p=0.446). However, a chi-square analysis revealed a significant association between β2-microglobulin levels below 3.5 mg/L and 5-PS scores of 3 and 4 (p=0.046). This finding underscores the link between increased metabolic activity in lesions, as indicated by 5-PS, and lower β2-microglobulin levels, suggesting lower disease activity. Conversely, patients with higher metabolic activity, based on 5-PS, tended to exhibit higher β2-microglobulin levels. ***Conclusion:*** This study elucidates the intricate interplay between metabolic activity in bone lesions, assessed by 5-PS on [18F]FDG PET/CT, and clinical parameters in newly diagnosed MM patients. While no direct correlations were observed between 5-PS-assessed metabolic activity and traditional laboratory values, the significant relationship with β2-microglobulin levels highlights the potential utility of 5-PS in gauging disease activity. These findings underscore the need for further research with larger cohorts to validate the role of 5-PS as a prognostic indicator in newly diagnosed MM.

EP-0374

Comparison study between ^{18}F-FDG PET/CT metabolic activity assessed by SUVmax and 5-Point Scale (5-PS) value as prognostic factors for overall survival (OS) and progression-free survival (PFS) in patients with multiple myeloma after chemotherapy

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Aim/Introduction: [18F]FDG PET/CT is a useful imaging technique for evaluating treatment response in multiple myeloma (MM). It can detect changes in glucose metabolism in the bone marrow, extramedullary disease and other tissues affected by the disease, can identify residual disease after treatment and detect relapse. These capabilities of [18F]FDG PET/CT are related to the prediction of overall survival. In addition to evaluating treatment response, [18F]FDG PET/CT can also be used to guide treatment decisions. ***Materials and Methods:*** A total of 31 patients with proven multiple myeloma and post-treatment [18F]FDG PET/CT were included in the present study. We used Kaplan-Meier survival analysis and the Log Rank test to compare the two groups of patients. We used Student's T-test to determine whether there was a statistically significant difference in the mean OS and PFS values of the individual groups. ***Results:*** .The majority (93.55%) of the patients had osteolytic lesions. The average SUVmax was 4.28, ranging from 1.3 to 12.4. Patients were categorized based on SUVmax values (cut-off of 3.13) and 5-PS visual assessment into negative (score 2 and 3) and positive (score 4 and 5) groups.Results indicated that patients with SUVmax less than 3.13 had a significantly longer median OS (26.8 months) compared to those with SUVmax equal to or greater than 3.13 (20.37 months), with a p-value of 0.039. For PFS, patients with SUVmax less than 3.13 also had a longer median PFS (25.6 months) compared to those with SUVmax equal to or greater than 3.13 (16.2 months), with a p-value of 0.011. Patients evaluated with a 5-PS score of 2 and 3 had a longer median PFS (25.67 months) compared to those with a score of 4 and 5 (16.2 months), with a p-value of 0.009. There were no statistically significant relationship was found between 5- PS and the overall survival. ***Conclusion:*** These findings suggest that SUVmax measured by ^{18}F-FDG PET/CT may serve as a prognostic factor for both OS and PFS in MM patients, with lower SUVmax values correlating with longer survival times and longer periods without disease progression. The 5-PS visual assessment also showed significance in predicting PFS. Incorporating ^{18}F-FDG PET/CT, particularly SUVmax, into clinical practice could improve risk stratification and treatment planning for MM. Further research with larger cohorts is needed to confirm these results and optimize the use of these parameters in MM management.

EP-0375

Role of ^{18}F-FDG PET/CT in Hemangiopericytoma

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Aim/Introduction: Hemangiopericytomas (HPC) are rare tumor (0.060 per 100,000 individuals) that originate from pericytes and can anywhere in the body along the blood capillaries, the most common locations reported are lower extremities, retroperitoneum, pelvis, brain, lungs, and pleura .This entity can either be benign or malignant, with the latter showing metastases primarily to the lungs and bones. They also have high incidence of local recurrence and distant metastases. Currently ^{18}F-fluorodeoxyglucose (FDG) positron emission tomography/computed tomography (PET/CT) imaging is the standard of care for staging and restaging for various malignancies but there is very little information about its application in HPC. ***Materials and Methods:*** We retrospectively evaluated clinical and imaging data of 10 HPC patients who underwent ^{18}F-FDG PET/CT for staging, restaging and surveillance, during the period from January 2017 to March 2024. All the 10 PETCT scans were analyzed for primary tumor site and response assesment . The maximum standardized uptake value (SUV max) of the primary lesion and background was calculated. ***Results:*** Total 10 patients (8 males and 2 female and, M:F=4:1) with median age of 28.5 years (range- 6 to 47 years) were included in the study. The primary sites of involvement were brain (7/10), pelvis (1/10) and tibia (2/10) in these patients with metastasis noted to liver (2 patients) ,axial(3 patients) and appendicular(2 patients) skeleton,lung(1patient),cutaneous nodules(1 patient) and abdominal (drop metastasis through CP shunt) with lymph nodes (1patient). The mean SUV-max of the primary tumors was 6.25±4.08 and the background was 1.79 ±0.92. Two patients underwent scan for baseline staging, 7 for restaging and 1 for surveillance purpose. There was a significant difference detected between the mean SUV max of primary lesions and the background with a p value of 0.013(<0.05, paired student T test). ***Conclusion:*** ^{18}F-FDG PET/CT can be used for staging and re staging purpose in HPCs thus helping in the management of the disease. Additionally, parameters like SUV-max assessed on ^{18}F-FDG PET/CT can give semiquantitative assessment of the lesions.

EP-0376

Prognostic value of SIOPEN and Curie scores of 123I-MIBG scintigraphy in neuroblastoma

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Aim/Introduction: The aim of the study was to verify the prognostic value of the Curie and International Society of Pediatric Oncology Europe Neuroblastoma (SIOPEN) scoring systems in paediatric patients with neuroblastoma undergoing staging 123I-meta-iodobenzylguanidine (MIBG) scans. ***Materials and Methods:*** Patients with a diagnosis of neuroblastoma and without prior therapies were retrospectively enrolled. All 123I-MIBG staging scintigraphies and SPECT/CT were evaluated according to SIOPEN and Curie semiquantitative scores. Patients' clinical histories were collected by examining oncology visits and diagnostic tests performed to obtain data on relapse, progression and death events. Event-free survival (EFS) and overall survival (OS) were calculated in months from the date of the staging scintigraphy to the date of the first event of progression or relapse for EFS and to the date of death or the last follow-up for OS, respectively. Curie and SIOPEN scores at diagnosis were correlated with EFS and OS by dichotomizing them on the basis of their median value. Kaplan-Meier analysis was used to draw survival curves and log-rank test applied to compare these curves, considering a p value <0.05 as statistically significant. ***Results:*** A total of 32 patients were included: 19 male and 13 female. Age range went from newborn to 12 years with a median of 2,5. After the staging scan the whole patients were treated with chemotherapy and/or surgery. SIOPEN staging scores went from 0/72 to 59/72 and their median value was 1/72. Curie staging scores went from 1/30 to 24/30 and their median value was 2,5/30. There were 12 patients who had progression or relapse events and 8 of them died. Calculated EFS went from a minimum of 1 month to a maximum of 323 months (26,9 years) and its median value was 60. Calculated OS went from a minimum of 1 month to a maximum of 323 months and its median value was 77,5. Based on Kamplan-Meier analysis, Curie staging score was a significant predictor for EFS (p<=0,001) and OS (p<=0,003). Similarly, SIOPEN staging score was a significant predictor for EFS (p<=0,001) and OS (p<=0,003). ***Conclusion:*** According to these results, higher scores of Curie and SIOPEN on 123I-MIBG staging scintigraphy are correlated with low EFS and OS, thus they could predict unfavourable prognosis. This study demonstrates the presence of significant negative correlations between both scoring systems and the two calculated survival parameters (EFS and OS), confirming the high prognostic value of these scores. ***References:*** doi: 10.4274/mirt.52533. doi: 10.4149/neo_2015_053. doi: 10.1007/s00259-017-3660-1.

EP-0377

Comparison of FDG PET/MRI and Whole Body Diffusion Weighted Imaging in Multiple Myeloma

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Aim/Introduction: The aim of this study was to evaluate the diagnostic performances of whole-body FDG PET/MRI and whole-body diffusion weighted imaging (DWI) in primary staging of multiple myeloma (MM) patients, to investigate their impact on disease stage and to compare their contribution to survival prediction. ***Materials and Methods:*** The data of 106 MM patients who underwent FDG PET/MRI and whole-body DWI in the same session for primary staging were evaluated retrospectively. Visual assessment included detecting FDG (+) and DWI (+) focal lesions (FL) throughout the entire body and in spesific regions (skull, vertebrae and other skeletal areas) by using FDG PET, T1 and T2-w images, DWI and ADC maps. Additionally, DWI and PET images were used to evaluate diffuse bone marrow (BM) involvement and extramedullary lesions (EMD). The diagnostic performances of the two modalities were evaluated by using McNemar, chi-square and Wilcoxon signed-rank tests. Durie-Salmon (D-S) stages of the patients were recorded. D-S plus stages were also identified using PET/MR and DWI data. The prognostic values of clinical parameters, D-S and D-S plus stages for overall survival (OS) were evaluated by using Cox proportional hazard regression models. Statistical analyses were performed on SPSS version 23.0. ***Results:*** DWI detected significantly higher numbers of FLs in the whole body, calvarium and vertebrae compared to FDG PET/MRI (mean: 31.5 vs 24.7, p=0.01; 2.5 vs 2.2, p=0.027; 16.4 vs 11.3, p=0.003, respectively). The number of EMD lesions was significantly higher in FDG PET/MRI (mean: 4.8 vs 2.8, p=0.027). There was no significant difference between the two modalities in terms of the presence of FL or EMD on patient based analysis. A higher proportion of patients showed positive DWI findings for diffuse BM involvement compared to FDG PET/MR (55.7% vs 39.6%, p<0.001). While D-S plus_DWI stages changed in 43 patients (40.6%; 32 upstaged, 11 downstaged), D-S plus_FDG PET/MRI stages changed in 44 patients (41.5%; 24 upstaged, 20 downstaged) compared to standard D-S staging. The discordance between D-S plus DWI and FDG PET/MR was observed in 28 patients (p=0.011). Patient age and D-S plus FDG PET/MR stages emerged as independent prognostic factors (p=0.032, p=0.011, respectively). ***Conclusion:*** WB-DWI detected more FLs, while FDG PET/MR detected more EMD lesions. However, no significant difference in FL detection per patient was observed. Although, DWI was observed to increase the stage in more patients compared to FDG PET/MR, staging with FDG PET/MR provided better prognostic risk stratification.

EP-0378

Combined Use of [18F]FDG PET/CT and Whole-Body Diffusion Weighted Magnetic Resonance in the Assessment of Multiple Myeloma: a Prospective Study

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Aim/Introduction: This is a non pharmacological, interventional, monocentric prospective study to compare the diagnostic performance of [18F]FDG PET/CT (FDG-PET/CT) and Whole-body Diffusion Weighted Magnetic Resonance (WB-MRI) in patients (pts) with smoldering multiple myeloma (SMM) or newly diagnosed multiple myeloma (NDMM) at staging and pre-maintenance. The aims are to compare the two modalities' positivity rates and to correlate baseline and post-treatment FDG-PET/CT and WB-MRI findings with prognostic markers and outcomes. ***Materials and Methods:*** FDG-PET/CT and WB-MRI were performed at baseline in pts with SMM or NDMM and repeated in the NDMM subgroup after ASCT or 1 year of treatment. IMPeTuS criteria and MY-RADS criteria were used for image interpretation and

reporting. ***Results:*** Up to Feb 2024, we enrolled 79 patients (n=25 SMM; n=54 NDMM). After the staging imaging, pts were excluded from further evaluations for early progression (n=4), death (n=1) and loss at follow up (n=1). In NDMM, baseline FDG-PET/CT and WB-MRI were concordant in 44/54 pts (82%): 35/54 (65%) were both positive and 9/54 were both negative (17%) (moderate agreement with k=0,53). In the remaining 10 pts the two imaging procedures were discordant (p<0.01): 1/10 was WB-MRI- and FDG-PET/CT+ for DS4 bone marrow (BM) diffuse uptake. In the other 9/10 pts with WB-MR+/PET-, WB-MR detected up to 3 bone focal lesions (FL) in 7/9 pts, more than 10 FL in 1/9 and BM involvement alone in 1/9. It is notable however that 7/9 pts had DS3 BM diffuse uptake at the FDG-PET/CT (borderline positivity). Overall, FL were detected more frequently by WB-MRI than by FDG-PET/CT (p<0.05), while significant BM involvement (DS4) was seen more frequently at FDG-PET/CT than WB-MRI (58/79 vs 21/79; p<0,01; K=0,35). Diffuse disease at baseline PET/CT and WB-MR correlated with R-ISS III (p=0,04 and p=0,048 respectively). 11/54 pts were also evaluated before maintenance (ongoing phase of the study). FDG-PET/CT and WB-MRI were concordant in 7/11 cases, discordant in 1/11 (non-responding at FDG PET/CT, RAC1 at WB-MRI, clinical PR), and not compared in 3/11 (2 FDG-PET/CT not performed due to negativity at baseline and 1 WB-MRI not performed due to recent positioning of internal metallic fixators). In the SMM subgroup, baseline positivity rates of WB-MRI and FDG PET/CT were comparable (k=0,13; p=0,5). ***Conclusion:*** Preliminary data support a combined use of FDG-PET/CT and WB-MRI imaging at staging in patients with NDMM. Data on response assessment and prognostic roles of the two modalities compared are awaited.

EP-0379

Usefulness of ^{18}F-FDG-PET/CT in the multidisciplinary management of muscle-invasive urothelial bladder carcinoma with inconclusive nodal involvement in CT scan

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Aim/Introduction: The standard treatment for non-metastatic muscle-invasive urothelial bladder carcinoma (MIUC) consists of radical cystectomy and bilateral pelvic lymphadenectomy with neoadjuvant chemotherapy in patients eligible for cisplatin-based chemotherapy. At least 20-40% of patients will have lymph node involvement at diagnosis, despite having a negative staging study with conventional techniques (contrast enhanced Computed Tomography (ceCT)), which is a poor prognostic factor.The aim of this study is to demonstrate the value of 18F-FDG(fluorine-18 fluorodeoxyglucose)-PET/CT in the staging of MUIC and its consequent implications for clinical management. ***Materials and Methods:*** Retrospective review of patients with muscle-invasive urothelial carcinoma (MUIC) staged pT2 with inconclusive lymph nodes on ceCT who underwent staging with 18F-FDG-PET/CT scan between 2022-2024. Patients with evidence of MUIC with locoregional nodal disease were administered neoadjuvant chemotherapy and underwent follow-up 18F-FDG-PET/CT scan. The gold standard for determining response was histopathological examination in patients who underwent surgery (absence of disease on initial ^{18}F-FDG-PET/CT or complete nodal response on follow-up 18F-FDG-PET/CT), or based on clinical and radiological features in patients who did not undergo surgery. ***Results:*** ^{18} patients (4 women;14 men; mean age 74) were included. Initial 18F-FDG-PET/CT showed: 3/18 cN0M0, 1/18cN1M0, 3/18cN2M0, 1/18cN3M0, 8/18cM1a and 2/18 cM1b. 4/18 patients (3 cN2M0; 1 cN3M0) received neoadjuvant chemotherapy and a 18F-FDG-PET/CT follow-up was acquired: 3/4 achieved complete nodal response (post-chemotherapy-cN0M0) and 1/4 showed partial nodal response (post-chemotheraphy-cN2M0). 2/3 of cN0M0 and 3/3 post-chemotherapy-cN0M0 had surgery which confirmed pN0M0. 1/3 cN0M0 was not eligible for surgery due to comorbidities and received chemotherapy and remains disease-free at follow-up. cN1M0 was surgically treated and did not demonstrate lymph node involvement (pN0). Post-chemotheraphy-cN2M0 kept on with chemotheraphy. The presence of cM1 in 10/18 ruled out surgery and were given chemotherapy. 18F-FDG-PET/CT showed a sensitivity of 100%, specificity of 66.7%, PPV of 93.8%, and NPV of 100%, which resulted in a change in clinical management in 10/18 cases (55,5%). ***Conclusion:*** The implementation of 18F-FDG-PET/CT in the staging of MUIC provides greater precision in the diagnosis of lymph nodes and leads to a change in clinical management in a high percentage of patients. ***References:*** Einerhand SMH, Zuur LG, Wondergem MJ et al. The Implementation of FDG PET/CT for Staging Bladder Cancer: Changes in the Detection and Characteristics of Occult Nodal Metastases at Upfront Radical Cystectomy? J. Clin. Med. 2023, 12, 3367.

EP-0380

Correlation between bone involvement measurements calculated with ^{18}F-FDG and ^{68}Ga-PSMA in multiple myeloma patients

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Aim/Introduction: 18F-FDG-PET/CT plays a significant role in the context of multiple myeloma (MM), being well established as an important tool for clinical management of these patients. However, due to the nonspecificity of FDG and the genetic heterogeneity of the lesions, other radiotracers have been proposed. Among them, PSMA has emerged as another important marker for MM[1]. Methods for quantifying bone involvement in MM patients have also been proposed, such as Percentage of Bone Involvement (PBI) and Intensity of Bone Involvement (IBI)[2]. Here, we aim to determine whether there is a correlation between PBI and IBI calculated in PET/CT with 18F-FDG and 68Ga-PSMA. ***Materials and Methods:*** In this study, 15 patients with MM were included, consisting of 8 men, with an average age of 66.7±10.7 years. All patients underwent PET/CT scans with 18F-FDG and 68Ga-PSMA on different days, with a maximum interval of 8 days between the scans. PBI was calculated as the percentage of bone tissue considered metabolically active. For 68Ga-PSMA and 18F-FDG, PBI was determined by a fixed threshold, with the mean SUV of the left atrium used for the former and the mean SUV of the liver used for the latter. Bone tissue volume was calculated using CT-based segmentation. IBI was calculated as PBI multiplied by the mean SUV of the metabolically active volume. The Spearman correlation, with a p-value<0.05, was used to assess the correlation between PBI and IBI in both imaging modalities.

Results: No significant correlations were found between the values calculated for 18F-FDG and 68Ga-PSMA for both PBI and IBI. For PBI, the Spearman correlation coefficient was 0.39 with a p-value=0.16. For IBI, the Spearman correlation coefficient was 0.41 with a p-value=0.13. The highest PBI and IBI values were found in different patients for both radiotracers. ***Conclusion:*** There was no correlation between bone involvement measurements calculated from 18F-FDG and 68Ga-PSMA PET/CT images, reinforcing the idea that the radiotracers are complementary in the context of MM. It is believed that the heterogeneous genetic profile of the disease leads to different uptake patterns for the two radiotracers. ***References:*** [1] Souza, Stephan PM, et al. "Head-to-head comparison of [68Ga] Ga-PSMA-11 and [18F] FDG PET/CT in multiple myeloma." European journal of nuclear medicine and molecular imaging 50.8 (2023): 2432-2440. [2] Takahashi, Maria ES, et al. "Proposal for a quantitative ^{18}F-FDG PET/CT metabolic parameter to assess the intensity of bone involvement in multiple myeloma." Scientific reports 9.1 (2019): 16429.

EP-0381

Exploring the relationship between PET-CT ^{18}F-FDG parameters and cytogenetic features at multiple myeloma diagnosis

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Aim/Introduction: Multiple myeloma (MM) is a common hematologic cancer, requiring ≥10% clonal bone marrow plasma cells or biopsy-proven plasmacytoma, with myeloma-defining events like hypercalcemia and anemia. Certain cytogenetic mutations at diagnosis have independent prognostic value. Treatment involves multi-drug regimens and, in eligible cases, autologous stem cell transplantation.Non-invasive risk stratification methods could optimize MM management. F^{18} fluorodeoxyglucose positron emission tomography/computed tomography (F^{18} FDG PET/CT) detects medullary and extramedullary disease, recommended for initial diagnostic workup and follow-up. Beyond diagnosis, FDG PET/CT findings predict prognosis. Extramedullary disease and high standardized uptake value (SUV) indicate poor progression-free survival. Volumetric parameters like metabolic tumor volume (MTV) and total lesion glycolysis (TLG) offer additional prognostic information. ***Materials and Methods:*** The study retrospectively analyzed 41 MM patients who underwent PET imaging and Certain cytogenetic analysis at diagnosis. PET parameters SUVmax, MTV, and TLG, were quantified, correlating cytogenetic mutations (Del1p/Amp1q, Del17p, t(4;14), t(11;14), t(14;16), Del13q) and bone marrow plasma cell percentage (PCP) with PET findings (pearson correlation-ANOVA). Additionally, a descriptive analysis was conducted to provide further insights into the study cohort. ***Results:*** Preliminary results didn't find correlation between the parameters studied, (P>0,05), probably due to a small sample size. Nonetheless, further patient enrollment is underway to elucidate PET parameters' relationship with cytogenetic features in MM diagnosis.The descriptive analysis showed: mean age=65; gender distribution=60%women-39%men; SUVmax mean= 4,6; SUVmax median=4,01; MTV mean=87,8; MTV median=6,4; TLG mean=318,8; TLG median=65; PCP mean=28%; PCP median=22%; Del1p/Amp1q+=7, Del17p+=1, Trasl 4-14+=0, Trasl11-14+=2, Trasl14-16+=0, Del13q+=3. ***Conclusion:*** While current findings lack certainty, ongoing research is crucial. Expanding sample sizes and refining methodologies promise more robust insights into PET parameters' association with MM cytogenetic features. The descriptive analysis shows normal parameters for the population studied, according to what has been published so far. Ultimately, this research aims to enhance MM understanding and clinical outcomes.

EP-0382

$^{[18F]}$Fluciclovine Compared to $^{[18F]}$FDG for Multiple Myeloma Imaging

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Aim/Introduction: Multiple myeloma (MM) presents challenges in accurate imaging due to its multifocal nature and the need of early detection of minimal residual disease (MRD). Anti-1-amino-3-$^{[18F]}$-fluorocyclobutane-1-carboxylic acid (Fluciclovine), an analogue of leucine, offers an alternative to the commonly used 2-Deoxy-2-$^{[18F]}$F-fluoroglucose (FDG) PET. In this prospective pilot study, we performed a head-to-head investigation of Fluciclovine PET and FDG PET imaging in MM patients undergoing autologous stem cell transplantation (ASCT). ***Materials and Methods:*** Thirteen patients were included (NCT03966443). PET/CT imaging was conducted at baseline and three months after ASCT. Fluciclovine PET was performed using 4 MBq/kg, with image acquisition mainly at 15 minutes post-injection. For the FDG examinations, 3 MBq/kg was injected and acquisitions performed 60 minutes p.i. Visual assessments were performed by two nuclear medicine physicians, who categorized patients as positive or negative for each tracer. Additionally, a quantitative analysis was conducted for six patients. The bone marrow was segmented using a deep learning CT segmentation method. Volumes with high uptake were defined using thresholds based on the mean standardized uptake value (SUV) measured in liver plus two standard deviations (SDs) for FDG, and the mean SUV in aorta plus five SDs for Fluciclovine. SUVmax, and SUVmean multiplied by the volume above threshold (TLGeq) were extracted. Progression-free survival (PFS) data were recorded for all except one patient. ***Results:*** At baseline, 12/13 patients were positive for Fluciclovine and 10/13 for FDG. Three months after ASCT 1/12 patients were positive for Fluciclovine and 2/10 for FDG. Mean (SD) high uptake volume SUVmax for Fluciclovine was 9.8 (4) and 5.6 (0.9) for baseline and three months, respectively Mean FDG-SUVmax were 7.0 (3.0) and 5.0 (2.5) for baseline and three months, respectively. For Fluciclovine, mean TLGeq was 3175 (3060) ml for baseline and 202 (176) ml for three months. Mean FDG-TLGeq was 804 (1146) ml at baseline and 34 (72) at three months. No statistically significant difference in PFS was found between positive/negative-stratified patient groups, except at baseline for Fluciclovine (log rank $p < 0.001$). However, only one patient was Fluciclovine-negative. ***Conclusion:*** Fluciclovine demonstrates promise as an alternative to FDG-imaging in patients with MM. While no clear differences in PFS were observed using visual assessment of positive/negative status, this population was limited. Future work will investigate Fluciclovine in a larger cohort, and also explore quantitative parameters further.

EP-20

e-Poster Area

B: Imaging Clinical Studies -> B1 Oncological Imaging Clinical Study -> B23 Bone and Soft Tissues

EP-0383

Prognostic impact of [18F]FDG PET metabolic parameters in adult and pediatric soft-tissue sarcoma: a systematic review and meta-analysis

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Aim/Introduction: Soft-tissue sarcomas (STS) are rare and heterogeneous malignancies with varied outcomes, highlighting the need for reliable prognostic indicators. This meta-analysis aims to evaluate the prognostic significance of [18F]FDG PET parameters in patients with, differentiating between adult and pediatric populations. ***Materials and Methods:*** We conducted a systematic review and meta-analysis following PRISMA guidelines, searching multiple databases (Medline, PubMed, Google Scholar, and the Cochrane Library) without language restrictions. Studies assessing the prognostic value of pre- and post-treatment [18F] FDG PET parameters (SUVmax, metabolic tumor volume [MTV], total lesion glycolysis [TLG]) in relation to event-free survival (EFS) and overall survival (OS) in patients with STS were included. Data extraction and risk of bias assessment were independently performed by two researchers. We used STATA 17 (StataCorp LLC, Texas, US) and Cochrane tool Review Manager (RevMan version 5.3) to perform meta-analysis. ***Results:*** Thirty-one studies involving 1,932 patients (adult and pediatric) were included. In adults, high pre-treatment SUVmax, MTV, and TLG and post-treatment SUVmax were significantly associated with worse EFS and OS (HR ranges for SUVmax: 1.68-3.13; MTV: 2.29-3.05; TLG: 2.85-3.23, all p-values < 0.05). However, in pediatric patients, these associations were not statistically significant. The prognostic impact of [18F]FDG PET parameters in pediatric STS remains unclear due to limited studies and non-significant findings. ***Conclusion:*** In accordance with the best available evidence to date, [18F]FDG PET metabolic parameters serve as significant prognostic markers in adults with STS but not in pediatric patients. Disparities between adult and pediatric STS highlight the necessity for age-specific research and prognostic tools. Future prospective, multicenter studies with standardized methodologies are essential to validate these findings and explore the clinical utility of [18F]FDG PET in STS treatment strategies.

EP-0384

Incidence of exclusive extrapelvic skeletal metastasis in prostate carcinoma on bone SPECT-CT scintigraphy

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Aim/Introduction: Bone is one of the common sites of metastasis from prostate carcinoma. Bone scintigraphy is one of the most sensitive imaging modalities currently used for bone metastatic work-up. Skeletal metastasis in prostate carcinoma commonly involves pelvic bones. We retrospectively analyzed the bone scintigraphy data to determine the pattern of skeletal metastases in the prostate carcinoma. ***Materials and Methods:*** This retrospective observational study involves patients with biopsy-proven prostate carcinoma referred for bone scintigraphy for staging assessment. Patients with abnormal bone scintigraphy (BS) were evaluated for the pattern of skeletal involvement and data was presented in descriptive format in the form of percentages. ***Results:*** A total of 150 patients with biopsy proven prostate cancer who were referred for staging were included in the study. 13 of 150 patients (8.67%) had no abnormal uptake on planar images ruling out metastatic disease. 24 patients (16%) had heterogenous uptake in spine with distribution characteristic of degenerative disease and no scan pattern of metastatic disease. 30 patients (20%) had multifocal uptake involving both pelvic and extrapelvic bones on planar images typical for skeletal metastasis and were considered metastatic. 83 out of 150 patients (55.3%) had increased tracer uptake which were indeterminate, thus, SPECT-CT was acquired which showed 51 metastatic disease, 31 benign lesions and 1 indeterminate finding. 7 of 150 patients had exclusive pelvic bone uptake which was found to be metastatic in 4/7 patients in SPECT-CT. 56 out of 150 patients showed exclusive extrapelvic tracer uptake of which only 3 patients had vertebral metastatic disease. None of the patients with increased uptake exclusively in the extrapelvic-extraspinal location was metastatic. ***Conclusion:*** Incidence of exclusive extrapelvic skeletal metastatic disease in prostate carcinoma is 2% (excluding one patient with indeterminate finding). Further, none of the patients in the current study had exclusive extrapelvic-extraspinal metastasis. Thus, exclusive extrapelvic- extraspinal focal abnormality on planar BS, carries a very low probability of metastatic disease and hence, further imaging or SPECT/CT can be safely avoided in such cases. ***References:*** 1. Roth AR, Harmon SA, Perk TG, Eickhoff J, Choyke PL, Kurdziel KA, et al. Impact of Anatomic Location of Bone Metastases on Prognosis in Metastatic Castration-Resistant Prostate Cancer. Clin Genitourin Cancer. 2019 Aug 1;17(4):306-14. 2. Bubendorf L, Schöpfer A, Wagner U, Sauter G, Moch H, Willi N, et al. Metastatic patterns of prostate cancer: An autopsy study of 1,589 patients. Hum Pathol. 2000;31(5):578-83.1.

EP-0385

Uterine sarcomas: our experience with PET-CT as an EURACAN reference center.

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Aim/Introduction: Uterine sarcomas are a rare entity, being characterized by a more aggressive behavior than the rest of uterine tumors. They are classified into several histological subtypes: carcinosarcomas, leiomyosarcomas, endometrial stromal sarcomas and adenosarcomas. PET-CT can be used both to assess distant involvement and to detect recurrence. Since we are a EURACAN reference center for these tumors, we intend to describe our experience. ***Materials and Methods:*** We retrospectively reviewed PET-CT studies with ^{18}F-FDG between 2014-2024, obtaining a total of 17 patients. The studies were analyzed by an expert nuclear physician and a radiologist. ***Results:*** The age range was 41-88 years. The most frequent

histological type was leiomyosarcoma in 12 patients (70%); in 3 high grade endometrial stromal sarcoma (18%), 1 carcinosarcoma (6%) and 1 undifferentiated sarcoma (6%). The indication was: 9 staging (52%) and 8 suspected recurrence (48%). Of the 17 patients, 5 had positive regional lymph nodes on PET (29%), with pelvic lymph node involvement being more frequent in staging (4 patients: 44%) than in recurrence (1 patient: 12.5%). The mean SUVmax of these nodes was 19.3 (31.2-11.3). 12 patients (70%) had metastases at diagnosis: 6 (66%) of the staging and 6 (75%) of the recurrences. The most frequent site of metastasis was the lung (9 patients: 53%), with mean SUVmax 5.05 (18.5-1.6). Six (35%) presented peritoneal carcinomatosis, with mean SUVmax 19.4 (39-20.1). The third most frequent were bone metastases (3, 17%) with mean SUVmax of 8.9. Only one patient had liver disease. ***Conclusion:*** Uterine sarcomas are a very rare group of neoplasms, generally associated with poor prognosis, so early diagnosis is essential. PET-CT with ^{18}F-FDG is a promising tool and appears to be useful both for initial staging and for recurrence.

EP-0386

Relationship between SUVmax and overall survival rate at FDG-PET scans in patients with leiomyosarcomas: a retrospective multicenter analysis

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Aim/Introduction: Our retrospective study aimed to assess the potential benefit of SUVmax in FDG-PET/CT and FDG-PET/MR scans for the characterization of leiomyosarcomas and its impact on overall survival. Researchers looked at FDG-PET/CT and FDG-PET/MR scans from 12 patients. They found that patients with an SUVmax value in the primary lesion under 11, were correlated with a 5-year overall survival and did not have metastatic disease at the moment of the diagnosis. These findings suggest that SUVmax values could be a clinically significant dependent prognostic marker for progression-free survival. The study highlights the importance of pre-surgery PET scans as a prognostic factor. ***Materials and Methods:*** Twelve patients with leiomyosarcoma tumors were included, from 2018 to 2023 at FUESMEN and COIR. We utilized a PET/TC GE-STE-16 and a 3.0T PET/MRI SIGNA GE with 3D TOF, which differ due to their disponibility and the medical request from the oncologist. Univariate analysis with Fisher analysis was performed between SUVmax values and the presence of metastasis at the first visit, tumor greatest dimension, and mainly with a 5-year overall survival. ***Results:*** After anatomopathological confirmation, we included 4 men (33%) and 8 women (66%). The primary localization of the leiomyosarcoma differed: 4 raised from the inferior vena cava (33.3%), 4 from the uterus (33.3%), 2 originated from muscle (16.6%), 1 from the scrotum (8.3%) and the last one from the retroperitoneal as unknown origin. The median SUVmax of the primary tumor lesion was 13.09 (range, 5-17.4). Distant metastasis was observed in 58.3% of the total. We noticed that the patients with an SUVmax value in the primary tumor equally or higher than 11 had distant metastasis at the moment of the diagnosis and particularly, they died in less than 5 years. This association was seen independently of the location of the primary lesion, age, gender, or tumor's greatest dimension. Thus, an SUVmax value higher than 11 could be related to a 5-year OS rate in leiomyosarcomas malignancies ($p < 0.01$). We also compared in a per-patient analysis, the characteristics of the SUVmax about the different locations of the LMS. We did not find a statistical association between the diverse origins, SUVmax 11 taken as objective, disease relapse nor a medium of tumor greatest dimension. ***Conclusion:*** The study highlights the importance of pre-surgery PET scans as a prognostic factor. SUVmax values could be a clinically significant dependent prognostic marker for progression-free survival.

EP-0387

Navigating metastatic Dermatofibrosarcoma protuberans: Harnessing ^{18}F-FDG PET/CT for prognostic insight

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Aim/Introduction: Dermatofibrosarcoma protuberans (DFSP) is an uncommon cutaneous soft tissue sarcoma characterized by locally aggressive growth and tendency for local recurrence. Metastatic DFSP presents significant challenges in management and prognosis. Imaging modalities such as computed tomography (CT) have traditionally been employed for assessing metastatic spread. However, role of FDG PET/CT in prognosis remains underexplored. ***Materials and Methods:*** We conducted a retrospective study involving 25 patients diagnosed with metastatic DFSP after local recurrence assessing utility of 18F-FDG PET/CT in prognostic evaluation. Patients underwent FDG PET/CT for restaging and subsequently for response assessment. Imaging findings were analyzed by experienced nuclear medicine physicians blinded to clinical outcomes. Prognostic parameters including metabolic activity, and presence of distant metastases were evaluated and correlated with clinical outcomes. ***Results:*** Total of 25 patients (M:F;15:10) with mean age of 41.9 years (18-76 years) were included undergoing treatment in tertiary care hospital in India. 10 patients had trunk as primary site, 8 patients had extremities and 7 patients had primary in head and neck region. All patients had local recurrence after surgery of primary site with 11 patients showing fibrosarcomatous variant of DFSP at histopathology after WLE of local recurrence site. On restaging FDG PET/CT, 72% had metabolically active lesion in post-operative bed indicating local recurrence with 88% patients having lung, 60% with lymph node s, 36% showing skeletal and marrow , 16% showing liver and 24% showing other rare sites of metastases with more than one site of metastases in few patients. Among quantitative parameters SUVmax was significantly higher ($p<0.001$) for patients with fibrosarcomatous transformation which are more aggressive than non-fibrosarcomatous variant. FDG PET/CT demonstrated superior sensitivity in detecting distant metastases (92% vs. 70% for CT) and provided additional metabolic information crucial for prognostication. SUVmax of metastatic lesions on FDG PET/CT correlated strongly with poorer overall survival ($p<0.008$). Furthermore, FDG PET/CT facilitated early detection of progressive disease in response evaluation and enabling timely therapeutic interventions. ***Conclusion:*** Metabolic information provided by FDG PET/CT, particularly SUV max of metastatic lesions, serves as valuable predictor of overall survival. Early detection of distant metastases and response evaluation with FDG PET/CT may guide treatment decisions and improve patient outcomes. Integration of FDG PET/CT into routine management of metastatic DFSP holds promise for enhancing prognostic accuracy and optimizing therapeutic strategies. To our knowledge, this is largest series of patients showing role of FDG PET/CT in this uncommon entity (DFSP).

EP-0388

Dynamic carbon-11-labeled methionine positron-emission tomography with texture analysis for the differential diagnosis between benign and malignant musculoskeletal lesions

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Aim/Introduction: This retrospective study assessed the diagnostic capacity of dynamic carbon-11 methionine (C-11 MET) positron-emission tomography (PET)/computed tomography for the diagnosis of pathologies in patients with primary unknown musculoskeletal lesions (MSLs) and explore the diagnostic performance of the texture analysis (TA) in differentiation between benign MSLs (BMSLs) and malignant MSLs (MMSLs). ***Materials and Methods:*** In total, 14 patients with 17 MSLs underwent dynamic scans (5-15 [phase 1], 15-25 [phase 2], and 25-35 [phase 3] min post-injection of C-11 MET). Volume of interest (VOI) was created for the entire musculoskeletal lesions and TA was performed using LIFEx software. We statistically compared the maximum standardised uptake values (SUVmax) for seven BMSLs, six primary malignant musculoskeletal tumours (PMMSTs), and four metastatic musculoskeletal tumours (MMSTs) cases and explored their diagnostic capacities using receiver operating characteristic (ROC) curve analyses. In addition, we statistically analyze the results of TA in BMSLs and MMSLs. ***Results:*** SUVmax gradually decreased or remained similar with minimal fluctuations in all BMSL cases and four of six PMMST cases. In contrast, SUVmax had been increasing tendency over time in two cases of PMMST and in all cases of MMST. Significant differences were observed in SUVmax for all time phases between BMSLs and MMSLs, in SUVmax for all time phases between BMSLs and PMMSTs, in SUVmax for all time phases between BMSLs and MMSTs, and in SUVmax for all time phases between PMMSTs and MMSTs. In ROC analyses, the areas under the curve (AUC) are higher than 0.917 in all analyses and AUC yielded the highest values at 1.00 for differentiating most intergroup comparisons. ***Conclusion:*** Dynamic C-11 MET PET scans and TA for C-11 MET PET have the potential to be good predictors of discriminating MSLs in patients with primary unknown MSLs in clinical practice.

EP-0389

Comparison of bone metastasis detection between bone scintigraphy recorded with a single fast whole-body 3D recording from a high-sensitivity 360° CZT camera and a conventional protocol combining whole-body planar with several SPECT acquisitions on an Anger camera

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Aim/Introduction: The OSS single-center non-inferiority trial aimed to determine whether a single high-speed whole-body CZT-SPECT recording of almost 18 min (CZT) provides equivalent results to a conventional longer duration recording protocol (40 to 60 min) combining whole-body planar with several SPECT acquisitions on an Anger hybrid system (ANG), in a total population of 146 cancer patients who were referred to bone scintigraphy for the detection or survey of bone metastasis. ***Materials and Methods:*** Patients were randomly assigned to ANG followed by CZT SPECT/CT recordings or the opposite, 3 to 4 hours after injection of 571 ± 42 MBq [99mTc]Tc-HDP. The SPECT/CT images were first analyzed independently, and then consensually by three experienced blinded observers, with bone metastasis results classified into three categories known to be associated with different therapeutic options: none, oligometastatic (< 5), or polymetastatic (≥ 5). ***Results:*** From the first 52 patients included in the OSS trial were analyzed and can thus be reported here. There were 17 men and 35 women, with mean age 66 ± 11 years, and mean body mass index of 28 ± 6 kg.m-2. All patients had a history of cancer (breast: 30, prostate: 17, others: 5), and 16 had a previous history of bone metastasis. The rates of total agreement between the three observers in the 3-group classification were high and were equivalent for ANG (89%) and CZT (87%) recordings. In total 8 (15%) and 10 (19%) patients were consensually considered to have, respectively, oligometastatic and polymetastatic metastasis on ANG images, and the corresponding rates were very close on CZT images, 9 (17%) and 10 (19%). The concordance rates between classifications consensually extracted from ANG and CZT images were 92% (48/52, kappa score: 0.89 ± 0.06), with only three discordant patients. These three patients were all considered to have single metastases, but only on ANG images in one case and CZT images in two cases. ***Conclusion:*** In cancer patients referred to bone scintigraphy for the detection or survey of bone metastasis, results extracted from a single fast (18 min) whole-body 3D bone scintigraphy recording provided by a high-sensitivity 360° CZT camera seem at least equivalent to those provided by a conventional and much longer (40 to 60 min) recording protocol combining whole-body planar and several additional SPECT recordings.

EP-0390

The usefulness of ^{18}F-FDG PET/CT imaging in theassessment of primary osseous and soft tissue sarcomas

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Aim/Introduction: Sarcomas are a heterogeneous group of aggressive connective tissue malignancies arising insoft tissues and bone.The aim of this retrospective study was to analyze the diagnostic accuracy of ^{18}F-FDG PET/CT in staging and detecting recurrence, in comparison with conventional imaging (CI) studies. ***Materials and Methods:*** We retrospectively evaluated 50 patients with histologically proven soft tissue or osseous sarcoma who had undergone a FDG PET/CT in our department from January 2020 until December 2023. We reviewed the pathology reports of these patients: epidemiological features, histological type of sarcoma, morphologic data, the maximum standardized uptake value (SUVmax) of each primary and/or most intense metastatic lesion, and the results of CI studies compared to ^{18}F-FDG PET/CT. ***Results:*** A total of 50 patients (31 women and 19 men) were referred for initial staging (10%), assessment of recurrence (68%), or evaluation of treatment response (22%). The mean age of these patients was 28 ± 19 years. Thirty-two percent were under the age of 16. Among those patients, 27 cases were soft tissue sarcomas and 23 were osseous sarcomas. The 27 cases of soft tissue sarcomas include 11 rhabdomyosarcomas, 5 leiomyosarcomas, 5 synovialosarcomas, 4 liposarcomas, 1 epitheloid sarcoma, and 2 unknown types. The 23 cases of osseous sarcomas include 12 ewing sarcomas (52%) and 11 osteosarcomas (48%).The mean SUVmax of the positive lesions for the cases of soft tissue and osseous sarcomas were respectively 11,6 and 12.Among those 50 cases, 35 patients (70%) have undergone CT and/or MRI before

referring to our department. PET/CT results, compared with conventional imaging, were concordant in 20 patients (57%) and discordant in 15 patients (43%). PET/CT shows false negative results in 6 patients due to lung micronodules (2). Moreover, 4 liver metastases were not detected by PET/CT. However, PET/CT detected more lesions in 9 cases (peritoneal carcinomatosis, muscular metastasis, bone polymetastasis···). PET/CT was effective in clarifying uncertain findings from CT and/or MRI in 10 cases. Therefore, PET/CT led to a change in the stage of the disease in almost half of patients. ***Conclusion:*** Overall, this study showed that PET/CT can be an important contributor towards sarcoma initial staging, detection recurrent disease, and evaluation of treatment response due to the combined metabolic and morphological information provided by this imaging. Nevertheless, larger studies will be helpful to further establish the clinical value of PET/CT in sarcomas.

EP-21

e-Poster Area

B: Imaging Clinical Studies -> B1 Oncological Imaging Clinical Study -> B24 Melanoma

EP-0391

Hybrid Imaging-Driven Adjuvant Treatment for Early Stage Malignant Melanoma (ESMM)

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Aim/Introduction: Adjuvant immune-(ImT) and target-therapies (TT) for stage IIB/C/III melanoma show big promise for improving outcome. High-risk ESMM patients, including SPECT/CT-detected-sentinel lymph node (SLN)-micrometastatic disease, require accurate ^{18}F-FDG-PET/CT staging for treatment tailoring. While in advanced MM PET/CT is established via elaborated criteria, its role in earlier stages-adjuvant setting is not that well acknowledged. The aim of our study was to assess the input of hybrid imaging in clinical algorithm, with special regard to ImT/TT-monitoring and SLN-status. ***Materials and Methods:*** This prospective study included 98 ESMM patients (50 female, 48 male, 28-83y; T-stage IA-IIC, cN0cM0), diagnosed 11.2019-11.2023. SPECT/CT-sentinel lymphoscintigraphy (SLSc) was performed in all pts, gamma-probe-guided biopsy (SLNB) followed. Micrometastasis-positive (+)SLN pts were tailored to adjuvant treatment (AT: ICIs or BRAF/MEK-inhibitors). Post-SLNB full-digital-PET/CT was indicated in all SLN(+)-cases or in high-risk SLN(-), with follow-up 3-6 months-scans to discriminate no evidence of disease (NED), progressive (PD), stable disease (SD), partial (PR), or complete metabolic response (CMR). Time-to-PD (TTP-first diagnose to PET-PD) and overall survival (OS-first diagnose to last PET) were estimated. ***Results:*** SPECT/CT found 11,3% more SLN than planar imaging, more than one route of lymphatic drainage in 28,6% of pts, in-transit SLN of 3-4mm in 4 pts - one with solitary in-transit-SLN. 18,4% of pts had (+)SLN, including 2(+) in-transits. Higher MM T-stage showed 2,4-fold higher chance for (+)SLN. One post-SLNB-PET/CT was performed in 59 pts (PET1 60%), 11 (18,6%) (+) SLN. Thirty pts had a second scan (PET2), 18 pts PET3, 7pts PET4, 5pts PET5, 1 pt - PET6-7. PET1 showed PD in 8pts (13%), 4 of them with (+)SLN, progression sites - metastatic LNs (6pts), in-transit (1), bone (1), breast lesion (1). TTP ranged 9-19 months (mo) for SLN(-), 2-14 mo for SLN(+). ImT was started in 5pts, TT in 2, radiotherapy in 2, 1 watch-and-wait approach. In 16pts PET1 found inconclusive findings to be observed (TBO), 37 pts - NED. Follow-up PET/CTs reported overall 3 CMR-, 9 PR-, 2 SD-, 1 sarcoid-like TT-reaction, 9 NED-, 9 PD, with consequent AT-adjustment. OS ranged 29-45 mo for SLN(-) and 12-30 mo for SLN(+) pts. ***Conclusion:*** Hybrid imaging in ESMM plays an essential role for individualized treatment. SLSc-SPECT/CT is needed for correct staging, in-transit SLN-detection and prognosis-critical early start of AT. Post-SLNB-PET/CT should be implemented in SLN(+)-cases, patient/lesion associated risk factors and therapy response assessment. Our ongoing study shows longer TTP and OS for SLN(-)-PD-pts undergoing AT, further analysis follows.

EP-0392

Comprehensive and longitudinal PET features of all metastatic lesions improves progression-free survival (PFS) prediction in metastatic melanoma (MM) patients receiving immune checkpoint inhibitors (ICIs)

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Aim/Introduction: Predicting clinical outcomes of ICI-treated MM patients is an unmet need. Relatively low performance is achieved using traditional approaches (EORTC, PERCIST), which analyze a limited number of lesions on one time-point, overlooking complex spatial response patterns. In this study, we explored the added value of comprehensive (all lesions) assessment and longitudinal treatment response features in predicting clinical outcome of ICI-treated MM patients. ***Materials and Methods:*** We retrospectively assessed $^{[18F]}$FDG PET/CT scans acquired at baseline and after anti-PD-1 based ICIs (post-treatment). PFS was determined from ICI start to clinical progression and used to stratify favorable (PFS>11.5 months) from unfavorable responders. All lesions were contoured, and quantitative features extracted. Lesions were matched between time-points and feature variation was calculated. The lesion-level features were aggregated into patient-level features. Using five-fold cross validation, optimal features were selected for maximum relevance and minimum redundancy and a multivariate linear regression (MLR) model was fitted for PFS regression., which was used for patient stratification. The all-lesions results were compared to five-lesions (PERCIST) and one-lesion (most conspicuous). The longitudinal results were compared to baseline-only and post-treatment-only. The

regression was evaluated using RSME and stratification using AUROC, Kaplan-Meier, and Proportional-Hazards analyses. ***Results:*** Images from 53 patients were identified (post-treatment median=3 months, min=1.6, max=4.2). Patients received ipilimumab+nivolumab (n=11), nivolumab (n=6), or pembrolizumab (n=36). Median follow-up and PFS were 42 and 9 months. Twenty-three patients responded favorably. Altogether, 632 lesions were identified (patient median=5, min=1, max=77]). Patient stratification and HRs were significant using features from one-lesion, five lesions, baseline-only, and post-treatment-only. However, longitudinal features from all-lesions yielded the most significant stratification (p=5×10-7, log rank) and HR=0.002 (95% C.I. [0.0002, 0.038]; p=1.6×10-5). MLR using features from all-lesions (RMSE=21 months) was superior to five lesions (RMSE=23), and one lesion (RMSE=28). The AUROC using all-lesions was 0.84, significantly higher than five lesions (AUROC=0.76, p=.001), and one lesion (AUROC=0.72, p=<.001). MLR using longitudinal features (RMSE=21) was superior to baseline-only (RMSE=23), and post-treatment-only (RMSE=22). The AUROC using longitudinal features was 0.84, significantly higher than baseline-only (AUROC=0.79, p=.04) and post-treatment-only (AUROC=0.76, p<.001). ***Conclusion:*** We are the first to investigate the utility of longitudinal features from all lesions for outcome prediction in ICI-treated MM patients. Our work suggests that an MLR framework combining multiple imaging features yields PFS prediction that leads to significant binary patient stratification. The PFS prediction and patient stratification are improved using longitudinal features from all lesions.

EP-0393

^{18}F-FDG PET/CT imaging predictions of immunotherapy-related adverse effects - single Center experience

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Aim/Introduction: Immunotherapies represent a major advance in melanoma therapy and various types of immunotherapy (IT) have been established in recent years as a standard of care in melanoma patients resulting survival benefit. However, a wide range of immune related adverse events (irAEs) have been reported, some of which can be apparent on PET/CT imaging. ***Materials and Methods:*** This is a retrospective study of the patients (pts) diagnosed with metastatic melanoma who were subjected to immunomodulating therapy during up to 2 years period with nivolumab and pembrolisumab. F^{18} FDG PET-CT findings from single PET/CT Centre were reviewed, and the patients with immune-mediated side effects were selected for further analysis, in conjunction with review of clinical progress notes, the results of laboratory tests, and findings of other imaging tests to confirm side effects of IT found on PET/CT imaging. ***Results:*** During 12 months period ^{18}F-PET/CT were performed 904 times in 669 patients with melanoma in our Centre. Among them 196 pts have metastatic melanoma and they have two, three or even four times repeated PET/CT to monitor treatment response (evaluation with PET/CT is done in a three months period). Out of 196 pts, 29 of them were on immunotherapy alone (12 pts receive nivolumab and 17 pembrolizumab), while others received specific therapy and were not included in these study. PET/CT were identified six patients with immune-mediated side effects among the 29 patients being treated with IT. These immune mediated side effects include new findings of abnormal increased FDG uptake associated with immune-mediated thyroiditis (2 pts), pneumonitis (3 pts), duodenitis (1 pt), colitis (3 pts) and athritis (3 pts) but some of patient show more than one site of increased FDG uptake related to irAEs . Patient with duodenitis was admitted twice to endoscopic procedure and biopsy to confirmed inflammation and rolled out new site of metastases. ***Conclusion:*** FDG PET-CT was highly predictive of treatment outcome in a retrospective evaluation of 196 patients who had unresectable metastatic melanoma and receive specific or IT. FDG PET-CT was also highly predictive of irAEs among 29 pts received IT alone and accurately identified pts who has severe irAEs and need to change therapy management. So, we concluded that early detection of irAEs is essential to aid management of patients and to reduce associated morbidity. It is also important not to mistake treatment related effects of IT for disease.

EP-22

e-Poster Area

B: Imaging Clinical Studies -> B1 Oncological Imaging Clinical Study -> B25 Any Other Malignant (including Primary of Unknown Origin)

EP-0394

End of planar bone scintigraphy: increased diagnostic performance of SPECT only scans in breast and prostate cancer

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Aim/Introduction: Bone scintigraphy is an essential tool in assessing osseous metastatic burden in the workup of oncological conditions, especially in breast and prostate cancer, due to its sensitivity to osteoblastic activity. This study investigates the potential for SPECT-only and SPECT/CT-only imaging protocols or surpass the diagnostic accuracy of conventional imaging protocols in bone scintigraphy. ***Materials and Methods:*** This retrospective analysis involved 74 breast cancer and prostate cancer patient datasets from routine diagnostic bone scintigraphy. Patients underwent planar whole body imaging as well 4-bed SPECT scans (head to mid of thighs) with reduced acquisition duration and auxiliary CT scans of thorax and abdomen. Imaging was performed on a hybrid 2-detector SPECT/CT scanner. Metastases, degenerative and unclear lesions were counted by two independent experienced readers. The study compared sensitivity and specificity in metastasis detection of a conventional imaging protocol (planar scans together with 1-bed position SPECT) with SPECT/CT only-protocols of various axial field of view lengths. Deviations from the conventional imaging protocol were assessed using T-tests and ANOVA. ***Results:*** 4-bed position SPECT-only and SPEC/CT protocols demonstrated a significant reduction in the number of unclear lesions, indicating improved diagnostic specificity (p-value: 0.0022). A notable difference was also observed in the detection rate of metastases with the SPECT-only protocols showing an advantage over the conventional protocols (p-value: 0.0011), particularly in prostate cancer patients. Missed metastases in lower body parts not comprised in the the SPECT-only protocols were negligible and did not affect the total clinical assessments. ***Conclusion:*** SPECT-

only and SPECT/CT-only imaging protocols show a potential for enhanced diagnostic sensitivity and specificity as compared to conventional imaging protocols. With reduced SPECT acquisition durations, the total scan time of 40 minutes does not exceed typical conventional scan times by a lot. Reduced SPECT imaging statistics are compensated by additional information from the auxiliary CT. When combined with diagnostic CT imaging in a one-stop-shop examination, patient comfort could be increased further by eliminating the need for an additional CT-only scan in the workup of breast and prostate cancer patients.

EP-0395

Preliminary comparison of 68Ga-FAPI-46 against ^{18}F-FDG, 68Ga-DOTATATE and 68Ga-Pentixafor PET/CT/MR imaging in the assessment of various cancer types

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Aim/Introduction: 68Ga-FAPI PET/CT imaging allows for effective lesion detectability in cancer microenvironment owing to the relatively high intra-tumoral uptake and low background. This work reports on preliminary comparison between 68Ga-Pentixafor and 68Ga-FAPI-46 PET radiotracers against commonly used ^{18}F-FDG and 68Ga-DOTATATE PET radiotracers in the assessment of various cancer types. ***Materials and Methods:*** Eleven patients with histopathologically confirmed breast cancer, gastric, cervical, glioblastoma multiform (GBM), well-differentiated adenocarcinoma, papillary thyroid carcinoma (PTC), Ewing's sarcoma, colon, and medullar thyroid cancer (MTC) were retrospectively studied. Nine patients were scanned with ^{18}F-FDG, eleven patients with 68Ga-FAPI, three patients with 68Ga-DOTATATE, and one patient with 68Ga-Pentixafor on a Siemens Biograph 6 PET/CT scanner. PET/CT images were evaluated by two nuclear medicine physicians to identify malignant lesions and perform semi-quantitative analysis to calculate maximum standardized uptake value (SUVmax) and target-to-background ratio (TBR). ***Results:*** The evaluation of the eleven subjects demonstrated the effectiveness of 68Ga-FAPI-46 compared to ^{18}F-FDG for the detection of metastasis in the lymph nodes (55 vs. 49), liver (4 vs. 3), and bone (4 vs. 3). 68Ga-Pentixafor and 68Ga-DOTATATE PET/CT scans exhibited no significant differences with both being inferior to 68Ga-FAPI-46 PET radiotracer in terms of metastasis detection. Semi-quantitative analysis showed that the TBR and SUVmax were significantly higher in 68Ga-FAPI-46 PET than ^{18}F-FDG PET for bone metastases and lymph nodes. ^{18}F-FDG and 68Ga-FAPI-46 images exhibited similar SUVmax in liver metastases. However, the TBRs in 68Ga-FAPI-46 images were significantly higher than those in ^{18}F-FDG images. ***Conclusion:*** Improved malignancy detection rates for metastases in the liver, lymph nodes, and bone were observed for 68Ga-FAPI-46 PET compared to 68Ga-DOTATATE, ^{18}F-FDG, and 68Ga-Pentixafor PET.

EP-0396

Using ^{18}F-FDG PET/MR as an initial staging procedure for pediatric malignant tumors

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Aim/Introduction: The purpose of this study was to determine the clinical value and cost-effectiveness of PET/MR as an initial staging procedure for pediatric malignant tumors compared with the PET/CT and conventional work-up (CWU). ***Materials and Methods:*** From August 2017 to October 2022, 1359 pediatric malignant tumor patients(Including 296 neuroblastoma, 126 nephroblastoma, 240 hepatoblastoma, 108 rhabdomyosarcoma, 244 lymphoma, 142 malignant germ cell tumors, 203 non-habdomyosarcoma soft tissue sarcoma)confirmed by pathology in our center were included in this study. Among them, 318 patients underwent PET/MR before treatment,440 underwent PET/CT and the remaining 601 only underwent CWU. Charges were used as issued in 2021 by the Medical Insurance Administration Bureau of Zhejiang, China. Each patient should be followed up for at least 1 year, with the final clinical staging as the gold standard. Incremental costeffectiveness ratio (ICER) measured cost of using PET/MR per percent of patients who avoid missed or misdiagnosis. ***Results:*** The percentages of missed or misdiagnosed cases in PET/MR, PET/CT, and CWU were 4.7%, 9.1%, and 20.8%, respectively($p<0.001$). The mean interval from pathological diagnosis to initiation of treatment was 4.2 days in the PET/MR group, 8.1 days in the PET/CT group and 13.8 days in the CWU group ($p< 0.001$). Mean cost per patient was \$1381 for PET/MR,\$739 for PET/CT and \$446 for CWU. Compared to CUW, the ICER for patients using PET/MR and PET/CT to avoid missed or misdiagnosis is \$58 and \$25 per percentage, respectively.The ICER between PET/MR and PET/CT is \$145. ***Conclusion:*** Compared with CWU and PET/CT, PET/MR reduced missed or misdiagnosed cases risk and decreased workup of incidental findings, allowing for earlier treatment start. Meanwhile, PET/MR can significantly reduce radiation exposure in pediatric patients during examination. It may be cost-effective in initial staging procedure for pediatric malignant tumor patients.

EP-0397

Clinical-radiomics nomogram based on [18F]FDG PET/CT for differentiation of lymphoma and cancer of unknown primary

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Aim/Introduction: To develop and validate a [18F] fluorodeoxyglucose ([18F]FDG) PET/CT-based nomogram combined with clinical and radiomic signatures to distinguish lymphoma and cancer of unknown primary. ***Materials and Methods:*** The retrospective study was conducted from January 1, 2010, to July 31, 2022 at Fudan University Shanghai Cancer Center (FUSCC). All patients underwent [18F]FDG PET/CT to simultaneously obtain metabolic and structural images. Patients with cervical poorly differentiated cancer and were clinically and pathologically diagnosed with lymphoma and cancer of unknown primary (CUP) were randomly divided into training group (n = 134) and test group (n = 58) with a ratio of 7:3. Radiomic signatures (n = 1967) were extracted from the volume of interest on PET/CT images. The least absolute shrinkage and selection operator (LASSO) algorithm and multivariable logistic regression analysis were used to screen for radiomics signatures and clinical features and construct clinical-radiomics model. ***Results:*** This study comprised 151 CUP patients (female: 23/151, 15.2%) and 41

lymphoma patients (female: 22/41, 53.7%). The area under curves (AUCs) for the PET/CT radiomics signatures selected from the nodule area with highest SUVmax were 0.851 and 0.736 in the training and test group. The integrated clinical-radiomics model, incorporating radiomics signatures, gender and heterogeneity index, demonstrated benign diagnostic efficacy with the AUCs of 0.929 and 0.837 in the training and test group, respectively. The nomogram showed satisfactory calibration and clinical benefit in distinguishing CUP and lymphoma patients. ***Conclusion:*** The study developed a nomogram combining clinical and radiomics signatures and validated the potential to predict the pathological type of patients with cervical poorly differentiated cancer.

EP-0398

Exploring the role of ^{18}F-FDG PET/CT in functioning and non-functioning adrenocortical carcinomas

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Aim/Introduction: Adrenocortical carcinoma (ACC), a rare malignant adrenal cortex neoplasm, carries poor prognosis due to its aggressive nature, rapid progression and high recurrence rate. It can be functioning (secreting hormones) or non-functioning. This study aims to assess the role of 18F-FDG PET/CT in patients with adrenocortical carcinoma and compare findings between those with functioning and non-functioning tumors. ***Materials and Methods:*** Data from consecutive patients with histopathologically proven ACC, who underwent 18F-FDG PET/CT between January 2017 and April 2024 in our department were retrospectively analyzed and correlated with hormone profile. Follow-up scans categorized responses as progressive disease, stable disease, partial response or complete response according to PERCIST 1.0 criteria. Quantitative variables were assessed for normality using the Shapiro-Wilk test, presented as mean (SD) and compared using the T-test. ***Results:*** Fifty-nine patients (27-men, 32-women) with adrenocortical carcinoma underwent 102 18F-FDG PET/CT scans: 54.2% (32/59) for baseline evaluation and 45.8% (27/59) for re-staging/response assessment/surveillance only. Among those undergoing baseline evaluation, 40.6% (13/32) had functioning tumors (median age 27.9 years) and 59.4% (19/32) had non-functioning tumors (median age 50 years). Resectable disease was noted in 61% (8/13) with functioning tumors and in 36.8% (7/19) with non-functioning tumors, while the remainder had unresectable/distant metastatic disease. Adrenal to blood-pool SUVmax ratio was significantly higher in non-functioning tumor group [9.39 (3.79) vs 5.84 (2.51), p=0.022]. Common distant metastatic sites were lungs (11/16) and liver (7/16). Among those undergoing post-treatment follow-up scans, 37% (10/27) had functioning tumors and 63% (17/27) had non-functioning tumors. In the functioning tumor group, 60% had localised disease, with 33% (2/6) developing recurrence post-surgery, while in the non-functioning tumor group, 57.4% (4/7) developed local/metastatic disease recurrence post-surgery and overall the common site being post-surgical bed. Disease progression on systemic therapy was comparable between groups: 61% (8/13) in non-functioning and 66% (4/6) in functioning groups. ***Conclusion:*** In adrenocortical carcinoma patients, 18F-FDG PET/CT showed differential uptake in functioning and non-functioning tumors. Non-functioning tumors often present with higher adrenal to blood-pool SUVmax ratios and have higher rates of recurrence.

EP-0399

Detection Efficiency of ^{18}FDG PET/CT for Detecting Primary Tumor in Carcinoma of Unknown Primary (CUP): Single Center Cross Sectional Study over 2017-2023 (Extension Study)

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Aim/Introduction: This is an extension of an already published parent study by same group in 2020 by Fatima et al1 over smaller cohort, to further validate the published facts of detection efficiency of 18Fflourodeoxyglucose positron emission tomography/computed tomography (18FDG PET/CT) in patients with CUP over larger sample from 2017-2023. ***Materials and Methods:*** This single center cross sectional study was conducted at PET/CT Section of Aga Khan University Hospital Karachi, Pakistan (ERC:2024-9755-28071). Patients with CUP and had baseline 18FDG PET/CT for identification of hypermetabolic primary site were retrospectively recruited from 2017-2023 (included 47 patients of parent study1). 18FDG PET/CT scan was acquired using standardized protocol, and patients with suggested hypermetabolic primary sites underwent biopsies. Scan findings and biopsy results were analyzed to find the detection rate, sensitivity, area under curve (AUC), and positive predictive value (PPV). As no biopsy was performed in unidentified primary site, all those cases were considered false negative. ***Results:*** During study, 230 consecutive patients with CUP were included. Similar trend was observed in patients' demographics in mean age (58 ± 14 years), body mass index (26.82 ± 5.43) and male predominance (63%). 18FDG PET/CT based suggested hypermetabolic primary site was identified in 60% (138/230) patients (74% parent study2) and 92% (127/138) true positive (TP) and remaining 08% (11/138) were false positive respectively on performed biopsy (76% TP and 24% FP in parent study1). Detection rate, sensitivity and PPV of 18FDG PET/CT for CUP were 55%, 58%, and 92%, respectively (57%, 68% and 76% respectively in parent study1). The remaining 40% (92/230) patients with unidentified primary site on 18FDG PET/CT did not have justification of biopsy. No statistically significant difference was found in patients and tumor' demographics in true positive and false negative cases. Receiver operating characteristic curve revealed statistically significant diagnostic strength of 18FDG PET/CT for detecting unknown primary with AUC 0.710; P <0.0001; standard error = 0.017; confidence interval: 0.647-0.768 (AUC 0.667; p=0.054 non-significant in parent study1). ***Conclusion:*** We support our previous published findings that detection efficiency of18FDG PET/CT for identifying primary tumor in CUP is 55% with enhanced PPV, reduced FP and overall, statistically significant better diagnostic accuracy in current study over larger sample size. We strengthen our previous conclusion that 18FDG PET/CT is an effective tool for detecting primary tumor in patients with CUP and its upfront use could preclude the use of many futile diagnostic procedures. ***References:*** World J Nucl Med 2020;19:47-51.

EP-0400

What can serum vascular endothelial growth factor do for ^{68}Ga-PSMA image for patients with clear cell renal cell carcinoma?

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Aim/Introduction: To investigate the value of serum VEGF in selection of patients with ccRCC suitable for 68Ga-PSMA-11 PET and its use in patient prognosis prediction. ***Materials and Methods:*** This was a retrospective study of ccRCC patients who underwent 68Ga-PSMA-11 between January 2021 and October 2023. Analysis was based on radiological parameters and angiogenesis indicators, including visual score of PSMA, SUVmax, volume rate (VR) of SUV≥50%SUVmax, and serum VEGF. Evaluated the correlation of serum VEGF and PSMA, the efficacy of serum VEGF in selecting high PSMA uptake ccRCC and the role of PSMA in predicting patient risk. ***Results:*** Totally of 44 ccRCC patients evaluated serum VEGF before PSMA scan and operation were included in this study. Serum VEGF was 86.7±34.4 pg/mL, average SUVmax was 15.3±8.97, VR was 0.32±0.28, the median of PSMA IHC stain was 2 and visual score was 2. Serum VEGF showed no correlation with PSMA IHC stain (r=-0.054, P=0.816) and VR (r=0.065, P=0.748), moderate correlation with SUVmax (r=0.338, P=0.025) and visual score (r=0.405, P=0.008). Based on the visual score of PSMA image, low group (0-1) and high group (2-3), serum VEGF was significant different in two groups (P=0.029). Serum VEGF was a good predictor of PSMA PET visual score with an AUC value of 0.707 (P=0.043), with cut-off value 67.71 pg/mL, the sensitivity 85% and specificity 78% for PSMA visual scores. Patients had high pre-operation serum VEGF might show high PSMA uptake. 19 patients measured serum VEGF post-operation and the median of follow-up was 81 days (IQR: 36-181 days). All patients imaging examination and clinical signs were normal during follow-up time, while serum VEGF of 9 patients increased during the follow-up time. Compared the pre-operative PSMA uptake characteristics between groups, SUVmax was no statistically difference (P=0.464), VR showed significantly difference (P=0.049), patients with increased VEGF had lower VR. ROC curve analysis found that using VR to predict postoperative VEGF changes, with an AUC value of 0.750 (P=0.143), sensitivity 50% and specificity 100%. Patients with preoperative VR≤0.42 were more likely to have increased VEGF post-operative. Serum VEGF was associated with patient prognosis, and results suggested that patients with low VR (high intratumoral heterogeneity) may have poor prognosis. ***Conclusion:*** Our study showed that pre-operative serum VEGF levels can provide assistance in screening patients suitable for PSMA imaging. Base on the change of serum VEGF, the Intra-tumoral heterogeneity index VR had potential value in predict of tumor prognosis risk.

EP-0401

Prognostic Role of FDG PET/CT Findings in Oligometastatic Bladder Cancer

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Aim/Introduction: A recently published consensus report for the definition of oligometastatic disease in bladder cancer (OMBC) made some recommendations regarding the definiton of oligometastatic disease and total number of metastatic lesions (≤ 3 lesions) in muscle-invasive bladder cancers [1]. In this study, it was aimed to investigate the relationship between FDG PET/CT findings and patient prognosis in OMBC. ***Materials and Methods:*** The data of 40 patients diagnosed with muscle-invasive bladder cancer, who underwent PET/CT for primary staging or restaging and had oligometastatic disease were evaluated retrospectively. The number of distant metastatic lesions and metastatic organs, distant metastatic sites and the presence of pelvic lymph node (LN) metastasis were examined. The highest SUVmax, total MTV and total TLG values of the lesions were determined. Progression-free survival (PFS) and overall survival (OS) times of the patients were calculated from the date of PET/CT imaging. Cox proportional hazards regression models were used to identify predictors for PFS and OS. Statistical analyses were performed on SPSS 23.0. Additionally, nomograms were created to determine the probability of 1-year-progression and 2-year-mortality by using the lrm() and nom() functions in the R software rms package. ***Results:*** Synchronous disease was present in 19 and metachronous disease was present in 21 patients. 19, 10 and 11 patients had 1, 2 and 3 distant metastatic lesions, respectively. 33, 6 and 1 patients had distant metastasis in 1, 2 and 3 organs, respectively. Pelvic LN metastasis, distant LN metastasis, lung metastasis, bone metastasis and extrapulmonary soft tissue metastasis were observed in 6, 13, 13, 11 and 11 patients, respectively. There were 24 patients who received local treatment to metastatic lesion in addition to systemic treatment. While there were 15 patients with progression within the first year, there were 19 patients with mortality within the two years. In multivariate Cox regression analysis with backward stepwise selection, the number of distant metastasic lesions, SUVmax and soft tissue metastasis were found as independent predictors for PFS (p=0.004, p=0.007, p=0.009, respectively). The number of involved organs, SUVmax and the presence of local treatment were also found as independent predictors for OS (p=0.001, p=0.034, p=0.048, respectively). ***Conclusion:*** In our study, the number of metastatic lesions and involved organs, the presence of soft tissue metastasis, SUVmax level and treatment modality were found as prognostic factors in OMBC. ***References:*** [1] Labaki C, et al: Oligometastatic Bladder Cancer: Defining a Novel Entity. Eur Urol 2023;84(4):390-392.

EP-0402

Novel and Precise Volumetric Tools for Assessing the Activity of Brown Adipose Tissue and Uncovering the Mysteries Underlying its Function

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Aim/Introduction: Due to its standardisation and ease of measurement, SUVmax remains the primary method for evaluating 18F-FDG uptake in oncology and brown adipose tissue (BAT). Furthermore, metabolic tumour volume (MTV) and total lesion glycolysis (TLG) have demonstrated their utility in quantifying the volume of the 18F-FDG uptake. Considering SUVmax's limitations and the benefits of MTV and TLG, we investigated the reliability of these two PET volumetric tools in measuring BAT activity. ***Materials and Methods:*** After retrospectively analysing 1377 18F-FDG PET/CT scans conducted in 648 cancer patients over three years, we chose post-therapy images that showed high 18F-FDG uptake in brown fat. Based on the normal distribution of BAT SUVmax and the mean value of 2.07±0.95 (median = 1.95), we categorised the BAT+ patients into two groups: BAT-moderate activation (BAT-MA) with SUVmax between 1-2, and BAT-high

activation (BAT-HA) with SUVmax > 2. Moreover, we calculated the sum of all MTV (TotMTV) and TLG (TotTLG) values measured in all the VOIs drawn from all BAT locations in every BAT+ scan. Finally, we conducted statistical analysis to determine the accuracy of these two parameters in demonstrating the degree of BAT activity. ***Results:*** Out of the included 92 BAT+ individuals, 48 had BAT-MA, whereas the remaining 44 had BAT-HA. The AUC for TotMTV was 0.69 (CI = 0.55-0.84, p = 0.009), while for TotTLG, it represented 0.72 (CI = 0.67-0.80, p = 0.015). Thus, the ROC curves showed that these PET instruments could significantly predict BAT function. Additionally, the precision-recall curves confirmed the effectiveness of both tools in categorising BAT activation intensity with high precision and recall. Furthermore, the findings indicate that TotMTV and TotTLG demonstrated high sensitivity levels of 80% and 88%, respectively. Likewise, both instruments showed an increased degree of specificity, with values of 77% and 78%, respectively. According to the generated paired histogram, along with the resulting sensitivities and specificities, BAT-HA was significantly correlated to TotMTV and TotTLG values above the established cutoffs of 56,1 and 78,4, respectively. Moreover, the resulting correlation showed that TotMTV (p = 0.0045) and TotTLG (p = 0.0003) increased significantly with the elevation of "the gold standard tool" for assessing BAT, SUVmax. ***Conclusion:*** MTV and TLG can classify brown fat activity levels and provide additional information about total BAT volume, overcoming SUVmax's limitations. Introducing these tools in the study of brown fat can help develop BAT-based therapies against obesity, diabetes, and other metabolic pathologies.

EP-0403

Role of F18-FDG PET/CT in the management of angiosarcoma.

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Aim/Introduction: Angiosarcoma, an infrequent malignancy, is defined by multiplying anaplastic cells originating from blood vessels, populating irregular blood-filled spaces. Its proclivity for recurrence and metastasis underscores the importance of accurate diagnosis for timely intervention. Employing 18F-FDG PET/CT enables comprehensive assessment of primary lesions and metastatic dissemination in affected individuals. ***Materials and Methods:*** At our institute, we gathered clinicopathological and PET/CT imaging data from 21 patients diagnosed with angiosarcoma. Utilizing dedicated PET/CT scanners (Biograph mCT, Siemens Inc and Discovery PET/CT, GE), we conducted 18F-FDG PET/CT scans 45-60 minutes following the intravenous administration of 8-10mCi of radiotracer. These scans were meticulously interpreted by two seasoned Nuclear Medicine Physicians to evaluate the localization of primary lesions and the presence of metastatic spread. ***Results:*** Among the 21 patients, there were 11 males and 10 females. Their mean age was 34.6 ± 14.3 years, ranging from 20 to 72 years. Thirteen patients underwent ^{18}F-FDG PET/CT as part of baseline evaluation, while the remaining 8 underwent it for response evaluation. Among the latter group, three patients exhibited progressive disease on follow-up ^{18}F-FDG PET/CT scans. The remaining patients showed varied responses: partial response in 2, stable disease in 2, and complete metabolic response in 1. The most common areas of metastatic foci detected on ^{18}F-FDG PET/CT were lymph nodes in 6 patients, bone in 3 patients, and adrenals in 2 patients, with less common involvement observed in the liver, lungs, and spleen. ***Conclusion:*** F^{18}-FDG PET/CT played a crucial role in both the initial assessment and treatment response evaluation of rare malignancies like angiosarcoma, providing comprehensive metastatic workup during baseline evaluation and aiding in therapy response monitoring.

EP-0404

^{18}f fdg pet/ct dynamic / blood flow imaging in urinary bladder cancer: nuclear medicine's answer to the oncologists' question of muscle invasion

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Aim/Introduction: Muscle invasion in urothelial carcinomas is a treatment defining parameter. Magnetic resonance imaging (MRI) is the gold standard modality to know about muscle invasion. Positron emission tomography imaging with ^{18}Fluorine-fluorodeoxyglucose (FDG PETCT) has demonstrated utility in metastasis evaluation of carcinoma urinary bladder, but its utility in tumour (T) staging is limited owing to high urinary FDG concentration. The aim of this study was to identify muscle invasion in bladder cancer with early dynamic /blood flow imaging using the logic of angiogenesis observed in malignancies. ***Materials and Methods:*** Early dynamic ^{18}F-FDG PET/CT scan imaging the blood flow to the lesion were performed on 68 patients with pathology confirmed bladder cancer. A series of 5 consecutive frames of 2 minutes each, starting at injection time, were obtained on each patient's urinary bladder. SUV max was calculated for each frame as (SUVmax1, SUV max2, SUV max3, SUV max4, SUV max5). The tracer uptake in initial frames is matched with pathology reports of the corresponding patients to look for relationship between muscle invasion and increase in blood flow in initial images. ***Results:*** Patients were grouped into two broad categories based on muscle invasion status. Patients with muscle invasion demonstrated increased tracer uptake in the first two frames. Patients without muscle invasion did not demonstrate significant tracer uptake in initial two frames. The tracer uptake was quantitatively marked using SUV max. Patients with muscle invasion also showed consistent increase in the SUV max over the next consecutive frames. Patients without muscle invasion demonstrated no significant increase in SUV max over the next consecutive frames. The average maximum standard uptake values (SUVmax +/- SD), at 2 to 4 minutes postinjection, of bladder wall areas in muscle invasion positive and muscle invasion negative patients were 8.5 and 1.8 respectively ***Conclusion:*** Out of 28 patients who showed muscle invasion in pathology, 23 patients demonstrated increased SUV max in the initial two frames and increased SUV max in successive frames. 5 patients demonstrated no uptake due to various reasons. So, Our study findings of early dynamic / blood flow ^{18}F FDG PET CT imaging can help as an adjunct to find muscle invasion status in carcinoma bladder patients. Hence ^{18}f fdg pet/ct can be tried as a one stop imaging solution in staging of carcinoma urinary bladder in patients, where mri cannot be used due to varying reasons.

EP-0405

^{18}F-FDG PET/CT: atool for diagnosing and prognosticating sarcomatoid differentiation in renal cell carcinoma

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Aim/Introduction: Sarcomatoid differentiation renal cell carcinoma (SDRCC) is a specific type of renal cell carcinoma, which

is often aggressive and more likely to present as locally advanced or metastatic lesions than non-sarcomatoid differentiation renal cell carcinoma (non-SDRCC). 18F-FDG PET/CT can be used to evaluate tumor characteristics and metastatic status of RCC and predict its prognosis by measuring metabolic parameters such as SUVmax. Therefore, the aim of this study was to evaluate the diagnostic and prognostic performance of 18F-FDG PET/CT for SDRCC. ***Materials and Methods:*** This retrospective study assessed newly diagnosed SDRCC patients staged with 18F-FDG-PET/CT, categorizing sarcomatoid differentiation into high-grade (HG-SDRCC) and low-grade (LG-SDRCC) based on a > 50% threshold, and compared their characteristics with a G3/G4 non-SDRCC control group. SUVmax, SUVmean, metabolic tumor volume (MTV) and the total lesion glycolysis (TLG) were compared among HG-SDRCC, LG-SDRCC and non-SDRCC groups, and receiver operating characteristic (ROC) curves were analyzed for the optimal cutoff value and area under the curve (AUC). Patients with SDRCC were retrospectively followed up to analyze their overall survival (OS) and progression-free survival (PFS), and Kaplan-Meier curves, the log-rank test and the multivariate Cox proportional hazards analyses was performed to compare the survival rates and identify the prognostic factors. ***Results:*** The SUVmax (P = 0.0027), MTV (P = 0.0299) and TLG (P = 0.0109) was significantly higher in SDRCC than in non-SDRCC. And ROC shows AUC of SUVmax (AUC = 0.6561), MTV (AUC = 0.6137) and TLG (AUC = 0.6330) for SDRCC and non-SDRCC. Meanwhile, the SUVmax (P = 0.0004), MTV (P = 0.0414) and TLG (P = 0.0126) was significantly higher in HG-SDRCC than in non-SDRCC, while the SUVmax, MTV and TLG was not significantly different between LG-SDRCC and non-SDRCC. ROC shows AUC of SUVmax (AUC = 0.7364), MTV (AUC = 0.6388) and TLG (AUC = 0.6689) for HG-SDRCC and non-SDRCC. The log-rank test shows SUVmax > 11 (PFS: HR = 2.554, P = 0.0404; OS: HR = 3.542, P = 0.0093). Multivariate Cox proportional hazards analyses show SUVmax > 11 (PFS: HR = 2.196, P = 0.053; OS: HR = 3.445, P = 0.022) and TLG > 500 (PFS: HR = 2.281, P = 0.049) were still risk factors under the mixing of age and gender. ***Conclusion:*** The metabolic parameters of 18F-FDG PET/CT including SUVmax, MTV and TLG could be effectively utilized for the diagnosis and prognosis of SDRCC.

EP-0406

The Place of [18F]FDG PET/BT imaging in bladder cancer patients

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Aim/Introduction: It is essential to know lymph node involvement in patients with muscle-invasive bladder cancer (MIBC) scheduled for neoadjuvant chemotherapy. The aim of this study was to compare lymph node involvement detected by F^{18} fluorodeoxyglucose (FDG) positron emission tomography/computed tomography (PET/CT) imaging with pathological findings after surgical resection in patients with MIBC. ***Materials and Methods:*** We retrospectively reviewed 34 patients with locally/locally advanced bladder cancer who underwent surgery at our institution and underwent simultaneous preoperative F^{18} FDG PET/CT scan. Patients with distant metastases detected on PET/CT, patients who did not undergo surgery, and patients who received nonsurgical treatment for malignancy were excluded from the study. Clinical outcomes, FDG-PET/CT findings, and postoperative pathology results were reviewed. Primary tumor localization, primary tumor SUV max values, lymph node localization, number, and SUV max values on FDG PET/CT scan were documented. Overall survival of the patients was determined by the Kaplan-Meier test, and the association between lymph node positivity and survival was investigated by log-rank analysis. ***Results:*** The mean age of the 34 patients (88% [n=30] men, 12% [n=4] women) included in the study was 68 years (53-85). F^{18} FDG PET/CT showed no metastases outside the primary tumor in 20 patients, while metastases in the pelvic lymph nodes were detected in 14 patients. The mean number of metastatic lymph nodes was 1.2 (0-7). The mean SUVmax of the metastatic lymph nodes was 5.1 (15.1-1.2), while the mean SUVmax of the primary bladder tumor was 14.63 (6.2-36). According to pathology results, 31 patients had at least one pathological lymph node. The sensitivity and specificity of PET/CT for detecting lymph node metastasis were 61.36% (45.5%-75.64%) and 95.82% (93.09%-97.70%), respectively. The overall survival of patients with positive lymph nodes was 29 months (95% CI: 21.8-36.2), the overall survival of patients with negative lymph nodes was 33 months (95% CI: 13.8-52.1), and the overall survival of the entire cohort was 33 months (95% CI: 17.2-48.7). Log-rank analysis showed no statistically significant difference in survival between patients with positive and negative lymph nodes (p: 0.871). ***Conclusion:*** The low sensitivity of F^{18} FDG PET/CT in bladder cancer imaging limits the role of F^{18} FDG PET/CT in the assessment of lymph node status in MIBC and, thus, in clinical decision-making.

EP-0407

Diagnostic Utility of ^{18}F-FDG PET-CT in the detection of underlying malignancy in Paraneoplastic Syndrome.

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Aim/Introduction: Diagnostic Utility of 18FDG PET-CT in the detection of underlying malignancy in Paraneoplastic Syndrome. Introduction: Paraneoplastic syndromes are a spectrum of rare systemic complications of malignancy that arise from tumour secretion of peptides or immune cross-reactivity between malignant and normal tissues. It can affect many organ systems most notably neurological, dermatologic and rheumatologic systems. It is estimated to affect upto 8% of patients with cancer (1). However, they also represent conditions that occur outside of a cancer association and there are few prospective clinical trials to guide management. 18FDG PET-CT has emerged as a practical imaging modality in localizing metabolically active tumours along with infective and inflammatory conditions. Hence, timely recognition of these symptoms and detecting the underlying etiology can play a critical role in management and improving patient's survival. ***Materials and Methods:*** We retrospectively analysed imaging data of 1320 patients clinically suspected to have paraneoplastic syndrome who underwent 18FDG PET-CT to assess the underlying etiology during the period of July 2018 to April 2024. Histopathological correlation was considered the reference standard. All the PET-CT scans were analysed by nuclear medicine physicians. ***Results:*** Out of 1320 patients, a total of 143 paraneoplastic syndrome patients with positive findings on ^{18}F-FDG PET-CT were included for the study purpose. The mean age of the study group was 50+15.7 years with a total of 75 male and 68 female patients. All underwent histopathological and cytological examinations. Out of which, 52 had no records available and 54 had nonspecific findings. In the remaining 37, we observed malignancies in 19 patients namely, thyroid

- 4, breast - 3, DLBCL - 2, ovary - 3, duodenum - 2, lung, colon, plasmacytoma, GIST and prostate - one each. Furthermore, 9 cases of inflammatory conditions were noted with the most common pathology being Dermatomyositis (5/9). Infective conditions were observed in 6 patients with the most common being tuberculosis. We also noted benign conditions in breast and thyroid in 3 patients. ***Conclusion:*** The study describes the diagnostic utility of ^{18}FDG PET-CT in paraneoplastic syndrome revealing diverse underlying pathologies including malignancies, inflammatory and infective etiologies. However, a larger cohort study is warranted to substantiate the role of 18FDG PET-CT in ascertaining the underlying etiology of paraneoplastic syndromes. ***References:*** 1. Pelosof LC, Gerber DE. Paraneoplastic syndromes: an approach to diagnosis and treatment. Mayo Clin Proc. 2010 Sep;85(9):838-54. doi: 10.4065/mcp.2010.0099. Erratum in: Mayo Clin Proc. 2011 Apr;86(4):364. PMID: 20810794; PMCID: PMC2931619.

EP-0408

Role of ^{18}F-FDG PET/CT in response assessment to imatinib in Dermatofibrosacroma protuberans

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Aim/Introduction: Dermatofibrosarcoma protuberans (DFSP) is a rare soft tissue sarcoma characterized by slow growth and high rates of local recurrence. Accurate assessment of treatment response is crucial for guiding clinical management and optimizing patient outcomes. Fluorodeoxyglucose positron emission tomography/computed tomography (18F-FDG PET/CT) has emerged as a valuable tool for evaluating treatment response in various cancers, but its utility in DFSP remains understudied. ***Materials and Methods:*** We conducted a retrospective study to investigate the efficacy of 18F-FDG PET/CT in assessing treatment response in DFSP. Twenty-one patients with histologically confirmed DFSP with local recurrence and metastases who underwent FDG PET/CT for response assessment following imatinib were included. FDG PET/CT images were analyzed for maximum standardized uptake value (SUVmax) and compared with clinical and radiological data to determine response to therapy. ***Results:*** A total of 39 patients were analysed undergoing treatment in the sarcoma clinic in the Department of Medical Oncology, AIIMS. Out of 39 only 22 patients were followed with PET/CT for response assessment and included in the study. Seven patients (31.8%) showed a response to therapy including a complete metabolic response (CMR) and partial metabolic response (PMR), while six patients (27.2%) showed stable disease. The remaining patient (40.9%) showed an increase in SUVmax, suggestive of disease progression or resistance to therapy. Baseline SUVmax of the hottest lesion was compared among patients with response to therapy (CMR and PMR) with the patient group who had progressive disease. Baseline SUVmax was higher among progressive disease group with mean SUVmax of 15.8 and SUVmax of 8.6 in patients showing response to therapy. ***Conclusion:*** FDG PET/CT represents a promising imaging modality for response assessment in DFSP, offering valuable prognostic information and guiding therapeutic decision-making in DFSP.

EP-0409

FGF23 - Related Hypophosphatemia in a TIO patient diagnosed by SSTR-based functional imaging

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Aim/Introduction: Tumour-induced osteomalacia (TIO) is a rare condition due to overproduction of fibroblast growth factor 23 (FGF23), with profound impact on patient quality of life. TIO finding could be a major diagnostic challenge due to the occurrence anywhere in the body, with similar prevalence in soft tissue and bone. TIO variably express somatostatin receptors (SSTR), allowing SSTR-based functional imaging by somatostatin receptor scintigraphy (SRS). ***Materials and Methods:*** We present a female patient with a 5-year-long history of an important chronic osteoarticular pathology (generalized osteomalacia, multiple bone fractures), which severely limited her daily activities. In 2021, she was admitted to the Neurology, where, based mainly on the laboratory results (high serum levels of FGF23 - 371 RU/mL, NR 44-140 RU/mL), the hypothesis of a possible secreting FGF23 mesenchymal tumor was issued. The patient underwent a comprehensive imaging examination (^{18}F-FDG PET/CT, thoracic-abdominal-pelvic CT / IRM, skull and appendicular skeleton X-ray), but without any suggestive TIO findings. To assess the possible SSTR TIO overexpression, in 2023 the patient underwent SRS. The whole body and SPECT images were acquired at 2, 4 and 24 hours after administration of 702,80 MBq 99mTc-EDDA/HYNIC-Tyr3-Octreotide. ***Results:*** SRS revealed a very intensive radiotracer uptake in the right lacrimal bone projection area, being suggestive for an expressing SSTR tumor. For further tumor localization, a cranio-cerebral MRI was performed which identified the tumor at the left ethmoidal level, with invasion of the left nasal fossa. The patient was referred to Neurosurgery where the surgical treatment was performed. The pathological exam confirmed the ki67- 1% secreting FGF23 TIO. Three months after surgery, all symptoms previously reported retreated and laboratory results revealed the normalization of the serum level of FGF23 = 109.3 RU/mL.Discussion In our case, the single mesenchymal tumor secreting FGF23 in the ethmoidal bone was responsible for osteomalacia and her pain over 2 years. FGF23 producing TIO are usually very small, with wide variety of its localization, their identification being difficult. Due to variety of FGF-producing TIO localizations, structural imaging should be preceded by functional imaging. ***Conclusion:*** SSTR-based functional imaging by SRS is a useful way to precise localize TIO, with the advantage of multiple acquisition images, without an increased radiation exposure. This investigation could represent a precious personalized tool for multidisciplinary management of the TIO.

EP-0410

Prognostic value of intra-tumoral metabolic heterogeneity on baseline ^{18}F-FDG PET/CT in patients with thymic epithelial tumors

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Aim/Introduction: The prognostic value of heterogeneity indices in thymic epithelial tumors (TETs) remains explored. This study aimed to evaluate the impact of intra-tumoral metabolic heterogeneity and quantitative 18F-FDG PET/CT imaging parameters on the prognosis of patients with TETs. ***Materials and Methods:*** This retrospective analysis involved 96 patients diagnosed with thymic epithelial tumors (TETs) who received pre-treatment ^{18}F-FDG PET/CT scans. We measured the highest

and average standardized uptake values (SUVmax and SUVmean), along with total lesion glycolysis (TLG) and metabolic tumor volume (MTV) from the PET/CT scans. We also assessed two heterogeneity indices: HI-1 (SUVmean divided by the standard deviation) and HI-2 (linear regression slopes of MTV based on different SUV thresholds). Associations between these parameters and patient survival outcomes were analyzed. ***Results:*** Among the 96 patients we studied, 47 experienced disease progression and 19 passed away during the observation period. In our analysis, we found certain factors to be significant indicators of progression-free survival (PFS), such as Masaoka stage, TNM stage, WHO classification, SUVmax, SUVmean, TLG, and HI-1, while others like MTV, HI-2, age, gender, presence of myasthenia gravis, and maximum tumor diameter didn't show significance. Further investigation through multivariate analyses revealed that HI-1 (P=0.001, HR: 54.564; 95% CI: 5.285-563.371) and TNM stage (P=0.002, HR: 10.415; 95% CI: 2.448-44.318) were identified as independent prognostic factors for PFS. Similarly, when we looked at overall survival (OS), factors like TNM stage, WHO classification, SUVmax, and HI-1 emerged as significant in the univariate analysis. However, Masaoka stage, SUVmean, MTV, TLG, HI-2, age, gender, presence of myasthenia gravis, and maximum tumor diameter didn't show significance. Multivariate analyses underscored TNM stage as an independent prognostic factor for OS (P=0.027, HR: 9.682; 95% CI:1.288-72.802). ***Conclusion:*** The findings suggest that HI-1, derived from initial 18F-FDG PET/CT scans, alongside TNM stage, independently predict progression-free survival in TETs. HI-1, which reflects intra-tumoral metabolic heterogeneity, might be promising to identify patients with poor prognosis.

EP-0411

Experience with Ga68-FAPI PET-CT Imaging in a Variety of Cancers

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Aim/Introduction: Ga68 FAPI (Fibroblast Activation Protein Inhibitor) is a new PET radiopharmaceutical, targeting Fibroblast Activation Protein (FAP). We aimed to evaluate FAP expression, imaging features, diagnostic performance in a variety of malignancies. ***Materials and Methods:*** Patients included a)Primary tumors with low glucose metabolism and not optimally imaged by FDG PET b) Head-Neck (HN) cancers where interpretation difficulties arise due to physiological activity in FDG PET c) Solid cancers otherwise well imaged by FDG, to assess their FAP expression. Ga68-FAPI(04) at dose of 0.1 mCi/kg body weight was administered intravenously. Whole Body PET-CT scans were acquired after 1hour. Diagnostic Contrast CT and in abdominal cases Triphasic contrast CT was done as part of the PET-CT. Standardized Uptake Values were calculated. Uptake was also qualitatively assessed as mild, moderate, intense. Findings were classified as Definitive for Diagnosis, Indeterminate, False Negative (FN), False Positive (FP). ***Results:*** Total 107 FAPI PET-CT were performed for 75 patients between April'2023 to March'2024. Cancers included HN carcinoma, hepatobiliary tumors, signet cell adenocarcinoma stomach (SCCS), few cases of lung, breast, colon, poorly differentiated prostate and Neuroendocrine tumors. FDG PET-CT correlation was additionally available in 31/107 scans. 15/15 HN cancers demonstrated intense FAP expression, with Definitive diagnosis. Was useful for follow up evaluation. No FP activity seen. For HCC, 10/15 at primary diagnosis showed intense, 4 showed moderate activity. 7/15 showed high background activity in cirrhotic liver -Definitive diagnosis was still possible in 6/7 due to higher than background activity, and enhancement patterns of simultaneous multiphasic CT. In 1/7 scan was Indeterminate. In 3/4 HCC post TACE/ RFA false positive uptake in involved segment caused Indeterminate results. 7/7 SCCS showed moderate to high FAP activity with Definitive Results in initial staging, compared to FDG PET. In response evaluation scans, FAP expression was variable and correlation with CT component was necessary. 6/6 cholangiocarcinoma, 11/11 Breast, colon and Lung cancers showed intense activity. False negatives included 2/2 endometrial adenocarcinoma, 1 dedifferentiated prostate, 1/1 RCC, 1/3 pancreatic adenocarcinoma, 2/3 NET. FP uptake seen in fractures, scar, lung infection, granulomatous nodes. ***Conclusion:*** FAPI PET-CT performed well for Definitive interpretations in good variety of tumors and could be performed in lieu of FDG in HN, Lung, Breast, SCCS without any loss of diagnostic information. For HCC it was superior to FDG PET, however some difficulties encountered in staging and Post intervention setting, where optimal use of multiphasic CT was essential for characterization.

EP-0412

Comparison of PET/CT Imaging with $^{[18F]}$PSMA-1007 and $^{[18F]}$FDG in Muscle-Invasive Bladder Urothelial Carcinoma

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Aim/Introduction: Muscle-invasive bladder cancer (MIBC) poses challenges in monitoring due to its high rates of metastasis and recurrence. PET/CT with $^{[18F]}$FDG can be used for MIBC evaluation, but the tracer urinary excretion can hinder analysis in some cases, even with diuretic use. Prostate-specific membrane antigen (PSMA) expression in neoangiogenesis of MIBC makes it a potential disease marker. Notably, the radiotracer $^{[18F]}$PSMA-1007, primarily excreted through the biliary tract, facilitates urinary tract evaluation. This study aimed to compare PET/CT with $^{[18F]}$FDG and $^{[18F]}$PSMA-1007 in evaluating MIBC. ***Materials and Methods:*** Four male patients (ages 57-73 years) underwent prospective PET/CT studies. $^{[18F]}$FDG PET/CT was performed 60 minutes after tracer injection, while $^{[18F]}$PSMA-1007 PET/CT was conducted 5 and 90 minutes post tracer administration. Additional late (2h) pelvic images were obtained with both tracers after intravenous furosemide injection. Experienced nuclear physicians and a radiologist analyzed the images. Maximum standardized uptake value (SUVmax) of each lesion was measured for both radiotracers. ***Results:*** $^{[18F]}$PSMA-1007 uptake in bladder lesions and regional lymph nodes increased progressively between 5, 90 minutes, and 2 hours. Eleven lesions were identified in the 4 patients with $^{[18F]}$PSMA-1007, compared to 9 with $^{[18F]}$FDG. Two patients who had undergone transurethral resection showed no active macroscopic lesions in the bladder. $^{[18F]}$PSMA-1007 detected bladder lesions in the other 2 patients (SUVmax= 9.8 and 23.4), while FDG detected only 1 (SUVmax= 30.0), with the other lesion obscured by radioactive urine, despite diuretic administration. Both tracers detected lymph node metastases in 3 patients (SUVmax= 4.1 to 15.8, and 9.5 to 18.3, respectively, for $^{[18F]}$PSMA-1007 and $^{[18F]}$FDG), and bone metastasis in 1 patient (SUVmax= 11.1 and 10.1 for $^{[18F]}$PSMA-1007 and $^{[18F]}$FDG, respectively). Two patients had FDG-avid pulmonary inflammatory/infectious processes which were not $^{[18F]}$PSMA-1007-avid. ***Conclusion:*** PET/CT with $^{[18F]}$FDG and $^{[18F]}$PSMA-1007 demonstrates similar sensitivities for MIBC lesions. With lower uptake in inflammatory processes, $^{[18F]}$PSMA-1007 appears to exhibit higher specificity and, due to significantly lower urinary excretion than $^{[18F]}$FDG, may be more advantageous for evaluating

primary bladder lesions. The substantial uptake of [18F]PSMA-1007 in some MIBC lesions suggests a potential theranostic approach in select patients.

EP-0413

Role of ^{18}F-FDG PET-CT in the Evaluation of Hemangioendothelioma (HE)

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Aim/Introduction: Hemangioendothelioma (HE) is a rare vascular neoplasm characterized of epithelioid or histiocytoid cells, typically detected between the ages of 20-60 years. The clinical manifestations vary from mild illness to severe illness with poorer prognosis in patients having metastatic disease. Imaging is important in HE to determine lesion resectability, stage, assess response to therapy, and evaluate for local recurrence following primary treatment. To date, most imaging studies have focused on the CT and MRI appearances of HE. In comparison, there is relatively limited data regarding the role of 18F-FDG PET/CT in evaluation of HE. Therefore, the present study is aimed to evaluate the imaging features of pathologically proven HE on staging FDG PET/CT. ***Materials and Methods:*** Eight (08) patients with HE were retrospectively evaluated and descriptive statistics related to patient demographic and clinical details were generated. All patients underwent 18F-FDG PET-CT for staging, treatment planning and follow up. ***Results:*** There were 8 patients (6 males, 2 females) with mean age of 44.3 ±14.1 years. The primary site for involvement was cardiac (1/8), left femur (1/8), liver (4/8), right elbow (1/8) & right thigh (1/8). Four (4) of 8 patients underwent surgical excision, 2/8 patients received chemotherapy, 1 patient underwent trans-arterial chemoembolization (TACE), 1 patient received radiotherapy (mean absorbed dose was 4.5 Gy), 5/8 patients received immunotherapy. Seven (7) patients presented with metastases at the time of initial diagnosis on 18F-FDG PET/CT and the ECOG PS was 1 in 7/8 & 4 in 1/8 patients. Total 9 sites of metastases were identified; lungs (7/9), lymph nodes (1/9) & bone (1/9) on 18F-FDG PET/CT. Baseline and follow up PET/CT was done for 7/8 patients. Mean longest axis dimension (LAD) on CT was 3.6 (±4) cm and mean SUV max for the primary site was 5.9 (±4.4). Follow up of 7/8 patients revealed progression of disease in 2 of the patients with a mean progression free survival (PFS) of 8.9 (±9) months. ***Conclusion:*** 18F-FDG PET-CT is a useful tool in staging, restaging and treatment planning in HE patients.

EP-0414

Is a tandem FAPI and FDG PET study effective in predicting the etiology of peritoneal disease

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Aim/Introduction: In India, peritoneal tuberculosis is a common presentation. However histopathology is not always feasible and treating it as infective might harm patients with early-stage metastatic peritoneal disease. Aim - To investigate the effectiveness of using sequential dual tracer PET scans with FAPI and FDG in distinguishing malignant from benign peritoneal disease. ***Materials and Methods:*** This is a single-institutional interventional study. The study included patients over 18 years of age who had ascites and, or peritoneal disease and faced a diagnostic challenge of determining whether they had an infection or malignancy based on their 18F FDG PETCT scan. The patients underwent a 68Ga FAPI-46 PETCT scan on a different day, not later than 5 days Analysis - All the images were analyzed by two experienced nuclear medicine physicians. Any well-defined focus of increased tracer uptake greater than the background activity in the expected anatomical region was considered positive Combined data - Results were grouped into categories based on quantification marker SUV Max Category I - Very likely benign -> FDG positive & FAPI negative or both negative Category II- Likely benign -> both positive with FAPI SUV≤50% FDG SUV Category III - Indeterminate -> both positive with FAPI SUV-50-70% of SUV of FDG Category IV- Likely malignant -> both positive with FAPI SUV≥70% of FDG SUV or only FAPI positive Histopathology and, or follow-up imaging are considered the gold standard for diagnosing medical conditions. ***Results:*** We included a total of 50 patients of them 25 had malignant peritoneal disease. The true positive, false-positive, true- negative & false-negative values of FAPI and FDG were 25, 9, 16 & 0, and 14,16, 9 & 11 respectively. The sensitivity, specificity, accuracy, positive predictive, and negative predictive values of FDG vs FAPI were 56% vs100%, 36% vs 64%, 46% vs 82%, 46.67% vs 73.53%, and 45% vs 100% respectively. Hence when compared FAPI- 46 PET CT scan had better diagnostic accuracy and also helped in detecting the primary site in 7 patients. ***Conclusion:*** This method reduced false positives by differentiating benign from malignant peritoneal disease. We attempted to introduce a triage system for patient biopsy selection criteria by preventing immediate biopsy in the 'Very likely benign' and 'Likely benign' categories.

EP-23

e-Poster Area

B: Imaging Clinical Studies -> B10 Other Imaging Clinical Studies -> B101 Other Clinical Studies

EP-0415

The Relationship Between Biometric Data And Lymphoscintigraphic Findings In Patients With Lower Extremity Lymphedema

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Aim/Introduction: Lymphedema is a chronic disease caused by functional insufficiency of the lymphatic system. Lymphoscintigraphy is an essential tool in the diagnosis and staging of lymphedema. Obesity has pressure on the lymphatic system and this pressure has effects on the development or aggravation of lymphedema. This study was aimed to evaluate the relationship between lymphoscintigrapic and biometric data [height, body weight and body mass index (BMI)] of the patients. ***Materials and Methods:*** The study included 115 patients who underwent lymphoscintigraphy ,with a diagnosis of lymphedema, in our clinic between January 2020 and February 2024. 95 patients who underwent lower extremity lymphoscintigraphy were included in the study. Lymphoscintigraphies were evaluated normal and between Grade 1-4. Biometric data, stemmer sign and medical history that may cause secondary lymphedema were obtained and BMI classifications were made according to the

World Health Organisation (1). Patients with a BMI value of 30 and above were considered obese. Statistical analyses were performed using IBM SPSS version 29.0. ***Results:*** In this study, 13 (13.7%) of the patients were male and 82 (86.3%) were female. Medical history that may cause secondary lymphedema was found in 17 (17.9%) of the patients and 38 (40%) of them had a positive stemmer sign. Mean age was 54.1±12.8 years, mean body weight was 89.2±18.3 kg, and mean BMI was 33.9±7.2 kg/m2. According to Chi-Square analysis, a significant relationship was found between lymphoscintigrapic grade with the positivity of stemmer sign and BMI ($p<0.001$). There was a significant correlation between lymphoscintigraphic grade with body weight and BMI ($p=0.014$, $p=0.031$ respectively) by Spearman analysis. BMI mean values of the patients with and without lymphedema were compared by Mann-Whitney U analysis, a statistically significant difference was found between the BMI mean values of the two groups ($p<0.05$). According to Kruskal-Wallis analysis the relationship between BMI mean values and the grade of primary lymphedema was statistically significant ($p<0.05$). ***Conclusion:*** Obesity may lead to a decreased lymphatic flow and increased risk of lymphedema. Obesity-related chronic inflammation may increase the severity of lymphedema by affecting the function of lymphatic vessels. We conclude that, there is a relationship between BMI and severity of lymphedema and this relationship is important for holistic and multidisciplinary management of these two conditions. ***References:*** Weir CB, Jan A. BMI Classification Percentile And Cut Off Points. [Updated 2023 Jun 26]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024 Jan.

EP-0416

The impact of glucose intake on screening FDG-PET/CT image before FDG infusion for hypoglycemia with diabetes mellitus examinees

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Aim/Introduction: FDG-PET studies strictly require at least 4 hours of fasting before FDG infusion to avoid study failures due to diffuse distribution to muscles. However, there is no consensus or rationale whether glucose intake before FDG infusion for hypoglycemia affects the image quality. In screening PET facilities, examinees with diabetes mellitus sometimes experience iatrogenic hypoglycemia during the screening course, but the standard policy for such examinees has not been determined, i.e., cancellation and re-scheduling of PET study. The study purpose is to investigate if the glucose intake prior to FDG influences the assessment of image evaluation. ***Materials and Methods:*** Subjects who received glucose due to hypoglycemia before FDG administration were explored from 2016 to 2021 in our membership health screening institute. The FDG PET images were evaluated from multiple perspectives; 1) reviewing PET reports retrospectively, 2) visual analysis of a randomized FDG PET dataset including normal scans of examinees without diabetes by two independent blinded readers, and 3) semiquantitative analysis on muscles, comparing with corresponding PET images from different years without hypoglycemia, and normal scans without diabetes. ***Results:*** A total of 17 studies of 14 patients (age, 61.5 ± 10) were identified as receivers of glucose before FDG administration due to hypoglycemia. The average blood sugar level was 70.2 ± 9 mg/dL when noticed as hypoglycemia. Symptoms were recorded in 4 subjects. The taken glucose dose was 10g in 13 studies, 5g in one, one candy in two, and twice of 10g in one study. The interval between glucose intake and FDG administration was 36 ± 44 minutes. None of the FDG PET reports mentioned elevated muscular uptake. There was no statistical difference of image evaluation between scans with glucose intake and normal scans by either reader. No statistical difference was observed in muscles among glucose intake group and other groups without glucose intake. ***Conclusion:*** Glucose intake before FDG venous infusion due to hypoglycemia in diabetes mellitus did not affect the quality of FDG-PET/CT scans. Clinical staff may be advised to instruct examinees to take glucose without hesitation at the noticed timing of hypoglycemia for examinees safety and encourage the examinees to undergo FDG PET as scheduled.

EP-0417

Effects of Bisphenol A and Bisphenol S Exposure on the metabolic parameters on FDG PET/CT image

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Aim/Introduction: Bisphenol A (BPA) and its analogues have been proved to be harmful to human health. This study aimed to assess the impact of Bisphenol A (BPA) and its major analogue, Bisphenol-S (BPS), on metabolic parameters within normal main organs using 18F-fluorodeoxyglucose positron emission tomography/computed tomography (FDG PET/CT) imaging. ***Materials and Methods:*** A retrospective analysis was conducted on patients who had undergone FDG PET/CT imaging and were also examined for BPA and BPS levels. Urine samples were collected for detection of BPA and BPS. Standardized uptake values (SUVmax and SUVmean) of normal main tissues including liver, blood, spleen, muscle, thyroid, and cerebral cortex were quantified. Statistical analysis was performed using Spearman's rank correlation. ***Results:*** Forty patients (20 female, 20 male; mean age: 56.1±15.4 years) were included. Mean urine BPA and BPS concentrations were 2.1±1.2 ng/mL and 1±0.6 ng/mL, respectively. Urine BPA exhibited a moderate positive correlation with liver SUVmax ($r=0.351$, $P=0.026$) and SUVmean ($r=0.361$, $P=0.022$). No significant correlations were found between BPA and blood, muscle, spleen, thyroid, and cerebral cortex ($P > 0.05$). Conversely, urine BPS demonstrated a negative correlation with thyroid SUVmax ($r=-0.43$, $P=0.012$) and SUVmean ($r=-0.432$, $P=0.012$), while a positive correlation was observed between BPS and cerebral cortex SUVmax ($r=0.366$, $P=0.033$). ***Conclusion:*** Urinary levels of BPA and BPS exerted distinct influences on tissue metabolic parameters observed via FDG PET/CT imaging, particularly affecting the liver, thyroid, and cerebral cortex. This finding suggests that SUV derived from FDG uptake by these organs on 18F-FDG PET/CT imaging may reflect the extent of BPA and BPS exposure in the body. However, further prospective studies are needed to validate these findings.

EP-0418

A new methodological approach to lower limbs lymphoscintigraphy

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Aim/Introduction: Lymphoscintigraphy is the gold standard procedure to diagnose lymphoedema. To date several methods have been proposed mainly based on static planar acquisitions and cut-offs derived from mixed protocols and gamma-cameras. The purpose of our study is to find and test, in a single tertiary clinical center, an easy and accurate protocol to semi-quantify limb lymphatic drainage reliably in daily clinical practice. ***Materials and Methods:*** From 2024 we replaced the lymphoscintigraphic semi-quantitative protocol developed by Brauer et al in 2002, with 3 simple WB scans respectively acquired soon after radiopharmaceutical administration (37 MBq of 99mTc-Nanocolloid in each side), 1 hour post-injection (after 45 consecutive minutes of walking-stress) and 2 hours after injection. Two-days lymphoscintigraphy study to evaluate separately. Superficial lymphatic system and deep lymphatic system have been studied separately in two distinct days. As injection sites we used intradermal injection for superficial lymphatic system and subfascial injection for the deep one. All the scans were performed on a gamma-camera, from feet to chin, with a fixed acquisition speed of 15cm/min. In case of doubtful findings, a SPECT/CT acquisition was acquired. After decay correction we estimated percentage wash-out from injection site, percentage accumulation in popliteal, crural-inguinal, iliac lymph nodes (both right and left) and liver uptake at 60 and 120 minutes. We compared this new approach to a validated method. ***Results:*** Until now we studied 10 consecutive patients referred for suspected lymphoedema of the lower limbs. All patients were acquired separately for superficial and deep lymphatic system. The proposed method is about 20% quicker as compared to the validated method and easier to be performed. Furthermore, the method provides 18 semi-quantitative separated metrics instead of the two usually adopted. There is a significant correlation between the new method and the validated one. ***Conclusion:*** Although cases are still limited and the proposed method needs more validation, it seems easy, quick and clinically useful. ***References:*** Brauer W and Weissleder H. Methods and results of lymphoscintigraphic function tests: Experience in 924 lymphedema patients; 2002/12/01, Phlebologie, Stuttgart.

EP-0419

The impact of preliminary patient hydration on urinary bladder uptake in cases of routinely high renal excretion of [18F]PSMA-1007 on PET/CT

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Aim/Introduction: [18F]PSMA-1007 has minimal renal excretion in comparison to 68Ga-labeled PSMA-ligands. It allows a better assessment of the pelvic area in patients with prostate cancer (PCa). Nevertheless, in our clinical practice, we routinely observed a notably high [18F]PSMA-1007 uptake in the urinary bladder. The underlying reasons for this phenomenon remain inadequately explored. The aim of this study was to assess the impact of preliminary hydration of patients on [18F]PSMA-1007 uptake in the urinary bladder. ***Materials and Methods:*** Prospective, multicenter, randomized controlled study included 180 patients with PCa who underwent [18F]PSMA-1007 PET/CT. Scans were performed 90 minutes after intravenous administration of [18F] PSMA-1007 using three different PET/CT-systems and according to the current EANM/SNMMI guideline v2.0. All patients were divided into two groups: the group with hydration (n=95, 53%), which included the subgroups of patients with oral (n=76, 80%) and parenteral (n=19, 20%) routes of hydration, and the control group with no hydration (n=85, 47%). The hydration procedure was carried out using 1000 ml of liquid after [18F]PSMA-1007 administration with no bladder voiding all uptake time. [18F] PSMA-1007 uptake in the urinary bladder was quantified using SUVmean (Mean Standardized Uptake value), measured within a spherical VOI with a fixed volume of 2.5cm3 delineating the bladder boundaries. Additionally, the TBRmean (Mean Target-to-Background Ratio), reflecting the ratio between bladder and right gluteal muscles SUVmean, was calculated to reduce the influence of inter-scanner SUV variability. Intergroup differences were assessed for statistical significance using the nonparametric Mann-Whitney U test. ***Results:*** SUVmean and TBRmean were significantly lower (p<0,001) in the group with hydration compared to the control group, regardless of PET/CT-system, with the following values: 1.3 [0.8; 2.0] versus 4.5 [2.7; 8.5] for SUVmean and 4.0 [2.3; 6.3] versus 13.0 [7.7; 24.0] for TBRmean. There was no significant differences in SUVmean and TBRmean between the subgroups with oral and parenteral routes of hydration (p=0.95 for SUVmean, p=0.49 for TBRmean). Additionally, comparatively lower interquartile range (IQR) values for both SUVmean and TBRmean in the group with hydration were noted, regardless of PET/CT-system (1.2 versus 5.8 for SUVmean, 4.0 versus 16.3 for TBRmean). ***Conclusion:*** Preliminary hydration of patients significantly reduces both the level and variability of [18F]PSMA-1007 uptake in the urinary bladder. This approach may be beneficial in cases of routinely increased renal excretion of [18F]PSMA-1007. The route of hydration did not affect [18F]PSMA-1007 uptake in the urinary bladder.

EP-0420

Clinical utility of 99mTc-MDP in detection and site localization of suspected protein losing enteropathy patients.

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Aim/Introduction: Protein-losing enteropathy (PLE) is an unusual cause of hypoproteinemia, characterized by the loss of protein from the gastrointestinal mucosa. This condition arises due to various etiologies that lead to injury or breakdown of the gastrointestinal epithelium, leading to varying clinical manifestations.The primary diagnostic test for PLE typically involves a 24-hour stool collection to test for the presence of alpha-1 antitrypsin. Additionally, a nuclear medicine technique utilizing 99mTc-labeled Methylene diphosphonate (MDP) has been found to be useful in detecting and localizing the site of the protein leak in PLE. ***Materials and Methods:*** We conducted a retrospective study to detect and localize protein leakage sites in suspected pediatric and adult PLE patients at our Department of Nuclear Medicine, AIIMS New Delhi. We administered 740 MBq (20mCi) of 99mTc-MDP intravenously to all the suspected adult PLE patients. However, in pediatric patients, we administered a dose adjusted based on age (using Webster's rule). After the intravenous injection of the

radiotracer, serial planar images were acquired from 15 minutes until 24 hours post-administration. Scan considered as positive, if visible tracer uptake was observed in the gut and it moved distally from the site of localization in subsequent planar static images. Additionally, SPECT/CT was acquired to confirm the positive findings on planar imaging. ***Results:*** In a study of 41 suspected pediatric and adult PLE patients, we observed 23 male and 18 female patients. The mean age of all patients were 37.6 ± 16.3. At an average time point of 180 minutes, we detected and localized the site of the protein leak in these patients. Out of the total 41 patients, 7 (17%) showed positive uptake on the scan, of which 6 were adults and 1 was a pediatric patient. The most common site was the cecum (3/7), followed by the ascending colon (2/7), small bowel (1/7), and transverse colon (1/7). The diagnostic yield of 99mTc-MDP was 33.3% (1/3) in pediatric PLE patients, while in adult PLE patients, it was 15.8% (6/38). These patients were managed conservatively based on protein diet and specific etiology-based treatment. On follow-up, we observed clinical improvement in the majority (5/7) of the positive cases. ***Conclusion:*** Our study highlights the significance of the 99mTc-MDP scan as a crucial alternative modality for the detection and localization of protein leakage sites in both pediatric and adult patients with PLE, thereby improving clinical outcomes.

EP-0421

Lymphoscintigraphic results in patients with lipedema. Preliminary data.

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Aim/Introduction: Lymphoscintigraphy (LS) is the gold standard for diagnosing lymphedema.In our experience, it is required for prognostic evaluation in established clinical diagnoses, differential diagnosis in edema of uncertain origin, and early detection of lymphatic disorder in lipedema.A complete lymphoscintigraphic study includes the investigation of both the superficial and the deep circulation.The alterations can affect both network's drainage simultaneously or even just one. All combinations of superficial and/or deep, uni-or bilateral damage were found.The object of our study was identifying LS patterns in patients with lipedema at 2nd and 3rd stages, or lipohypertrophy. ***Materials and Methods:*** A retrospective study was performed on LSes performed from 2013 to 2021.The exams were performed in a 1st session to visualize the superficial system and in a 2nd session, after 2-4 days, to study the deep circulation.After acquiring static images, performed immediately after the radionuclide injection, continuous segmental motor activity was performed for 45'; whole body images were acquired 1h and 2h after radiopharmaceutical administration. ***Results:*** 247 LSes of the lower limbs were performed.The exams were pooled, on the clinical data, into the following groups: lipedema at the 2nd stage (19 cases), lipedema at the 3rd stage (5), lipohypetrophy (4), suspected or established lymphedema (213), and other (6).In the case of lipedema at 2nd stage, we found no damage in 3 cases (3/19); impairment regarded only the superficial circulation in 2 cases (2/19), and both superficial and deep networks (in various combinations) in 8 patients (8/19); a mechanical insufficiency of deep circulation alone was found in 5 cases (bilateral in 4). In patients with lipedema at the 3rd stage, we found impairment of superficial and deep circulation in 3 cases, while in 2 patients, only the deep network was damaged bilaterally.In the case of lipohypertrophy, we found superficial damage together with deep circulation in 2 cases, while in 4 patients, the impairment regarded deep circulation (bilaterally in 2). ***Conclusion:*** Through LS, damage to lymphatic circulation has already been demonstrated in cases of lipedema. This condition is thought to happen in very evolved cases. Our data suggested that a lymphatic mechanical insufficiency can develop earlier, with different damage patterns. In many cases, the impairment concerns only the deep circulation. These results could motivate a broader but more subtle clinical picture and justify closer monitoring and treatment of lipedema. ***References:*** Reich-Schupke S, et al. S1 guidelines: Lipedema. J Dtsch Dermatol Ges. 2017 Jul;15(7):758-767. doi: 10.1111/ddg.13036. PMID: 28677175.

EP-0422

Exploring the Uptake of [18F]FDG by the Gallbladder in PET Studies: Impact of Biological, Pathological, and Procedural Factors

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Aim/Introduction: [18F]Fluorodeoxyglucose(FDG)-PETiscommonly used in cancer and inflammatory studies. The biodistribution of FDG varies and can be affected by intrinsic or iatrogenic factors. Identifying these factors is crucial for accurately interpreting FDG-PET results. While the gallbladder (GB) typically shows low FDG uptake in routine PET/CT, newer scans reveal increased GB activity unrelated to inflammation or neoplasia. Understanding these factors is essential for interpreting FDG-PET comprehensively. This study aimed to assess the impact of biological, pathological, and procedural factors on FDG uptake by the gallbladder. ***Materials and Methods:*** A unicentric prospective study was conducted in February 2024. Participants aged over 18 years undergoing FDG-PET were enrolled, excluding those with prior gastric/biliary reconstruction or gastroenteropancreatic endoscopic procedures. Biological factors (age, gender, BMI, blood glucose levels), pathological factors (tumor burden including SUVpeak, SUVmax, SUVmed, TLG, MTV, and differentiation between neoplastic and inflammatory/infectious lesions), and procedural factors (temperature, administered activity dose, and acquisition time) were evaluated for their impact on FDG uptake by the gallbladder. ***Results:*** A cohort of 107 patients participated, with 61.7% being males and a mean age of 62 years. Predominantly, solid tumors (64.5%) were examined, followed by hematologic tumors (19.6%) and investigations for infectious/inflammatory foci (15.9%). Mean blood glucose level was 110.2 mg/dL, with an average BMI of 1.76. Patients received an average FDG activity of 205.17 MBq, and imaging occurred approximately 62.3 minutes post-radiopharmaceutical administration. The room temperature remained stable at 22.3°C, contrasting with the external temperature of 13.4°C. Additionally, 14% of patients underwent delayed image acquisition. Statistically significant correlations were found between FDG uptake in the gallbladder, TLG, and biodistribution time, with no significant associations observed with other variables. ***Conclusion:*** Physiological FDG uptake in the gallbladder observed in modern imaging equipment is a norm rather than an anomaly. This uptake can be predicted based on biodistribution time and tumor burden. It is crucial to differentiate this physiological uptake from inflammation to avoid misdiagnosis and unnecessary examinations ***References:*** doi:10.1186/s12880-022-00957-5. doi:10.1097/RLU.0000000000002769.

EP-0423

Evaluation of the Contribution of Prone Positioning in Lung Perfusion SPECT/CT Imaging

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Aim/Introduction: Lung perfusion scintigraphy is a widely used imaging technique for evaluating pulmonary arterial blood flow and diagnosing pulmonary embolism (PE). False positive defects can occur due to the continuous movement of the lungs and diaphragm. Additionally, imaging performed in the supine position may result in less distribution of activity in the anterior parts of the lungs, creating difficulties in evaluating these areas. Our study aims to evaluate the contribution of lung perfusion imaging obtained in the prone position to reporting. ***Materials and Methods:*** We included 131 patients who underwent perfusion SPECT/CT imaging in both supine and prone positions between 2020 and 2024 to investigate pulmonary embolism (PE). Lung parenchyma was evaluated with the CT component of SPECT/CT, and mismatch defects involving at least 2 subsegments or 1 segment were considered positive. Perfusion defects showing filling in either supine or prone imaging were considered false positives. Three different nuclear medicine physicians with varying levels of experience (2, 10, and 14 years) individually evaluated supine (S) and prone (P) SPECT/CT images, as well as combined (S+P) images. The contribution of prone images to reporting was investigated. Additionally, interobserver agreement between two experienced nuclear medicine physicians was evaluated using Cohen's kappa analysis. ***Results:*** In the evaluation of S, the positive reporting rates of the three readers were 53%, 31%, and 24%, respectively. These rates partially decreased in the evaluation of P images (33%, 21%, 20%, respectively), and significantly decreased in the S+P (28%, 17%, 13%, respectively). There was also a significant decrease in the total defect counts for each reader in the evaluation of S+P compared to S (350/208; 236/139; 209/130, respectively). The distribution of defects is given in Table 1, with the most significant changes observed in the anterior regions of the lungs, specifically the right lung medial lobe and the left lung lingular lobe. In the assessment of consistency between the two experienced nuclear medicine physicians, higher agreement was found in the evaluation of S+P and P compared to the evaluation of S (kappa values S: 0.62; P: 0.72; S+P: 0.73, respectively). ***Conclusion:*** In lung perfusion SPECT/CT imaging, obtaining additional images in the prone position reduces false positive results, particularly in the anterior regions, thereby enhancing reporting accuracy. ***References:*** 1.Suzuki, H et al. Prone positioning improves distribution of pulmonary perfusion: noninvasive magnetic resonance imaging study in healthy humans. Eur Radiol 18, 522-528 (2008).

EP-0424

Total-Body Dynamic PET/CT Imaging Reveals Kinetic Distribution of [^{13}N]NH_3 in Normal Organs

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Aim/Introduction: To systematically investigate kinetic metrics and metabolic trapping of [13N]NH3 in normal organs, which remains unclear. ***Materials and Methods:*** Eleven participants performed total-body [13N]NH3 dynamic positron emission tomography (PET). Regions of interest were drawn in organs to obtained time-to-activity curves (TACs), which were fitted with an irreversible two-tissue compartment model (2TC) to investigate constant rates K1, k2 and k3. Additionally, one-tissue compartment model using all of the data (1TCfull) and using the first four minutes of data (1TC4min) were fitted to TAC data. Comparison of K1 and k2 were compared among different models to assess potential kinetic trapping of [13N]NH3 in organs. ***Results:*** Kinetic rates of [13N]NH3 varied significantly among organs. The mean K1 ranged from 0.049 mL/cm3/min in the muscle to 2.936 mL/cm3/min in the kidney. The k2 and k3 were lowest in the liver (0.001 min−1) and in the pituitary (0.009 min−1), while highest in the lung (0.502 min−1) and in the liver (0.800 min−1), respectively. Three groups of organs with similar kinetic characteristics were revealed: (1) the thyroid, the lung, the spleen, the pancreas, and the kidney; (2) the liver and the muscle; and (3) the cortex, the white matter, the cerebellum, the pituitary, the parotid, the submandibular gland, the myocardium, the bone, and the bone marrow. Obvious k3 was identified in multiple organs, and significant changes of K1 in multiple organs and k2 in most of the organs were found between 2TC and 1TCfull, but both K1 and k2 were comparable between 2TC and 1TC4min. ***Conclusion:*** The kinetic rates of [13N]NH3 differed among organs with some have obvious 13N-anmmonia trapping. The normal distribution of kinetic metrics of 13N-anmmonia in organs can serve as a reference for its future potential use in tumor imaging.

EP-0425

Intraobserver concordance analysis of a quantification method of pulmonary reperfusion after pulmonary thromboembolism using lung perfusion SPECT/CT

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Aim/Introduction: Our aim is to analyse intraobserver concordance by applying a method in development for the quantification of pulmonary reperfusion after pulmonary thromboembolism (PTE) using lung perfusion SPECT/CT. ***Materials and Methods:*** We conducted a prospective study of 45 patients in follow-up for PTE who underwent a lung perfusion SPECT/CT at diagnosis and at 6 months post-PTE.For assessment of the degree of pulmonary reperfusion, 3D quantification was performed by manual SPECT/CT segmentation (Q.Volumetrix software, GE). The relative evolution (%) of the perfusion defect (differences in volume and mean counts) at baseline and at scintigraphic control was calculated.Patients were classified into 4 groups according to the degree of reperfusion: complete reperfusion (>80%), major partial reperfusion (>50-80%), minor partial reperfusion (>15-50%) or no reperfusion (≤ 15%).To assess the degree of intraobserver consistency of the method a repeated measurement was made by the same observer.Intraobserver concordance was calculated using the kappa index (κ). According to the clinical impact on the therapeutic decision, 3 variables were considered for analysis (1: no reperfusion; 2: minor partial reperfusion; 3: major partial reperfusion/complete reperfusion). ***Results:*** Of the 45 patients analysed, up to 76% (34/45) showed concordance between the two measurements. Statistical analysis showed substantial-moderate agreement with a kappa value of 0.6.Furthermore, of the 11 patients with non-concordant results between the two measurements, it should be noted that only 4 had strong variability in their interpretation (in one measurement they were considered to be in complete or major partial reperfusion and in the other one in no reperfusion). ***Conclusion:***

This proposed method to assess the degree of pulmonary reperfusion in the context of pulmonary thromboembolism presents an adequate intraobserver concordance. Therefore, it suggests to be a diagnostic support tool, which may have a clinical impact on the therapeutic decision.Since the population studied is limited, the application of this method in a larger number of patients is necessary in order to reach more robust conclusions for a real application in clinical practice.

EP-0426

Potential Impact of Bile Acid Scintigraphy in the Cost and Time Saving of the Diagnostic Process of Chronic Diarrhoea

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Aim/Introduction: To evaluate the potential impact of the scintigraphic study with 75Se-taurocholic acid (SeHCAT scan) on the management of patients with chronic diarrhoea. ***Materials and Methods:*** Retrospective study including consecutive patients undergoing a SeHCAT scan from 21/06/21 to 22/12/22. The retention index (RI) was obtained, determining patients with a negative result (RI>15%) or with mild (10-15%), moderate (5-10%) or severe (<5%) bile acid malabsorption (BAM). For patients with moderate-severe BAM, the following exclusion criteria were applied: insufficient follow-up and complicated concomitant pathology. The diagnostic time delay until the SeHCAT scan was calculated, as well as the total cost of the diagnostic tests performed from the first gastroenterology appointment.The association between the different variables with respect to diagnostic delay and economic cost was analysed using Student's t-test. ***Results:*** One hundred and eighty-four patients were included (70.1% women), with a mean age of 51.97 years (16-87), 59.78% of them presenting a positive SeHCAT scan result for BAM. After applying exclusion criteria, we obtained a sample of 57 patients (23/57 cholecystectomized) with SeHCAT scan results compatible with moderate (43.86%) or severe (56.14%) BAM. During the diagnostic process, the following tests were performed: basic blood test (in 93% of the patients), determination of anti-transglutaminase IgA antibodies (73.7%), stool for microbiology culture (56.1%), faecal occult blood test (54.4%), determination of faecal calprotectin (49.1%), colonoscopy (43.9%) and other studies in a lower percentage. The mean diagnostic time was 59 weeks (1-326) and the mean cost of the diagnostic process prior to SeHCAT scan was €964.71 (325.91-3181.61). Performing the SeHCAT scan after the first gastroenterology appointment was statistically associated with a lower total cost (t=7.272, p<0.001) and a shorter diagnosis time (t=4.299, p<0.001), getting an average saving of €856.2/patient and an average reduction in diagnostic time of 81 weeks. Colonoscopy was the most determining test in the increasing of cost (t=8.202, p<0.001) and diagnostic time (t=3.659, p=0.001). Moreover, 100% of patients presented at least partial clinical improvement after starting medical treatment. ***Conclusion:*** Performing a SeHCAT scan in the early evaluation of patients with chronic diarrhoea could potentially reduce the delay and the cost of the diagnostic process.

EP-0427

Standardization of a hypoallergenic meal for gastric emptying scintigraphy. "One diet to empty almost everyone".

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Aim/Introduction: Several test meals have been proposed for gastric emptying scintigraphy, but any of them consider intolerances or allergens. The aim of the present study is to establish normal values for gastric emptying of a hypoallergenic meal which can be used in all patients. ***Materials and Methods:*** We present a prospective and observational study in volunteers (good health without gastrointestinal diseases and non-previous intra-abdominal surgery except for appendectomy) from 1 centre. Gastric emptying of a novel hypoallergenic meal was assessed by scintigraphy at 0, 30, 60, 110, 120, 130, 180, 230, 240 and 250 minutes after its ingestion. Diet composition: 100g of pasteurized egg labelled with 2 mCi of 99mTc-DTPA, 100g baked potato, 50g white rice, 16mL of olive oil and 120 mL of water. Caloric content of 495 Kcal with nutritional composition of 60% carbohydrate, 21% fat, 17% protein and 2% fiber. We collect clinical and demographic dates (age, gender, body mass index (BMI), menstrual state, menstrual cycle, smoking habit, alcohol consumption). Statistical analysis was based on demographics dates description and covariance analysis between variables. ***Results:*** We included 50 healthy volunteers (median aged 41.46±13.56 years (range 26-69), 29 women and 21 men). Median and standard deviation (5-95th percentiles) at 60, 120, 180 and 240 minutes were 52±9.36 (36.55-70.00%), 22.42±10.47 (6.55-45.00%), 7.92±6.15 (1.55-21.90%), 3.04±2.23 (1.00-9.00%), respectively. Gastric emptying was faster in men than in women at 60 minutes (48.57±10.51 versus 54.48±7.68, p-value=0.026) and at 120 minutes (18.10±11.64 versus 25.55±8.49, p-value=0.011). 5-95th percentiles at 60 and 120 minutes in men were 34.30-76.40% and 4.20-46.80%, respectively, and in women 39.00-70.00% and 13.00-43.00%, respectively. Age was positively correlated with slower gastric emptying at 240 minutes (r=0.344, p-value=0.014). We observed a significant positive correlation between BMI and gastric emptying at 240 minutes (r=0.302, p-value=0.033) and negative correlation in alcohol consumption (r=-0.291, p-value=0.04). Smoking habit, menstrual state and menstrual cycle did not affect gastric emptying values. ***Conclusion:*** This study provides gastric emptying values in healthy subjects using a hypoallergenic meal, alternative to the previous meals described and applicable to other departments. ***References:*** 1. Tougas, G. et al. Standardization of a Simplified Scintigraphic Methodology for the Assessment of Gastric Emptying in a Multicenter Setting. The American Journal of Gasroenterology, 2000;95(1), 78-86. 2. Abell, T.L., et al. Consensus recommendations for gastric emptying scintigraphy: A joint report of the American neurogastroenterology and motility society and the society of nuclear medicine. American Journal of Gastroenterology, 2008;03(3), 753-763.

EP-0428

Analysis of the measurement of the retention index 75SeHCAT with collimated gamma camera by different mathematical methods

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Aim/Introduction: Diarrhea resulting from bile acid malabsorption (BAM) is a prevalent yet often overlooked cause. The assessment of [75Se]tauroselcholic acid retention (75SeHCAT) is the gold standard diagnostic method. With over 20 years of experience conducting this test at our center, recent published studies indicate variances in the retention index (RI) with and without the use of the collimator. The aim of this study is show that employing the collimator during the acquisition process does not introduce uncertainties on the final diagnosis. ***Materials and Methods:*** Prospective study involving 103 patients (p) with suspected bile acid malabsorption (BAM), the RI of 75SeHCAT was evaluated. All patients underwent RI measurements following a minimum 4-hour fast and were administered a capsule containing 0.37 MBq of 75SeHCAT. Measurements were conducted in anterior and posterior projections with patients positioned supine and centered on abdominal region, using a large field of view (LFOV) gamma camera equipped with two low energy, high resolution, high sensitivity (LEHRS) dual-peak collimators at 136-264 KeV. Images were captured at 3 hours and 7 days, with acquisition times of 5 minutes each, and a fixed distance of 15 cm. A normal RI was defined as greater than 10%. Patients were categorized based on their weight, using body mass index (BMI), and RI results were compared between the geometric means of patient/background activity on days 0 and 7, in comparison to the equation recommended by Gregory James et al. ***Results:*** Out of the 103 patients (p) assessed, 70.8% (73 female), with ages from 21 to 79 years. The average BMI was 27.6 (14.9 to 48.8), and 59% of patients were classified as overweight or obese, having a BMI>24.9. The average retention rate was 13.9% (0-80.5%). The mean absolute error of the retention rate was 0.13% (maximum error 0.88%). Among all evaluated patients, there were no statistically significant differences detected in the utilization of collimator gamma cameras and retention index estimation methods that could impact the final diagnosis, irrespective of BMI. ***Conclusion:*** The RI of 75SeHCAT using collimated gamma cameras, as per our protocol, demonstrates no significant difference when compared to the equation endorsed by Gregory James et al., and no patient had change in diagnosis. Furthermore, the utilization of collimated gamma cameras offers advantages over non-collimated imaging, as it is easily integrated into routine clinical workflows and mitigates the risk of detector damage due to enhanced protection.

EP-24

e-Poster Area

B: Imaging Clinical Studies -> B3 Other Oncological Clinical Study -> B31 Radioguided Surgery and Radiation Therapy Planning

EP-0429

Exploring the use of a mobile high resolution PET/CT-camera for imaging surgical specimens in (para)thyroid surgery

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Aim/Introduction: We evaluated a compact mobile PET/CT camera designed to capture submillimeter resolution images of surgical specimens. Initial clinical trials indicate its positive impact on breast and prostate cancer surgeries, primarily through precise assessment of surgical margins. We investigated its potential application in thyroid cancer and parathyroid adenoma surgeries. ***Materials and Methods:*** This investigator-initiated study assessed a mobile PET/CT device's performance in a general hospital with a significant caseload of thyroid and parathyroid surgeries. We explored various clinical scenarios to gauge the peroperative PET/CT's utility in managing thyroid cancer and hyperparathyroidism. In thyroid carcinoma cases, 4 MBq/kg FDG was intravenously injected 1h before tumor or lymph node removal, while for parathyroidectomy, 2-4 MBq/kg F18-Choline was administered. The device captured images of the surgical specimen within 10minutes, allowing immediate review of PET and CT images by the surgeon in the operating room. Specimen PET/CT images were compared with pathology findings. ***Results:*** We tested the mobile PET/CT in 4 procedures involving thyroid carcinomas: 1 total thyroidectomy with lymphadenectomy and 3 interventions for lymph node recurrence, with/without local thyroid recurrence. The technique facilitated margin assessment for recurrent thyroid carcinoma, particularly in delicate areas. Assessment of lymphadenectomy specimens, when compared with pre-operative FDG PET/CT images, aided in confirming complete lymph node removal. One thyroid cancer patient exhibited small FDG avid lymph node recurrences in both sides of the neck on pre-operative FDG PET/CT. However, precise delineation of the lesions was hindered by significant physiological brown fat uptake. Administration of propranolol on the day of surgery effectively suppressed the brown fat uptake, enabling clearer identification of the lesions when the surgical specimen was scanned. Peroperative PET/CT findings aligned with pathologists' conclusions in all but one node. The mobile PET/CT was also evaluated in 3 hyperparathyroidism patients undergoing parathyroidectomy. Within 10minutes post-resection, the device assessed F18-Choline avidity of the suspected parathyroid adenoma. High SUVmax values correctly predicted adenoma removal, allowing surgeons to review images before frozen section results, thus shortening intervention times. Further analysis indicated that reducing administered activities by a factor of 2-4 still resulted in satisfactory image quality. ***Conclusion:*** This study marks the initial exploration of peroperative use of a mobile high-resolution PET/CT camera for imaging surgical specimens of thyroid carcinoma and parathyroid adenoma in the operating room. The device demonstrated significant utility in

thyroid carcinoma (using FDG) and parathyroid adenoma (using F18-Choline) surgeries, showcasing promising applications for future clinical practice.

EP-0430

Use of 125I Seeds in Breast Tumor and Axillary Labeling Prior to Conservative Surgery in Patients with Response to Neoadjuvant Chemotherapy (NAC)

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Aim/Introduction: Assessment of labeling with 125I seeds in residual tumor and positive axilla in breast cancer patients who have received NAC and are candidates for conservative surgery. ***Materials and Methods:*** Prospective study of 38 patients diagnosed with breast cancer (average age 57.2 ± 11.6 years) who, after NAC, are candidates for conservative surgery and staging via sentinel lymph node biopsy. Labeling with 125I seeds was performed in the residual tumor and, in cases with pre-NAC metastatic axilla, in the previously biopsied lymph node (marked with a coil). Post-NAC radiological response was assessed with mammography, ultrasound, and MRI, classified as complete response, major partial response, minor partial response, and no response. Concordance between the sentinel lymph node and labeling with 125I seeds was evaluated. ***Results:*** 52.63% (20/38) had a complete radiological response, 39.47% (15/38) had a major partial response, and 7.89% (3/38) had a minor partial response. 39.47% (15/38) also had axillary labeling due to pre-NAC positive lymph nodes. 10.52% (4/38) required rescue surgery in a second time due to insufficient margins: in 3 cases, mastectomy was performed, and in 1 case, margin enlargement was performed. 38.23% (17/38) had no residual tumor (all with complete response). The size of the residual tumor in partial response cases was 17.53 ± 10.65 mm. In the 15 cases with pre-NAC positive axilla, at least 3 lymph nodes were obtained in all of them: in 7 cases (46.66%), it coincided with the isotopic sentinel lymph node. In 8/15 (53.33%), lymphadenectomy was completed due to metastasis. ***Conclusion:*** Labeling with 125I seeds in breast cancer after NAC is a technique that facilitates complete tumor resection in the context of breast-conserving surgery. Similarly, labeling of axillary lymph nodes with imaging response to NAC ensures detection and accurate staging with sentinel lymph node biopsy in this patient group.

EP-0431

Usefulness of roll technique in injuries/adenopathies in the cervical region. Our experience

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Aim/Introduction: Radioguided localization of occult lesions (ROLL) in oncological surgery consists of the direct administration of a radiopharmaceutical to a target lesion. In recent years this technique has spread, allowing lesions and/or metastases of different tumor strains to be located.Assess the usefulness of the ROLL technique in radiologically suspicious lesions/adenopathy and/or with histological confirmation of malignancy in the cervical region. ***Materials and Methods:*** Retrospective study of 7 patients (p), referred to our service from February 2020 to June 2023, to perform the ROLL technique for lesions/adenopathy in the cervical region, after evaluation by the multidisciplinary committee. Together with the radiology service and using ultrasound guidance, we marked radiologically suspicious lesions/adenopathy (2 PET-Dopa and 4 PET-^{18}F-FDG, finding 14 pathological lesions) and/or histologically confirmed by FNA.1 mci of MAA-99mTC was administered to each of the lesions, subsequently, 60 minutes later, lymphoscintigraphy with planar images and SPECT-CT of the neck was obtained. With the help of a gamma detector probe, surgical excision was performed the day after marking. Demographic data, histology of the primary tumor, number of marked lesions, location of the lesions, correlation between marked lesions and histopathological findings and clinical follow-up were collected, mean follow-up: 26 months (M) (9-50 M). ***Results:*** Mean age 50 years old, 57% women and 43% men, 6p with a history of thyroid CA: 3p medullary CA and 3p with papillary CA; 1p with a history of difuse large B cell lymphoma (DLBCL). 18 lesions/adenopathy were marked, of which 72% (13) were positive for malignancy, 28% (5) were negative. All lesions/adenopathy were located and removed during surgery.In all patients with thyroid CA, laterocervical dissection was performed, finding 7 lesions/adenopathy positive for malignancy that were not previously marked.In the patient with DLBCL, only the marked lymphadenopathy was resected, which was suggestive of Castleman Disease.Of the patients with thyroid CA, 6p have stable disease and 1p with medullary thyroid CA with distant progression (mediastinum and hepatic). ***Conclusion:*** The ROLL technique is a useful technique in localizing previously marked lesions/adenopathy in this group of patients, ensuring their histopathological correlation.In patients with thyroid cancer, the ROLL technique added to the laterocervical dissection procedure has allowed the surgical removal of metastases, obtaining adequate locoregional control of the disease.

EP-0432

Radioguided surgery with [^{125}I] seeds for localization of non-palpable malignant breast lesions. Experience in our center and analysis of the learning curve

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Aim/Introduction: Since 2005, our center has been performing selective sentinel lymph node biopsy and radioguided localization of occult lesions (ROLL). In 2021, radioactive seed localization (RSL) with [125I] was implemented and to date we have performed more than 400 procedures with this technique. Our objective is to verify an improvement in the results of surgery with [125I] RSL over time in our center. ***Materials and Methods:*** Descriptive study of 2 sample groups (mean age: 57 and 60 years respectively) corresponding to the first 30 and last 30 patients (first and last group) undergoing [125I] RSL of non-palpable malignant breast lesions. The following variables were analyzed: affected quadrant, histological type, closest margin to tumor, surgical piece volume, tumor volume, healthy tissue volume (surgical - tumor volume), ideal volume (adding 1 cm of margin to the tumor radius). surgical/ideal volume ratio, number of intraoperative margin widenings and number of reinterventions. ***Results:*** In both groups, the most frequent tumor location was the upper outer quadrant (58.3%), the histological type was infiltrating ductal carcinoma (80%), and the closest margin to tumor was the posterior margin (55%). The mean tumor volume of the first and last group was 1.5 and 1.3

cm3 respectively. A total of 15 intraoperative margin widenings were performed, 10 (66%) in the first group and 5 (33%) in the last one, finding presence of tumor cells in 6 of them: 5 (83%) in the first group and 1 (17%) in the last one. Likewise, 8 surgical reinterventions were performed, 5 (63%) in the first group and 3 (37%) in the last one, finding tumor cells in 4 of them: 3 (75%) in the first group and 1 (25%) in the last one. Considering patients with free margins, there were no significant differences between the first and last group when comparing healthy volume resected (33 vs 32.6 cm3 respectively) nor the surgical/ideal volume ratio (2.4 vs 2.2). Given that, between the first and last group, the number of margin widenings and reinterventions decreased by 50% and 40%, these results show an improvement in the localization of lesions while respecting the surgical margins. ***Conclusion:*** [125I] RSL is a useful and effective technique for localizing occult breast lesions and requires a learning curve to improve its surgical performance.

EP-0433

Quantitative analysis of 99mtc-sestamibi parathyroid scintigraphy: An accessible tool in single parathyroid adenoma localization prior to minimally invasive radioguided surgery

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Aim/Introduction: To evaluate the accuracy of quantitative analysis of early-phase in parathyroid scintigraphy with 99mTc-sestamibi for the localization of single parathyroid adenomas before minimally invasive radioguided surgery. ***Materials and Methods:*** A retrospective study was conducted, including 49 patients who underwent minimally invasive radioguided surgery based on clinical diagnosis and scintigraphic localization of single parathyroid adenoma. Quantitative analysis of early-phase in parathyroid scintigraphy was performed by using workstation (Xeleris, GE Healthcare). Initially, the activity of the parathyroids in both thyroid lobes was compared in early image. Subsequently, symmetrical regions of interest (ROIs) containing the same number of pixels were placed over the activity in both thyroid lobes in the early image. A ROI ratio was calculated by dividing the number of counts (Kc) from the side with higher activity by the number of Kc from the contralateral side. The ROI ratios were used to assess the accuracy of quantitative analysis using ROC analysis. The optimal cutoff point for localizing a single parathyroid adenoma was identified using the Youden index. ***Results:*** The studied cohort had a mean age of 66.6 ± 11,7 years with 67.3% being female. In 79,6% of cases, histopathological analysis confirmed the presence of a parathyroid adenoma. Quantitative evaluation showed an area under the curve of 0.64 (95% CI 0.46-0.82 Regarding adenoma localization, an optimal cutoff point of 1.13 was identified, with a sensitivity of 58.9%, specificity of 70.0%, positive predictive value of 88.4%, and negative predictive value of 30.4%. ***Conclusion:*** Quantitative image analysis of the early-phase technetium-99m sestamibi scintigraphy is a useful method for identifying single parathyroid adenomas, because of its high positive predictive value. This aspect is particularly beneficial in uncertain situations where conventional visual analysis is limited. Therefore, its use may reduce the need for resorting to more expensive diagnostic methods for localization of the adenoma responsible for hyperparathyroidism.

EP-0434

Development and Implementation of a Standardized Protocol for I-125 Seed Localization Technique (ROLL) across Diverse Pathologies: Initial Experience

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Aim/Introduction: The primary aim of this study is to assess the efficacy of the standardized protocol developed at our institution for I-125 seed implantation, facilitating accurate localization of occult lesions. Secondary objectives encompass evaluating the safety profile of the implantation procedure, encompassing the incidence of intra- and postoperative complications. Additionally, we aim to analyze seed retention at the implantation site to ensure precise localization during subsequent surgical interventions. Clinical outcomes will be described, and the success rate of the technique will be determined. ***Materials and Methods:*** Cases necessitating radio-guided occult lesion localization (ROLL) between April 2023 and March 2024 were included in the study. A systematic workflow was established, comprising seed implantation, radiological confirmation of intralesional localization, surgical extraction, and radiological assessment of the specimen. Nuclear medicine specialists provided assistance in histopathological processing and seed retrieval. ***Results:*** A total of 103 seeds were successfully implanted in 72 patients, with 96 guided by ultrasound and 7 by CT scan. Breast pathology constituted the majority, with 87 cases (84,4%), while the remaining cases consisted of 2 melanomas (1.9%), 7 lung carcinomas (6.7%), and 7 axillary lymphadenopathies(6.7%). In all instances, seeds were accurately localized within the lesions, with complete lesion retrieval achieved in 86% of cases without margin involvement. In seven cases, portable gamma cameras facilitated real-time intraoperative assessment, with three incidents (4.1%) observed during seed extraction. ***Conclusion:*** The adoption of a standardized protocol for the ROLL technique using I-125 seeds has yielded a 100% success rate in lesion localization, with a minimal incidence of complications, thus underscoring its safety and reproducibility across diverse clinical scenarios. This approach demonstrates its utility as a reliable adjunct in clinical practice, regardless of surgical complexity, thereby enhancing precision and patient outcomes.

EP-0435

Molecular surgery in breast cancer: our first experience.

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Aim/Introduction: The aim of this paper was to analyse the usefulness of molecular imaging in the localization and assessment of affected edges in breast cancer. Additionally, the effectiveness and safety of the standardised work protocol (SWP) developed in

our centre were evaluated. ***Materials and Methods:*** Descriptive and prospective study. Patients diagnosed with breast cancer who had surgical indication and hypermetabolic lesions in preoperative positron emission tomography (PET) and computed tomography (CT) were included from November 2023 to March 2024. A SWP for radioguided surgery was elaborated. The procedure consisted in a preoperative intravenous injection of 18F-FDG, followed by surgical intervention assisted by a nuclear medicine physician who localised the lesion with a gamma probe. Afterwards, the surgical specimen and its edges were assessed in a 5-minute PET-CT image and subsequent histopathological analysis (HA). A dosimetric study with radiological protection physicist was performed in the first two surgical procedures. ***Results:*** Seven radioguided surgeries (4 lumpectomies, 2 mastectomies and a systemic ROLL of an axillary adenopathy) were performed. The surgical specimens corresponded to 6 breast lesions (luminal A infiltrating carcinoma, luminal B with neoadjuvant treatment, luminal A infiltrating lobular carcinoma, 2 triple negative with neoadjuvant treatment and a local relapse due to spindle cell sarcoma) and a triple negative axillary lymphadenopathy. 100% of the lesions were located, 6 pieces and 36 surgical edges were analysed. There was a correlation between PET-CT imaging results and HA in 30 edges (24 negative and 6 positive, 83% agreement). However, discordances were found in 6 of the analysed edges. No complications occurred during the nuclear medicine procedure or the surgical intervention. ***Conclusion:*** Hybrid molecular imaging techniques following our SWP have shown to be helpful in lesion's localization and the assessment of surgical edges without increasing surgical timing or an additional dosimetric risk. Despite our reduced sample, this technique could be used in the future as an intraoperative tool, reducing the need for other surgical interventions, but further investigation is needed.

EP-0436

Offline PET Proton Therapy Verification Protocol: A Fast Transport Trial Using Total-body PET/CT

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Aim/Introduction: Verification of proton therapy is difficult as proton beams cannot penetrate human body to provide tomographic information for imaging. While, high energy proton beam generates isotopes that decay by positron emission. Positron annihilation produces 511 keV photons and a PET scanner can receive signals indicating the annihilation location. The proton range is concordant with the generated isotope location. Now PET is the only method amenable to noninvasively finishing proton therapy verification. Due to the extremely short halflife of proton-produced isotopes, the time interval between proton therapy and PET scan is vital for the PET verification process. In this research, we proposed a clinical trial using total-body PET/CT to verify proton therapy within an extreme short time. ***Materials and Methods:*** Tongji Hospital, Wuhan, China has a proton therapy gantry on the first floor and a total-body PET/CT on the second floor. The close layout of the two devices makes it proper to run offline PET verification protocol of proton therapy. The protocol is designed to finish PET scan as fast as possible after patient receives proton therapy. One mobile stretcher was used to transport patients between two devices. Overhead lasers were applied to locate and place patient on PET coach quickly. A total-body PET scan was then performed for at least 30 minutes to obtain enough counts for PET image reconstruction due to proton-excited radionuclides' low activity and short halflife. After PET scan, attenuation correction CT is performed to provide attenuation and anatomical information. PET images are reconstructed using a long decay constant (2.6 years) to unify different halflife of mixed isotopes. Dynamic total-body PET images are generated to track the metabolism of radionuclides or the so-called "washout effect". ***Results:*** We used a polymethyl methacrylate (PMMA) phantom to verify the protocol's time consumption and image quality. The protocol ran smoothly at Tongji Hospital, with only 70 seconds of transport time. A Monte-Carlo simulation of phantom PET image showed good cooperation with proton therapy range. Following study will focus on head & neck tumor patient verification before clinical application. The estimated time for patient transport time is 90 seconds. ***Conclusion:*** We proposed a fast transport proton therapy offline PET verification protocol and did phantom verification. This protocol can run fluently and show offline PET an efficient and precise way for proton therapy PET verification.

EP-0437

Clinical utility of PET/CT-guided metabolic biopsies in diagnosing metastatic or doubtful lesions

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Aim/Introduction: PET imaging offers metabolic information complementing CT scans, potentially aiding in the localization and characterization of lesions with increased metabolic activity. The integration of PET/CT-guided metabolic biopsies offers a promising approach to resolve diagnostic uncertainties and improve patient outcomes. The present study is aimed to investigate the utility of PET/CT-guided biopsy in diagnosing metastatic or doubtful lesions with a focus on improving diagnostic precision and guiding optimal clinical management strategies. ***Materials and Methods:*** A total of 18 patients (13 male; 8 female) with mean age 50.44±13.16 years initially underwent 18F-FDG PET/CT imaging for lesion characterization and identification. Biopsy was performed either on the same day that the whole-body PET/CT examination was performed or on another day (injection of lower activity of 18F-FDG, 110-185 MBq), after discussion with the referring physician, with use of the same PET/CT scanner used for the whole-body examination. We used a PET/CT-guided robotic positioning system (Maxio v2, Perfint Healthcare) that assists in fast and submillimeter and subdegree accuracy in targeting lesions accurate tumor targeting and tool placement for interventions, including biopsy. The pathologic diagnoses from PET-guided biopsies were compared with the final diagnosis based on findings from pathologic, clinical, and radiologic follow-up examinations. ***Results:*** Of the 18 patients assessed, 16 were oncology patients with suspected metastasis or residual disease. The pathologic diagnosis was not known for remaining 2 patients with clinically suspected benign (n = 1) or malignant (n = 1) disease. Fifteen (12) soft tissue lesions (including muscles, intercostal spaces, liver and lung nodules), 3 lymph nodes and 3 bony lesions were targeted. All procedures were technically successful and safe, and no major complication was observed. Pathologic diagnosis was confirmed for 16 patients, for a diagnostic yield of 89%. For 2 patient for whom repeat biopsy was advised due to presence of scanty fibro-collagenous tissue with focal foreign body giant cells. Biopsy results revealed 8 true-positive findings, 7 true-negative findings, zero false-positive findings, and 3 false-negative finding. The sensitivity, specificity,

positive predictive value, negative predictive value and accuracy for the detection of malignancy were 72.7%, 100%, 100%, 70%, and 83.33%, respectively. The procedure was helpful in determining the treatment plan for 91.7% of patients. ***Conclusion:*** The integration of PET/CT-guided metabolic biopsies into clinical practice has the potential to optimize patient management strategies and facilitate timely initiation of appropriate treatments.

EP-0438

Utility of Radioactive Iodine125 seed as preoperative method for localization of cervical thyroid cancer recurrence.

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Aim/Introduction: The use of radioactive seeds (RSL) has been documented for lesions localization in patients with recurrence or persistence of thyroid cancer. Our group wanted to evaluate its usefulness to improve the surgical result in patients re-operated of cervical metastasis of thyroid cancer. ***Materials and Methods:*** Prospective study with twenty three patients (19/4 F/M) with a mean age of 48.6 years (21-71) with differentiated thyroid carcinoma with cervical lymphatic involvement due to recurrence/persistence evidenced by ultrasound and confirmed by cytology and/or Tg-FNAB, submitted to new surgical intervention with curative purpose. Prior to surgery, an I-125 seed was placed, under aseptic conditions and under local anesthesia, in the target lymph node using an 18G needle guided by ultrasound performed by an endocrinologist with experience in the follow-up of thyroid cancer. Its correct position was verified by a radiation detector and ultrasound image. In the operating room, we used a gamma probe (Navigator GPS®) and a portable gamma camera (Oncovision Sentinella 102®) were utilizes to identify the maximum activity point (125-I seed) in order to locate the suspicious lymph node. We locate this point within the surgical field, removing the target tissue and verifying that the seed was included in the excised tissue. Analysis of seed placement time, surgical procedure duration and difficulty, lesion size and localization, surgeon advantages, average nodal index and pre and post surgery TG levels. ***Results:*** All marked lymph nodes were positive in histology (33 metastatic nodes). The mean duration of the sonographic insertion was 14±3.99 minutes. Days from placement prior to surgery was 3,2 days (1-7) and average surgical duration was 40 min (12-120). The average nodal index of 0,77. The average maximum diameter of excised lypnh nodes was 11,05±5.53 mm. Presurgery levels Tg levels were 6,4±3.17 ng/dl significantly decreased after surgery 0,97±0,0.46ng/dl ($p < 0.05$) with positive antithyroglobulin antibodies were three. There was not major complications. In three cases, seed migrated near the lesion but only in two cases seeds were not helpful. Surgery team evaluation average was excellent (2,6/3) considering radioguided surgery was faster and safe in node location. ***Conclusion:*** The implementation of the RSL has shown benefits for the patients and for surgery team, as a safe and uncomplicated procedure, reducing surgical time and improving the programming of the operating room activity.

EP-0439

PET integration in re-irradiation treatment planning for recurrent high-grade gliomas: impact on patient outcomes.

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Aim/Introduction: Conventional radiation therapy planning of recurrent high grade gliomas (rHGG) is based on magnetic resonance imaging (MRI). Because positron emission photography with amino acid tracers (AA-PET) is known to delineate HGG more accurately than MRI, PET has been integrated into re-irradiation treatment planning of rHGG by some academic and non-academic centers. Yet, impact of PET-guided re-irradiation treatment on patient outcomes is still unknown. Thus, the aim of this study was to evaluate the impact of AA-PET-guided re-irradiation treatment planning on progression-free survival (PFS) and overall survival (OS) of patients with rHGG. ***Materials and Methods:*** Our institutional database was searched for patients with the first recurrence of a HGG, who had been treated with radio(chemo)therapy alone, i.e., without re-resection, and for whom data on PFS, OS, and quality of life (QoL) were available. Out of 80 identified patients, 28 and 52 were treated based on MRI alone and MRI plus AA-PET, respectively. The Kaplan-Meier analysis was performed to evaluate the impact of AA-PET integration on the primary (PFS and OS) and secondary (QoL) endpoints. ***Results:*** The MRI alone group showed a significantly shorter PFS compared to MRI plus PET group (mean 3.6 vs. 8.1 months, $p=0.005$). No significant difference was found for OS (mean 16.1 vs 16.9 months, n.s.). Age significantly impacted PFS, while WHO grade, Karnofsky performance scale and time to recurrence significantly impacted OS. No significant impact of tumor to background ratio was found. The total dose delivered to patients showed a significant impact on QoL in the acute phase. The difference in planning target volume between two groups was not significant. ***Conclusion:*** Integration of PET into re-irradiation treatment planning of patients with rHGG significantly improved PFS. However, there was no significant impact on OS. These results are no unexpected, because in a longer term other factors such as variability in patient general condition, tumor biology, and treatment may overweight the initial benefit of a more efficient AA-PET-guided rHGG re-irradiation. These results play an important role in understanding of rHGG and might impact patient management.

EP-0440

Radio-guided surgery for non-palpable lesions in different clinical scenarios

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Aim/Introduction: Thanks to advances in imaging techniques, it is possible to detect non-palpable lesions that can be located and biopsied through radio-guided surgery. The objective of this study was to analyse our experience in radio-guided surgery for non-palpable lesions (ROLL) in different pathologies. ***Materials and Methods:*** Retrospective study that includes all consecutive patients referred for marking non-palpable lesions to the Nuclear Medicine Service from December 2017 to March 2024. Data

collected was based on: the service of origin, initial imaging technique, location and size, technique used for marking, success rate of marking and excision and pathological data. The labelling techniques used were the ultrasound-guided injection of 99mTc-albumin macroaggregates with 18.5MBq or 37MBq in a volume of 0.1 ml of physiological saline, depending on whether the excision was performed on the same day of inoculation or the following day, and the eco-guided seed arrangement 125-I.The labelling success rate was verified by reviewing planar scintigraphic ± SPECT/CT acquisitions. Surgical removal of the lesion was assisted by a gamma probe and in some cases a portable gamma camera. ***Results:*** A total of 64 lesions were marked in 62 patients, 39 (62.9%) were women, with a mean age of 56±13.9 years. Of the total, 51 came from plastic surgery, 10 from breast surgery and 1 from endocrine surgery. Most lesions were initially located by CT (46.8%) followed by PET/CT (30.6%), ultrasound (21.0%) and mammography (1.6%). A total of 48 (75.0%) lesions were marked with 99mTc-macroaggregates and 16 (25.0%) with 125-I seed. The location of the lesions was 37 (57.8%) axillary region, 13 (20.3%) inguinal, 6 (9.4%) cervical and 8 (12.5%) in other locations (dorsal, sartorius, pectoral). The median size was 20.5 mm (IQ: 18.0-26.0). The marking and excision technique was successful in all lesions. Oncological anatomopathological findings were positive in 7/13 patients with melanoma, 19/25 lymphoproliferative syndromes, 5/8 breast neoplasms and in 5/16 patients with other pathologies (fever of unknown origin, dermatofibroma protuberans and recurrence of thyroid cancer). ***Conclusion:*** Our experience in the ROLL technique has proven to be simple, safe and effective in detecting and biopsying non-palpable lesions, allowing pathological study of suspicious lesions. A technique requires multidisciplinary work between radiology, nuclear medicine and surgery.

EP-0441

Analysis of response and survival following treatment by hepatic radioembolization for unconventional indications

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Aim/Introduction: Based on a multidisciplinary selection, some patients with dominant hepatic metastatic disease of hypervascular nature might benefit from treatment by radioembolization (SIRT). However, the literature on SIRT for indications not listed in international guidelines and referred to as unconventional (NC) is limited. The objective of this study is to evaluate survival (in comparison to our SIRT cohort for colorectal cancer (CRC)) and response after SIRT treatment for NC indications. ***Materials and Methods:*** In this single-center retrospective study, overall survival (OS) and progression-free survival (PFS) data were collected for 37 patients with NC indications and for 65 patients with CRC treated in our institution. On the other hand, the response to treatment was analyzed for each patient and for each lesion according to RECIST and PERCIST criteria. Kaplan-Meier survival curves were used to compare OS and PFS between NC and CRC. The Mann-Whitney test was used to compare the absorbed dose between responder and non-responder patients/lesions respectively for RECIST and PERCIST criteria. ***Results:*** The median OS for NC was 501 days and the median PFS was 58 days. The median OS for CRC was 408 days and the median PFS was 57 days. There was no difference in OS (adjusted HR: 0.90; 95% CI: [0.59-1.38]; p=0.64) or in PFS (adjusted HR: 0.84; 95% CI: [0.55-1.28]; p=0.40) between NC and CRC. In the patient-based analysis, the minimum absorbed dose was similar between patients categorized as responders compared to non-responders according to RECIST and PERCIST criteria (p=0.43 and p= 0.62 respectively). In the lesion-based analysis, the absorbed dose was similar between lesions categorized as responders vs. non-responders according to RECIST and PERCIST criteria (p= 0.77 and p= 0.61 respectively). ***Conclusion:*** Our study did not show a difference in OS and PFS between NC indications and our SIRT cohort for CRC. We did not demonstrate a relationship between absorbed dose and response according to RECIST/PERCIST criteria in analysis by patient or by lesion.

EP-0442

Performance of DROP-IN beta probe for 68Ga-PSMA-11 in high-risk prostate cancer patients eligible for robotic-assisted radical prostatectomy.

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Aim/Introduction: The primary aim of this analysis was to evaluate the diagnostic accuracy of the combined approach with a DROP-IN positron detector (β-Probe) and 68Ga-PSMA-11 PET/CT (PSMA-PET) in the correct identification of lymphnode metastases, in high-risk prostate cancer (PCa) patients undergoing robotic radical prostatectomy (RARP) and extended pelvic lymph-node dissection (ePLND). The standard of reference was the histopathological analysis. ***Materials and Methods:*** This is a prospective, single-arm, single-center, non-interventional, phase II trial (NCT05596851), aimed at enrolling fifteen (n=15) PCa patients. We present an interim analysis in the first eight consecutive (n=8) patients enrolled. Inclusion criteria were: a) biopsy proven, high-risk PCa; b) patients candidate to RARP + ePLND as primary therapy; c) PSMA-PET performed within 6 weeks prior to surgery; d) PSMA-positive nodes in PSMA-PET; e) age>18. The surgery procedure started with the intravenous injection of 1.1 MBq/Kg of 68Ga-PSMA-11 directly in the surgery theatre. After the injection the surgery procedure proceeded first with ePLND followed by RP. The in-vivo measurements of the surgery templates with β-Probe were performed with a DROP-IN system, inserting the probe into a trocar. All removed nodes were also measured ex-vivo. The tumor-to-background-ratio (TBR). was evaluated graphically in a display showing real-time counts per time. Furthermore, a dedicated, operator-independent, algorithm to reliably identify pathologic vs. non-pathologic nodes was developed. PSMA-staining was performed in all specimens. Data derived by the PSMA-PET, β-Probe and histopathological analysis were compared in a per-region analysis. ***Results:*** The live β-Probe-guided ePLND was a feasible procedure, without significant changes in the surgery practice. No side effects have been observed during ePLND. In total, 64 specimens were removed and analyzed. Pathology results were used to validate in vivo and ex-vivo β-Probe counts interpreted according to the operator-indipendent algorithm. Four (n=4) false positive and seven (n=7) false negative findings were detected. The intra-operative β-Probe sensitivity to detect PCa nodal metastasis was 76.7%, while specificity was 88.2%. ***Conclusion:*** These are the first ever published data derived from a live surgery experience using a β-Probe to identify PSMA-positive lymph nodes. This new approach proved to be feasible and safe. Visual TBR interpretation (operator-dependent) revealed to be

more challenging than expected. After the implementation of a dedicated, operator-independent, algorithm for the identification of a cut-off in TBR analysis, the diagnostic accuracy improved. The completion of this phase II trial will provide more data about the efficacy of this new generation image-guided approach.

EP-0443

Pulmonary radioguided occult lesion localization (ROLL) by electromagnetic navigator-guided bronchoscopy (ENGB) in a single surgical time.

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Aim/Introduction: Our aim was to evaluate the success rate of ROLL technique with 99mTC-MAA using electromagnetic navigator-guided bronchoscopy (ENGB) in the intraoperative localization of small lung nodules and resection with video-assisted thoracoscopy (VATS) in a single surgical time. ***Materials and Methods:*** EBGN was performed under general anesthesia by a thoracic surgeon.The target lesion was localized using a therapeutic bronchoscope and a working set consisting of an extensible channel (2.7 mm diameter x 1070 mm long) and a localization guide with an electrode at the tip to navigate the electromagnetic field. ROLL is performed intralesionally or as close as possible with a range of 2 cm using a 21G needle 137 cm long with a 2 mm working channel. Radiotracer 99mTc-MAA (37-185 MBq) was administered in a volume of 0.6 ml under simultaneous visual control with a portable gamma camera. Subsequently, lung resection was performed using a video-assisted approach (VATS) or thoracotomy. Intraoperatively, the radiolabeled area was located with a laparoscopic gamma probe and surgical resection was performed with endograpators. The radioactivity in the specimen and its location were confirmed ex-vivo using a gammaprobe and a portable gammacamera. ***Results:*** A total of 19 lung ROLL techniques were performed between 2022 and 2024. The majority of patients (75%) were male, with an age range of 21 to 86 years. The last imaging technique performed prior to surgery was a chest CT in 62.5% of cases and PET-CT in 37.5%. The dimensions of the lung lesions ranged between 5-21 mm (mean 10.9 mm). They were located in left upper lobe (47%), left lower lobe (26%), right lower lobe (15.8%) and right upper lobe (10.5%). By diagnostic imaging techniques, 62.5% of the marked lesions were solid, 25% subsolid nodules/nodular opacities and 12.5% cystic lesions. Among 19 ROLL procedures, only three resulted unsuccessfully, two of them due to an incorrect localization of the navigator and the other one because of technical difficulties. A total of 84% of pulmonary lesions were successfully detected. ***Conclusion:*** Pulmonary ROLL using electromagnetic navigator is a simple, reliable and reproducible technique. It facilitates intraoperative localization in the same surgical act. The concurrent monitoring of the radiotracer administration with a portable gamma camera could potentially enhance the success rate.

EP-25

e-Poster Area

B: Imaging Clinical Studies -> B3 Other Oncological Clinical Study -> B32 Sentinel Node

EP-0444

Impact of neoadjuvant chemotherapy on sentinel lymph node performance and recurrence-free survival in breast cancer patients

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Aim/Introduction: To assess the impact of neoadjuvant chemotherapy (NAC) on sentinel lymph node (SLN) biopsy performance and recurrence-free survival (RFS) in patients with breast cancer (BC). ***Materials and Methods:*** Retrospective study including 107 women (mean age: 51.7±11.6, 28-80 years) with BC treated with NAC who underwent SLN biopsy between 2018 and 2023. Histological type was invasive ductal carcinoma (IDC) in 73 patients (2 bilateral), invasive lobular carcinoma in 12, and other types in 22. Seventy-one patients had complete response to NAC, 35 partial response and 1 no response. Lymphoscintigraphy was complemented with SPECT/CT in 17 patients. Parameters evaluated: SLN detection by lymphoscintigraphy, lymphographic drainage patterns, surgical detection, histological status of the excised nodes, distant recurrence disease and survival (follow-up interval: 1-5 years). ***Results:*** Lymphoscintigraphy detected lymphatic drainage in all the patients included. In total, 153 axillary SLNs were identified: 63 patients showed drainage to 1 SLN, 42 patients to 2 SLNs, and 2 patients to 3 (one of them having bilateral BC with 1 SLN detected in the right axilla and 2 in the left axilla). Drainage to the internal thoracic chain was detected in 9/107 patients. During surgery, 150/153 axillary SLNs were removed, 10 of them (corresponding to 8 patients, 7.4%) were metastatic (8 macrometastasis/2 micrometastasis). The subsequent lymphadenectomy showed other metastatic nodes in 3/8 patients. The other 140 excised SLNs were negative (corresponding to 97 patients, 90.6%). Three SLNs (2 patients, 1.9%) were not localized during surgery, performing axillary sampling instead that revealed no metastasis. None of the 8 patients with metastatic SLNs showed recurrence during follow-up. Five of the 97 patients (5.2%) with non-metastatic SLNs experienced recurrence (1 patient in the contralateral breast, and 4 patients at distant sites, including extra-axillary lymph nodes in 2). Of the 2 patients who underwent axillary sampling, one had triple-negative IDC unresponsive to NAC and later developed local recurrence (bilateral breasts and right axillary nodes) and distant metastasis. In summary, 6/107 patients (5.6%) showed recurrence. No mortality was documented in any of the patients during the follow-up. ***Conclusion:*** In our experience, lymphoscintigraphy is a reliable technique for the identification of the SLN in patients with BC after NAC with good results and low percentage of lymph nodes recurrence (in the present study only in extra-axillary territory), and distant metastasis. Our results reinforce

the indispensable role of SLN biopsy in this clinical scenario in a context of personalized patient management.

EP-0445

Accuracy of sentinel lymph node detection with indocyanine green compared to technetium 99m in early-stage vulvar cancer.

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Aim/Introduction: Lymph node pathologic status is the most important prognostic factor in vulvar cancer. Lymphoscintigraphy (LY) with gamma-probe guided surgery is nowadays the most cost-effective approach than lymphadenectomy in early-stage vulvar cancer. Next to the LY there is an increasing interest for others approach, like indocyanine green (ICG). This study evaluates the accuracy of sentinel lymph node (SLN) detection using ICG compared to the gold standard of LY with technetium 99m (99mTc)-nanocolloid in women affected by early-stage vulvar cancer in high-level experienced oncological setting. ***Materials and Methods:*** Thirty-seven patients with vulvar squamous carcinoma stage IB were enrolled in a prospective observational study from December 2014 to April 2023. Patients underwent standard LY using 99mTc-nanocolloid, the day before surgery. In addition, a total dose of 2 ml ICG solution (1.25 mg/ml) was intradermally administered before surgery at the same sites of the 99mTc injections. All SNLs were identified and sent to histological examination. ***Results:*** Eighteen patients had a midline tumor and nineteen a unilateral tumor (12 left and 9 right), therefore 57 groins were investigated. Mean body mass index (BMI) was 24.9, mean age was 65.4 years. Overall, SLN detection rate (DR) was 94.6% and 89.2% by ICG and LY, respectively. Considering laterality and for patients, ICG showed a SLN DR of 94.4%, 100% and 85.7% for midline, left and right tumors. LY demonstrated a lower DR for midline tumors (83.3%) but not statistically impactful. For groins, ICG and LY had an overall DR of 94% and 92%, divided in 94% vs 100% in midline, 100% vs 83 in left and 86% vs 86 in right. BMI was significantly associated with SLN detection discordance between ICG and LY (p= 0.03) as well as surgical diagnostic excision (p= 0.04). ***Conclusion:*** Our data show that ICG tracer is feasible and safe. It has a high accuracy to identify SLN, better or at least comparable to LY detection rate. Moreover, a combined technique (ICG + 99mTc) could be suggested in patients with midline tumors and high body mass index.

EP-0446

Breast Cancer in Women Over 70 Years Old - Incidence of Positive Cases After Sentinel Node Biopsy

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Aim/Introduction: In recent years there has been a growing concern to avoid overtreatment of breast cancer in older women. In 2016, the North American Society for Surgical Oncology recommended against routine sentinel node biopsy (SNB) in women aged ≥70 years, diagnosed with early-stage invasive breast cancer (cT1), node-negative (N0), hormone receptor-positive (HR+) (oestrogen and/or progesterone) and human epidermal growth factor receptor 2-negative (HER2-), based on studies that demonstrated that the omission of SNB does not seem to have a significant impact in patient's survival, given that there is good control of the disease with adjuvant hormone therapy. They note however, that axillary staging may be considered individually if its results have an impact on the therapeutic decision. Our objective was to evaluate the incidence of positive SNB in women aged ≥70 years, with invasive breast carcinoma, cT1N0/RH+/HER2-, in a treatment centre for oncology. ***Materials and Methods:*** Retrospective analysis of patients with early-stage breast carcinoma aged ≥70 years, referred for lymphoscintigraphy for SNB, over a 5-year period (01/01/2019 and 12/31/2023). ***Results:*** Of 621 patients aged ≥70 years referred for lymphoscintigraphy, 187 met the inclusion criteria (cT1N0/RH+/HER-), median age 76 years (range 70-93). Of these 187 patients, there was no migration of 99mTc-Nanocolloids in 6 (3.2%). 167 (89.3%) patients underwent lumpectomy and 20 (10.7%) total mastectomy. Medium tumour size on histology was 1.6 cm (range 0.6-4.8 cm). Most tumours were ductal (133/187, 71.1%) with low/intermediate grade (135/187,72.2%). All patients were offered hormone therapy, except for one patient (without clinical conditions). Of the total of 187 patients, 26 (13.9%) had nodal metastases: 1 (3.8%) - isolated tumour cells [pN(i+)]; 8 (30.8%) - micrometastases [pN(mi)]; 15 (57.7%) - metastases in 1-3 axillary nodes [pN1] and 2 (7.7%) - metastases in 4-9 axillary nodes [pN2]. ***Conclusion:*** We conclude that in our centre, there is a low incidence of patients with positive SNB in women ≥70 years old, with invasive breast carcinoma (cN0T1, HR+/HER2-). Furthermore, several clinical trials have shown a lack of survival benefit for axillary dissection (ALND) versus no ALND in both node-positive and node-negative breast cancer. These data are in favour of a more restricted selection of patients aged ≥70 years (cT1N0, HR+/HER2-) for SNB since this procedure is associated with some long-term morbidity. It will also be important to carry out a future analysis of overall survival in this group of patients.

EP-0447

Into the Lymph Nodeverse: The Role of Sentinel Lymph Node Biopsy in Managing Oral Squamous Cell Carcinomas. Our experience

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Aim/Introduction: While surgical treatment of primary tumours in early stages oral cavity squamous cell carcinoma (OCSCC) is well established, controversy remains regarding clinically node-negative (N0) neck management. The selective sentinel lymph node biopsy (SLNB) emerges as the sole technique capable of guiding towards potentially affected nodes, given that micro metastases are undetectable in pre-surgical tests. Considering lymph nodes metastasis represent the primary prognostic factor, this study aims to describe the SLNB as a treatment modality and as a mapping technique for a subsequent neck dissection (ND) in handling clinically N0 early OCSCC. Additionally, to assess the treatment's impact on disease-free survival (DFS) time conducting a pilot survival analysis, facilitating thereby the groundwork for broader longitudinal studies. ***Materials and Methods:*** Thirty-six patients diagnosed with clinically N0-OCSCC between February 2022 and April 2024 were selected and categorized into three groups based on the surgical interventions received: SLNB alone, SLNB with ND or ND alone. The number and pathological state of sentinel lymph nodes (SLN) removed were analysed. Additional patient data such as smoking habit, tumour differentiation grade, immunohistochemical markers, and adjuvant treatment were also collected. A DFS analysis

was conducted for SLNB and SLNB+ND groups on R Commander Software, with Kaplan-Meier curves generated from the data. ***Results:*** The primary tumour was predominantly located at the tongue (61.11%), with only one lesion being central. A slightly higher incidence was observed in males (52.77%). Ipsilateral level II drainage was the most frequent (81.81%). Pathological SLNs were found in 21.21% of patients (7/33). Subsequent ND was performed in 16 patients (44.44%), although 9 of them had a previous negative SLNB, due to intraoperative assessment. Pathological lymph nodes were identified in 12.5% of patients who underwent consecutive ND (2 out of 16). Regarding recurrences, six-month DFS in SLNB and SLNB+ND groups was 33.33% and 30%, respectively (p=0.81). ***Conclusion:*** SLNB proves to be a valuable technique for mapping the lymphatic drainage, with ipsilateral level II being the most frequently involved. We observed ND was performed in several patients, considering this could potentially increase morbidity; we propose further comprehensive investigation into this approach. Although there is no statistical significance, similar survival rates were observed between groups (SLNB vs SLNB+ND). Acknowledging that our study's main limitation is constrained follow-up time, ongoing future studies will allow a log-rank analysis comparing treatments and advancing towards a more effective management of these patients.

EP-0448

Intra-operative lymphatic mapping and sentinel node biopsy in laryngeal carcinoma using radiotracer injection

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Aim/Introduction: The purpose of this study was to determine the value of sentinel lymph node biopsy in the laryngeal SCC, using intra-operative peri-tumoral injection of Tc-99m-phytate. ***Materials and Methods:*** Patients with biopsy-proven squamous cell carcinoma of the larynx were included. On the day of surgery, after anesthesia induction, suspension laryngoscopy was performed to inject 74MBq/0.4 ml Tc-99m-phytate in four aliquots into the sub-mucosal peri-tumoral location. After 10-minute wait, portable gamma probe was used to locate sentinel nodes. Subsequently, all patients underwent laryngectomy and neck dissection. Both sentinel nodes and non-sentinel nodes were examined using hematoxylin and eosin (H&E) staining. ***Results:*** Twenty-six patients with diagnosis of laryngeal carcinoma were included in the study. The sentinel lymph node (SLN) detection rate was 65.4%, with 100% detection rate in the supraglottic region and 52.6% detection rate for glottis/transglottic patients. Permanent pathology results showed lymph node involvement in four patients, but only one patient had negative result in the sentinel lymph node biopsy (SLNB), resulting in an overall false negative rate of 25%. The sensitivity of the SLN technique was 75% overall, 100% in the supraglottic region, and 67% in the glottis/transglottic region. ***Conclusion:*** Accuracy and feasibility of sentinel lymph node biopsy may be related to the location of the tumors in the larynx. For supraglottic tumors, the technique seems to be feasible with low false negative rate. For glottis/transglottic tumors both detection rate and false negative rate seem to be suboptimal. Further studies are needed to validate our results.

EP-0449

Lymphatic drainage rate in breast cancer recurrence and its relationship with surgical and medical management in the first breast tumor

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Aim/Introduction: The aim of this study is to analyze the relationship between lymphatic drainage of sentinel node selective biopsy (SLNB) in breast cancer recurrence, considering the surgical approach and adjuvant treatment administered in the first breast tumor. ***Materials and Methods:*** Descriptive and retrospective study of 1266 patients undergoing SLNB between the years 2020-2023. Of these, 39 patients were diagnosed with breast cancer recurrence. Patients with local recurrence or with a second ipsilateral primary breast tumor were included. The results of axillary lymphoscintigraphy of the second breast tumor were evaluated, analyzing the relationship between the type of lymphatic drainage (ipsilateral, aberrant and exclusive aberrant) and previous axillary surgical management, as well as adjuvant medical treatment administered during the first breast tumor.The data obtained were analyzed using mean and standard deviation for quantitative variables, and frequency and percentage for categorical variables. The comparative analysis was performed using the ANOVA test for quantitative variables and Fisher's test for qualitative variables, with values of $p<0.05$ being considered significant. ***Results:*** All patients were female with mean age 57.5 years. Lymphatic drainage was evident in 82% (n=32), of these, 81.25% (n=26) had ipsilateral axillary drainage, 31.25% (n=10) had aberrant migration, and exclusive aberrant drainage in 18.75% (n=6).A higher drainage rate was observed on lymphoscintigraphy in patients without axillary lymphadenectomy (90.3% vs. 50%) ($p<0.022$), with majority migration to the ipsilateral axilla (80.6%) ($p<0.001$). A significant relationship was identified between chemotherapy administration and the incidence of axillary lymphatic drainage, showing a lower drainage rate in patients treated with chemotherapy ($p<0.020$). No significant differences were observed between chemotherapy and the incidence of aberrant drainage. On the other hand, the rate of aberrant lymphatic drainage is significantly higher in patients who received radiotherapy in their first breast tumor ($p<0.014$), and a significant decrease ($p<0.004$) of ipsilateral lymphatic drainage was observed in patients who received in association radiotherapy and chemotherapy as adjuvant treatments. ***Conclusion:*** There is a high rate of axillary lymphatic drainage in breast cancer recurrence, even in patients who have previously undergone axillary lymph node resection. The rate and type of axillary lymphatic drainage in breast cancer recurrence are influenced by the surgical and medical management of the initial breast tumor. Chemotherapy was associated with a lower incidence of lymphatic drainage, whereas radiotherapy was associated with a higher incidence of aberrant drainage. And the combination of radiotherapy and chemotherapy showed a significant reduction in ipsilateral lymphatic drainage.

EP-0450

Drainage Patterns in Breast Cancer Assessed by SPECT/CT Sentinel Lymph Node Mapping: Our Experience

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Aim/Introduction: The sentinel lymph node (SLN) technique

using planar imaging has high accuracy in axillary staging of clinically localized breast tumors.The incorporation of the hybrid SPECT/CT technique has enabled better staging by allowing precise determination of the number/location of SLNs. ***Materials and Methods:*** Patients between January 2016 and May 2023 were included. All underwent routine SLN procedure by periareolar subdermal administration of 37-148 MBq 99mTc-nanocolloid and subsequent acquisition of planar images and SPECT/CT on a 16-slice scanner. In a subgroup of patients, an intra-individual comparison of planar vs SPECT/CT results was performed using the Lin concordance correlation coefficient (ρc) with its respective 95% confidence interval (CI 95%). Suggestions for interpreting the Lin concordance correlation coefficient are as follows: almost perfect agreement (>0.99); substantial concordance (>0.95-0.99); moderate agreement (0.90-0.95); and poor concordance (<0.90). Concordance was also evaluated using 95% concordance limits, and the range within which 95% of the differences in the number of nodes between planar and SPECT/CT were estimated. ***Results:*** A total of 782 breast cancer patients were included, 778 female and 4 male. A single injection was performed in 708 patients (90%), while two or three injections were performed in the rest (n=63; 8% and n=11; 1%; respectively). Breast cancer was right-sided (n=350; 45%), left-sided (n=407; 52%), or bilateral (n=15; 3%), with 1 node identified (n=342; 44%), 2 nodes (n=290; 37%), 3 nodes (n=101; 13%), 4 nodes (n=30; 3%), or "5 or more nodes" (n=6; <0.1%). Axillary drainage was identified in 758/782 patients (97%): Level I (n=748), Level II (n=205), Level III (n=48). Single (n=530; 70%) or multiple (n=228; 30%) axillary drainage: two levels (n=205; 27%) or three levels (n=23; 3%). Extra-axillary drainage (27/782 patients; 3%) was intramammary (n=11; 40%), supraclavicular (n=6; 22%), and internal mammary chain (n=10; 37%).The estimated Lin concordance correlation coefficient (CCC) was 0.9243 (95% CI: 0.8779-0.9535), classifying it as moderately accurate, although according to the interval, it could range from poor to substantial.The average difference was 0.13 (95% CI -0.84-1.1), which was not significant. ***Conclusion:*** Accurate axillary staging and identification of drainage patterns influence surgical management and allow for minimal morbidity compared to axillary clearance.SPECT/CT has higher accuracy in SLN localization than planar imaging. ***References:*** McBride, 2005, 2007Bland and Altman, 1986, 1999.

EP-0451

Selective Sentinel Lymph Node Biopsy in Cervical Cancer: 99m-Tc-Nanocolloids versus Indocyanine Green and Their Combined Benefit

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Aim/Introduction: To compare the efficacy of selective sentinel lymph node biopsy (SLNB) technique using two tracers: 99mTechnetium nanocolloid and Indocyanine Green in patients with cervical cancer in stages IA1-IIB. ***Materials and Methods:*** Retrospective descriptive study including all patients (p) between 2017-2024 diagnosed with cervical cancer in stage IA1-IIB without nodal or distant metastasis, who underwent SLNB with dual tracer. The radiopharmaceutical was injected the day before surgery, and static images and SPECT/CT were acquired to locate its drainage. In the operating room, the dye injection was performed using the same injection technique. Sentinel lymph nodes were biopsied with the assistance of a gamma probe and polarized light. Pelvic lymphadenectomy was performed in patients with stages ≥ IB or with aggressive features. Subsequently, patient follow-up was conducted in consultation. Statistical analysis was performed using SPSSv23 for both qualitative and quantitative variables. ***Results:*** Thirty-seven patients (100% female) with a mean age of 47.35 years (range 28-69) were included. Tumor staging: IA1 8.1%, IA2 24.3%, IB1 51.4%, IB2 10.8%, and IIB 5.4%. The radiopharmaceutical had a higher overall drainage rate than the dye (94.6 vs 89.2%), although it showed a higher unilateral drainage rate (35.1% vs 18.9%). In 50% of cases without dye drainage (n=2/4), the radiopharmaceutical drained bilaterally. The intraoperative detection rate of sentinel lymph nodes using the radiopharmaceutical was similar to the imaging localization rate. The combined use of both tracers showed significantly higher overall drainage rates than the isolated use of dye (94.6 vs 89.2%) and similar to those of the radiopharmaceutical, although it improved the bilateral drainage rate of the latter (83.8% vs 59.5%). Only one sentinel lymph node tested positive for malignancy. Eighteen standard lymphadenectomies were performed with negative results for malignancy. Median follow-up was 4 years (range 0-6). Of the 33 patients (89.2%) with a minimum follow-up of 3 years, only 1 (4.2%) had lymph node recurrence. ***Conclusion:*** SLNB with dual tracer in cervical cancer improves overall drainage rates and increases the likelihood of bilateral drainage. Likewise, it allows for accurate lymph node staging, as it presented only one case of lymph node recurrence after a minimum three-year follow-up.

EP-26

e-Poster Area

B: Imaging Clinical Studies -> B4 Cardiovascular Imaging Clinical Study -> B41 Perfusion

EP-0452

Limited Generalizability and Potential Bias in a Deep Learning Model for Predicting Obstructive Coronary Artery Disease from Myocardial Perfusion SPECT Imaging: Insights from Cross-Institutional Evaluation

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Aim/Introduction: Deep learning (DL) models for predicting obstructive coronary artery disease (CAD) with stress myocardial perfusion imaging (MPI) have shown promising potential to improve diagnostic accuracy compared to visual interpretation and current quantitative methods. However, the consistency of DL model performance across healthcare institutions or different populations remains an important area of investigation. This study aimed to evaluate the generalizability and potential bias of our in-house MPI DL model between two hospital-based cohorts stratified by demographic factors and comorbidities. ***Materials and Methods:*** We included subjects who underwent stress and

redistribution thallium-201 (201Tl) MPI SPECT using a cadmium-zinc-telluride camera followed by coronary angiography within 90 days as the reference standard, from two tertiary medical centers, National Taiwan University Hospital (NTUH) and Far Eastern Memorial Hospital (FEMH), in Northern Taiwan. A polar map-free 3D DL model was trained on 928 MPI images from NTUH to predict obstructive CAD and subsequently tested on an internal cohort (933 tests from NTUH) and an external cohort (3315 tests from FEMH). Diagnostic performance, assessed by area under the receiver operating characteristic curves (AUCs), was compared using DeLong's test between the internal and external cohorts to evaluate generalizability, and to detect potential confounding factors across patient groups. Additionally, diagnostic performance was compared between datasets propensity-matched for key demographic factors and comorbidities. ***Results:*** The external cohort had significantly lower prevalence of obstructive CAD (46% vs. 58%, $p < 0.001$), higher body mass index, and higher proportions of women, smokers, and patients with diabetes and dyslipidemia compared to the internal cohort (all $p < 0.05$). The DL model exhibited lower diagnostic performance in the external cohort than in the internal cohort, both in patient-based (AUC = 0.709 vs 0.813) and vessel-based (AUC = 0.730 vs 0.782, both $p < 0.001$) analyses. After propensity matching for key clinical parameters except sex, the DL model still exhibited lower diagnostic performance in the external cohort compared to the internal cohort, in both patient-based (AUC = 0.711 vs 0.844, $p = 0.014$) and vessel-based (AUC = 0.740 vs. 0.810, $p = 0.049$) analyses. ***Conclusion:*** The current study demonstrated limitations in the generalizability of this DL-based model across institutions. Alongside demographic characteristics and comorbidities, factors such as sex or disease probability may affect the DL model's diagnostic accuracy. Therefore, including low-risk patients in the training dataset and validating the DL model across diverse populations are crucial.

EP-0453

Adenosine-induced Splenic Switch-off Evaluation in ^{99m}Tc Tetrofosmin Myocardial Perfusion Studies as Marker of Stress Adequacy by Semiquantitative Analysis of Acquired SPECT/CT Images

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Aim/Introduction: Adenosine IV infusion is commonly used as pharmacological stress method in myocardial perfusion imaging (MPI) using radiotracers to induce vasodilation of the coronary arteries thus enabling detection of critical coronary artery stenosis. Usually, MPI studies are done in 2 parts: stress and rest with imaging of the heart using gated SPECT/CT. Recently, a phenomenon known as splenic switch off (SSO) has been observed in which reduced perfusion to the spleen occurs after adenosine infusion and its presence suggests adequate effect of adenosine stress on the heart. The aim of the study is to evaluate the SSO effect in adenosine stress 99mTc tetrofosmin MPI studies using semiquantitative analysis of the acquired SPECT/CT data. ***Materials and Methods:*** 17 MPI studies with adenosine stress were selected successively from the PACS system. Each study had a stress and a rest part processed using software for cardiac reconstruction involving slice reorientation in the heart's short, horizontal and vertical long axis. In addition, the data were reconstructed in the body transaxial, coronal and sagittal planes using SPECT/CT software. In the resulting images, the spleen was identified on the CT component and regions of interest (ROIs) were drawn on spleen, adjacent thoracic vertebra and myocardium. The average count per pixel was recorded for each ROI and the ratios Spleen/Vertebra (S/V Ad, S/V Rst) and Myocardium/Vertebra (M/V Ad, M/V Rst) were calculated. Statistical analysis of the imaging data was done using paired t-test and descriptive statistics for non-imaging data. ***Results:*** Mean patient age was 60.35±12.97 yr. There were 9 males (53%). Clinically, 11 (65%) had ischemia, 1 scar (6%) and 5 (29%) were normal. The mean count-for spleen adenosine (S Ad) was 308±136, spleen rest (S Rst) 144±77 ($t=4.64$, $p<0.001$). For the heart, M Ad 793±282, M Rst 263±149 ($t=7.612$, $p<0.001$). Vertebra (background) V Ad 349±170, V Rst 80±26 ($t=6.888$, $p<0.001$). Mean S/V Ad was 0.98±0.38 and S/V Rst 1.87±0.87 ($t=-3.707$ $p<0.01$). The mean M/V Ad was 2.86±1.65 and M/V Rst 3.75±2.41 ($t=-1.323$, $p=0.204$). ***Conclusion:*** Using the semiquantitative method outlined especially the S/V ratio, evaluation of the SSO can be achieved from the acquired data. Comparison of the results with other stress modalities such as exercise would establish its value as a marker for adequate effectiveness of adenosine stress in doubtful cases. ***References:*** Manistry C et al. Splenic Switch-off: A Tool to Assess Stress Adequacy in Adenosine Perfusion Cardiac MR Imaging. Radiology 276, 2015 https://doi.org/10.1148/radiol.2015142059.

EP-0454

Assessment of gated-SPECT disturbance to determine ejection fraction in patients with left bundle branch block

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Aim/Introduction: To analyze the diagnostic accuracy of the ejection fraction (EF) of the gated-SPECT study in patients with Left Bundle Branch Block (LBBB) contrasting results given by echocardiography. ***Materials and Methods:*** We performed a retrospective study of patients with LBBB who had undergone cardiac perfusion SPECT-CT with Tc99m-tetrofosmin performed between January/2021 and December/2023 and who also had a recent echocardiography. The exclusion criteria were the presence of atrial fibrillation (AF) and previous coronary bypass. A total of 50 patients were studied, 35 men and 15 women. They were compared with a group of 50 other patients without LBBB who met the same inclusion criteria (19 men and 31 women). A statistical analysis was performed to calculate the intraclass correlation between Gated-SPECT EF and echocardiography with a 90% confidence interval using the two-factor mixed-effects model. Likewise, a subgroup analysis was performed studying those patients with ≥3 segments with low uptake artifact secondary to LBBB (with 24 patients) and those with <3 affected segments (with 26 patients). ***Results:*** In the group of patients without LBBB, an intraclass correlation coefficient of 0.85 (90% CI: 0.7-0.9) was obtained. In the group of patients with LBBB, a coefficient of 0.71 was obtained (90% CI: 0.5-0.8).In the subgroup analysis, patients with ≥3 more affected segments had a coefficient of 0.58 (90% CI: 0.1-0.7) and those with <3 segments had a coefficient of 0.77 (90% CI: 0.4-0.9). ***Conclusion:*** In patients without LBBB, the concordance between EF and echocardiography is adequate. In patients with LBBB, concordance decreases, with Gated-SPECT presenting an underestimation of EF. The extent of the low uptake artifact observed in SPECT has a straight association with the underestimation of EF. ***References:*** Myocardial Perfusion SPECT in Right Bundle Branch Block and Left Anterior Hemiblock. Emilio

Paredesa, Jaume Candell-Rieraa, Guillermo Oller-Martíneza, Gustavo de Leóna, Santiago Aguadé-Bruixb, Joan Castell-Conesa. Servicio de Cardiologia. Hospital Universitario Vall d'Hebron. Barcelona.

EP-0455

Role of coronary artery calcium score in the detection of silent myocardial ischemia in diabetic patients with high cardiovascular risk.

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Aim/Introduction: According to various studies, no contribution from systematic screening for silent myocardial ischemia (SMI) in diabetics was found. The selection of patients for screening must not only be based on the assessment of cardiovascular (CV) risk but also on the use of non-invasive "risk-modifying" tests such as the Coronary Artery Calcium (CAC) score. Our study aimed to evaluate the CAC score for diagnosing SMI in diabetics with high CV risk. ***Materials and Methods:*** From April 2022 to September 2023, 105 diabetic patients were recruited for this prospective study. All of them were asymptomatic, had a normal ECG, and were classified as high CV risk with a SCORE 2-Diabetes between 10 and 20% over 10 years. These patients benefited from a quantification of the CAC score by CT scan and then searching for SMI by Sestamibi-99mTechnetium myocardial perfusion scintigraphy (MPS) after physical stress or under dipyridamole. ***Results:*** Our sample had an average age of 58+/-7 years and was made of 39% men. The mean SCORE 2-Diabetes was 17+/-2% over 10 years. SMI was diagnosed with MPS in 9 patients (8,6%). The average CAC score was 82+/-224 Agatston units (AU) minimum 0AU and maximum 1431AU. A CAC score <10UA was found in 59% of patients, a CAC score between 10 and 100UA was found in 26,7% of patients, a CAC score between 100 and 400AU was found in 7,6% of patients and a CAC score>400AU was found in 6,7% of patients. The CAC score was associated with ischemic status: in patients without SMI, the average CAC score was 62+/-183AU; in patients with SMI, the average CAC score was 298+/-446AU (p=0,002). Using the CAC score with a threshold value of 10AU we have found for the diagnosis of SMI: Sensitivity (Se) 77%, Specificity (Sp) 62%, positive predictive value (PPV) 16%, and negative predictive value (NPV) 96%. For a threshold value of 100AU, we have found: Se 44%, Sp 88%, PPV 26%, and NPV 94%. For a threshold value of 400AU, we have found: Se 22%, Sp 94%, PPV 28%, and NPV 92%. ***Conclusion:*** Searching for SMI in diabetic patients with high CV risk using the CAC score presents an insufficient sensitivity but a satisfactory negative predictive value, useful in screening situations. ***References:*** 1- Marx N et al. 2023 ESC Guidelines for the management of cardiovascular disease in patients with diabetes. Eur Heart J. 2023; 44(39): 4043-140.

EP-0456

Deep learning quantitative angiography (DL-QCA) versus total perfusion deficit (TPD): Quantitative analysis of myocardial perfusion studies (MPI)

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Aim/Introduction: Evaluate the severity of ischemia using MPI and comparing DL-QCA with TPD, using invasive coronary angiography (ICA) as gold standard. ***Materials and Methods:*** Retrospective study of 82 patients (65 males, mean age 70 years) from December 2015 to March 2017 undergoing MPI, followed by ICA within six months after the MPI. The MPI was performed in a dedicated CZT cardio camera with a two-day protocol, according to current EANM guidelines. DL-QCA was evaluated using a novel software, the severity of ischemia was expressed in % and divided in different thresholds ≤50%, 50-70%, ≥70%. TPD was evaluated using stablished values in routine clinical praxis to determine the degree of isquemia; below 5%=normal, 5-10%= slight abnormality, 11-14% moderate abnormality, and ≥15% significant abnormality, a value of ≥11% was regarded as a positive test. All ICA studies were examinated visually and with a quantitative angiography software, any stenosis ≥50% was considered significant and regarded as a positive test. ***Results:*** The overall diagnostic accuracy of DL-QCA to identify patients with significant obstruction at MPI was 62%, sensitivity 67%, specificity 100%. For TPD ranging from 10-14% was sensitivity 46%, specificity 100%, accuracy 49%. For TPD ranging from ≥15% was sensitivity 35%, specificity 100%, accuracy 38%. For the visual analysis was sensitivity 81%, specificity 100%, accuracy 82%. ***Conclusion:*** The novel DL-QCA software outperforms TPD in the quantification of significant obstruction in MPI, providing additional information on the degree of artery stenosis, something which if further developed, could possibly avoid unnecessary ICA interventions. Further studies are necessary to confirm our results. ***References:*** Arvidsson I, Davidsson A, Overgaard NC, Pagonis C, Åström K, Good E, Frias-Rose J, Heyden A, Ochoa-Figueroa M. Deep learning prediction of quantitative coronary angiography values using myocardial perfusion images with a CZT camera. J Nucl Cardiol. 2023;30(1):116-26.

EP-0457

Effect of myocardial flow reserve measured by cadmium zinc telluride cameras on the diagnosis of coronary artery disease

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Aim/Introduction: A cadmium-zinc-tellurium (CZT) camera can simultaneously evaluate myocardial flow reserve (MFR) and myocardial perfusion imaging (MPI) without positron emission tomography scans. Adding MFR to MPI for coronary artery disease (CAD) screening may help identify high-risk patients and improve diagnostic performance. This technological innovation has renewed interest in single-photon emission computed tomography (SPECT) MFR assessment in patients with CAD. We quantitatively measured the contribution of MFR to improving the diagnostic performance of CAD by adding MFR to the increase rate (IR) in myocardial radionuclide uptake during stress and transient ischaemic dilatation (TID), which have traditionally been used as indicators to assess CAD severity in MPI. ***Materials and Methods:*** We retrospectively analysed the clinical images of 60 patients who underwent dynamic CZT SPECT to evaluate suspected CAD (40 men and 20 women; mean age: 65.9 ± 10.1) after injection of 99mTc-sestamibi for rest and stress imaging. The additional effects of MFR on the IR and TID indices were examined to assess the severity of CAD. Receiver operating characteristic (ROC) and multivariate ROC analyses were used to quantify the ROC curve (area under the curve (AUC)), how CAD diagnostic performance improved when IR, TID, and MFR were used alone, when IR and TID were combined, and when IR, TID, and MFR were combined. ***Results:*** The AUC for the IR, TID, and MFR alone were 0.57, 0.62,

and 0.80, respectively. The diagnostic performance improved the AUC to 0.63 when IR and TID were combined and to 0.87 when IR, TID, and MFR were combined. Adding MFR to the conventional combination of IR and TID significantly improved CAD diagnostic performance by 24% (p=0.002). Furthermore, combining MFR with IR and TID improved detection by 7% compared to MFR alone, but the difference was insignificant (p=0.086). ***Conclusion:*** The effect of MFR on improving the diagnostic performance of CAD relative to the combination of IR and TID, a measure of ischaemia calculated using MPI, was 24%. Adding MFR to MPI for CAD screening is thought to significantly contribute to high-risk patient identification and enhance diagnostic performance.

EP-0458

Transient ischemic dilatation with adenosine ^{99m}Tcsestamibi stress: prognostic significance in diabetic patients with normal myocardial perfusion SPECT/CT scans

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Aim/Introduction: Previous studies have shown that transient ischemic dilatation (TID) does not predict adverse prognosis in patients with otherwise normal perfusion. However, data in diabetic patients is limited. The objective of this study is to investigate the prognostic significance of non-attenuation corrected (NAC) and attenuation corrected (AC) TID in diabetic patients with normal perfusion on adenosine stress/rest 99mTc-sestamibi imaging. ***Materials and Methods:*** We analyzed 274 patients with normal perfusion on 2-day adenosine stress/rest 99mTc-sestamibi SPECT/CT. A group of patients with Framingham 10-year coronary heart disease risk < 10% was used to derive abnormal AC and NAC TID thresholds (derivation group). The significance of TID at these thresholds was validated in the remaining patients (validation group) followed for cardiac events for 43.6 ± 9.5 (mean ± SD) months. ***Results:*** NAC TID in the derivation group was 1.14 ± 0.15 while AC TID was 1.14 ± 0.19. Three definitions of an abnormal TID were used: > mean + 2SD (NAC TID ≥ 1.43, AC TID ≥ 1.52), > mean + 1SD (NAC TID ≥ 1.28, AC TID ≥ 1.33) and a TID in the derivation group's highest quartile (NAC TID ≥ 1.25, AC TID ≥ 1.26). Of the validation group patients, 8 (3.1%), 29 (11.3%) and 39 (15.2%) had NAC TID ≥ 1.43, 1.28 and 1.25, respectively, while 5 (1.9%), 13 (5.1%) and 23 (8.9%) had AC TID ≥ 1.52, 1.33 and 1.26, respectively. Gender, family history of coronary artery disease (CAD), known CAD, smoking, hypertension, dyslipidemia, post-stress LVEF, ΔLVEF, ≥ 5% or 10% decrease in LVEF did not predict abnormal AC or NAC TID at the thresholds mentioned above. However, NAC TID ≥ 1.25 and 1.28 were predicted by rest LVEF (p = 0.001 and 0.009, respectively). Cardiac event-free survivals were similar in patients with NAC TID ≥ and < 1.43 (p = 0.49), ≥ and < 1.28 (p = 0.78) and ≥ and < 1.25 (p = 0.90). Similarly, cardiac event-free survivals were similar in patients with AC TID ≥ and < 1.52 (p = 0.58), ≥ and < 1.33 (p = 0.37) and ≥ and < 1.26 (p = 0.53). ***Conclusion:*** TID, whether based on attenuation or non-attenuation corrected scans, does not confer adverse prognosis in diabetic patients with normal perfusion on adenosine stress/rest 99mTc-sestamibi SPECT/CT irrespective of the threshold used for its definition.

EP-0459

Evaluation of Critical Stenosis Involving The Inferior Wall of the Left Ventricle Using Czt Camera and 4DM Software

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Aim/Introduction: CZT cameras have significant advancements in MPS imaging. The aim of this study is to compare visual scoring with the quantitative scoring provided by 4DM software in examining inferior wall perfusion using CZT camera and to investigate the importance of providing ischemia percentage in detecting critical stenosis by comparing with coronary angiography (CAG) findings. ***Materials and Methods:*** Data of 890 patients suspected myocardial ischemia underwent imaging with CZT-SPECT camera system (GE NM-530c). 207 cases who underwent CAG within 30 days after MPS and whose data were available were included in the study. Perfusion defects in seven segments involving inferior, inferoseptal, and inferolateral walls according to the left ventricular 17-segment model were visually scored and scored using 4DM software. Summed stress-rest difference score (SDS) and ischemia percentage were calculated using both visual and 4DM software. Patients were grouped into ischemia rates of <%10 and > %10 in the inferior wall according to both scoring systems. The presence of >70% stenosis in Cx or RCA on CAG results was considered as a confirmation criterion, and scoring groups were statistically compared. ***Results:*** Of the 207 cases included in the study, 56 were male (mean±SD: 61.65±10.32 years) and 151 were female (mean SD: 61.85±10.44 years). Significant stenosis was detected in 65 patients (31%) on CAG. In 19 patients where ischemia was detected visually, no ischemia was detected to any degree according to 4DM software, confirming the CAG results. The positive predictive value (PPV) of visual scoring in detecting critical stenosis was 51%, with a negative predictive value (NPV) of 71% (p: 0.014), while the PPV of 4DM software was 56%, with an NPV of 73% (p: 0.001). (Table1-2). ***Conclusion:*** In our study aimed at investigating the contribution of quantitative software programs in overcoming difficulties in evaluating inferior wall perfusion, most patients with critical stenosis in coronary vessels supplying the inferior wall (Cx, RCA) constituted those with ischemia percentage below 10% according to both visual and quantitative scoring. This suggests that even low-level ischemia detected in the inferior wall may be clinically significant. Our study also found that 4DM software was statistically superior to visual assessment in detecting the presence of critical ischemia in the inferior wall. Considering all the data together, we believe that the contribution of quantitative software programs to MPS reporting should not be overlooked.

EP-0460

Evaluation of Myocardial Perfusion and Its Heterogeneity in HIV-Infected Patients Using Myocardial SPECT Imaging

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Aim/Introduction: Cardiovascular disease remains a leading cause of morbidity and mortality worldwide, and its intersection with chronic infectious conditions like HIV has become a crucial

area of medical research. Despite significant advancements in the treatment and management of HIV, including the widespread adoption of antiretroviral therapy (ART), HIV-infected individuals continue to face an elevated risk of cardiovascular complications. This increased risk is partly attributed to the chronic inflammation and immune system alterations associated with HIV, as well as potential side effects from ART. This study aims to utilize myocardial perfusion SPECT imaging to quantitatively evaluate myocardial perfusion abnormalities in patients with HIV compared to a non-HIV-infected control group. ***Materials and Methods:*** Thirty-eight HIV-positive patients and twenty five control subjects were assessed using myocardial perfusion SPECT with technetium-99m methoxyisobutylisonitrile (99mTc-MIBI). Traditional scores—summed stress score (SSS), summed rest score (SRS), and summed difference score (SDS)—along with novel quantitative indices such as severity sigma and heterogeneity sigma, were analyzed. The novel indices were calculated as mean-square deviations of relative perfusion values (in %) in each of 17 standard segments in reference to maximum of 100% and to arithmetical mean of those values accordingly [1]. ***Results:*** HIV patients demonstrated significantly elevated myocardial perfusion heterogeneity compared with the control group, with mean values of 10.1 and 6.0, respectively (p=0.02). Traditional scores, however, have shown no statistically significant difference between the groups. This finding might suggest highly irregular myocardial blood flow distribution without critical perfusion decline. This can be fully or partially explained by multiple smaller-grade stenoses. It was previously shown that the virus itself or viral proteins can trigger the release of inflammatory mediators that cause endothelial dysfunction, which in turn could lead to stenotic changes and thrombosis [2]. ***Conclusion:*** The use of novel quantitative indices alongside traditional perfusion scores in SPECT imaging enhances the characterization of myocardial perfusion abnormalities in HIV-infected patients. These results substantiate the significant impact of HIV on myocardial health and underscore the need for further research. ***References:*** 1. Ansheles, A. A. et al. (2015). New Approaches to Quantifying Early Disorders and Perfusion Inhomogeneity of the Myocardium According to the Data of Single-Photon Emission Computed Tomography. Journal of Radiology and Nuclear Medicine, 5. 2. Pillay B, Ramdial PK, Naidoo DP. HIV-associated large-vessel vasculopathy: a review of the current and emerging clinicopathological spectrum in vascular surgical practice. Cardiovasc J Afr. 2015 Mar-Apr;26(2):70-81. doi: 10.5830/CVJA-2015-017. PMID: 25940120; PMCID: PMC4832607.

EP-0461

The utility of quantitative parameters of dynamic myocardial perfusion imaging performed by cardiac dedicated CZT gamma camera

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Aim/Introduction: We aimed to evaluate the utility of dynamic myocardial perfusion imaging with cardiac-zinc-telluride detectors (MPI-CZT) and the impact of quantitative parameters on the diagnosis of coronary artery disease (CAD). ***Materials and Methods:*** We enrolled patients who underwent two day dynamic MPI (GE NM-530C) due to suspected CAD and subsequently underwent coronary angiography within 30 days. Dynamic stress images were acquired after iv injection of 140 mcg/kg/min adenosine, and SPECT images obtained after 45-60 minutes. GE Health Care-4 DM Reserve Software Program has been used to calculate myocardial blood flow reserve (MFR). Findings were noted on both patient-based and coronary region-based. Ischemia was defined as stenosis of >%70 on coronary angiography. The cutoff values of MFR were measured using ROC analysis. ***Results:*** In our study, we enrolled 61 patients (32 female, 52% and 29 male, 48%). 18 patients (29%) had clinically significant stenosis. The cutoff values of MFR were 1.95, 1.9. and 1.95 for LAD,RCA, CX, respectively. The sensitivity and specifity of MPI were 100% and 46% on patient based analysis, while they were 94% and 70% for MFR. Region based analyses of MPI showed that sensitivity and specifity were 100% and 84% for LAD; 90% and 80% for RCA and 100% and 72% for CX; while region based analyses of MFR showed that sensitivity and specifity were 67% and 71% for LAD; 90% and 80% for RCA and 87% and 79% for CX. All patients with normal MPI (n=20) had no significant stenosis. Of 41 patients who had abnormal MPI results, 23 patients (56%) had no significant stenosis. 6 out of 23 patients had also abnormal MFR values and one patient from those had coronary artery ectasia. The sensitivity and specifity to define ischemia with using MFR values for patients with only abnormal MPI results were 94% and 74% respectively. ***Conclusion:*** MFR values measured by performing dynamic MPI-CZT might improve the diagnostic capability of MPI with reducing false positivity of MPI.

EP-0462

Prognostic Value of Chemotherapy-induced Myocardial Injury before Hematopoietic Stem Cell Transplantation Based on Myocardial Perfusion Imaging in Patients With Hematologic Malignancies

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Aim/Introduction: Chemotherapy-induced myocardial injury was assessed by myocardial perfusion imaging (MPI) in patients with hematologic malignancies before hematopoietic stem cell transplantation (HSCT), the purpose of this study was to explore the long-term prognostic value of chemotherapy-induced myocardial injury before HSCT in patients with hematologic malignancies. ***Materials and Methods:*** This retrospective study included patients who underwent MPI from March 2016 to August 2022 and subsequently underwent HSCT. MPI abnormalities were assessed visually by two experienced physicians, and a summed rest score (SRS) ≥ 4 defined myocardial injury. Patients were divided into myocardial injury and non-myocardial injury groups. Long-term adverse outcomes (>100 days post-transplant), including post-transplant mortality and overall survival (OS), were followed up for all patients. Kaplan-Meier analysis and Cox regression analysis were used to identify independent risk factors affecting OS. ***Results:*** A total of 139 patients with hematologic malignancies were included, with a mean age of (45.7 ± 13.0) years, including 80 males. The median follow-up was 41.6 (3.4~95.1) months, with 40 deaths recorded. Among the 139 patients, 44 had myocardial injury. Pre-transplant eukocyte levels were slightly lower in the myocardial injury group [3.50 (2.74-5.23) vs. 4.11 (3.16-5.89), P = 0.044]. There were no statistically significant differences in cardiac enzymes or electrocardiographic results between the two groups, but the left ventricular ejection fraction (LVEF) was lower in the myocardial injury group compared to the non-myocardial injury group [(60.0 ± 4.6) % vs. (63.2 ± 4.0) %, P < 0.001]. Post-transplant mortality was significantly higher in the myocardial injury group to

the non-myocardial injury group [22/44 (50%) vs. 18/95 (18.9%), $\chi 2 = 14.148$, $P < 0.001$], with significantly shorter OS time [26.17 (17.89-50.69) months vs. 48.73 (24.98-69.50) months, $Z = -2.706$, $P = 0.004$] in the myocardial injury group. Kaplan-Meier analysis revealed significant differences in OS time ($P < 0.001$). Cox regression analysis indicated that myocardial injury on pre-transplant MPI was an independent risk factor affecting OS after HSCT in hematologic malignancies (HR = 2.70, 95% CI: 1.33~5.46, P = 0.0057). ***Conclusion:*** Patients with abnormal MPI before HSCT for hematologic malignancies have a poorer prognosis, with higher post-transplant mortality rates and shorter OS. Using MPI to assess myocardial injury before HSCT in hematologic malignancies helps predict adverse long-term prognosis after transplantation.

EP-0463

The relationships between myocardial blood flow by dynamic SPECT CZT with clinical and laboratory profile in patients with non-obstructive coronary artery disease

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Aim/Introduction: Patients with non-obstructive coronary artery disease (NOCAD) have a high frequency of cardiovascular risk factors, which may cause the development of microvascular dysfunction. Currently, there are a limited number of studies on the noninvasive assessment of microvascular dysfunction in the NOCAD population. The aim of the study is to evaluate the relationships between dynamic SPECT CZT derived myocardial blood flow and clinical and laboratory profile in patients with NOCAD. ***Materials and Methods:*** Based on coronary computed tomography angiography results, patients with NOCAD (stenosis <50%) were included in the study. All patients underwent dynamic SPECT on cardiac hybrid system (CT-NM) with Cadmium-Zinc-Telluride (CZT) with the assessment of stress and rest myocardial blood flow (MBF), myocardial flow reserve (MFR), flow difference (FD) [1,2]. The Net Retention with attenuation correction flow model was used for quantitative analysis. Additionally, the blood lipid levels: total cholesterol (TC), low-density lipoprotein cholesterol (LDL-C), non-high-density lipoprotein cholesterol (non-HDL-C); and coagulation testing (activated partial thromboplastin time (APTT)) were also assessed. Based on MFR results, all patients were divided into two groups: 1. with reduced MFR <2.0 (n=32), 2. with a normal value of MFR ≥2.0 (n=51). ***Results:*** The study included 83 patients (53 men, age 58.2±9.5 years) with stable angina pectoris and/or dyspnea. Patients with reduced MFR had statistically significant ($p<0.05$) higher blood lipid levels: TC 5.34(4.3;6.29) vs 4.6(3.8;5.34) mmol/l, LDL-C 2.95(2.35;3.56) vs 2.11(1.84;3.17) mmol/l, non-HDL-C 4.1(3.15;4.6) vs 3.39(2.24;4.1) mmol/l; and lower APTT level 26.5(25.5;28.2) vs 28.55(26.75;33.6), respectively. The Spearman correlation showed that scintigraphic parameters had negative relationships with lipid profile: stress MBF and TC ($\rho=-0.24$,$p=0.03$), MFR and TC ($\rho=-0.22$,$p=0.045$) and LDL-C ($\rho=-0.22$,$p=0.049$), FD and TC ($\rho=-0.24$,$p=0.03$). According to a stepwise multivariate logistic regression analysis, non-HDL-C (OR 2.64; 95%CI 1.21-5.76; p=0.01) and APTT (OR 0.69; 95%CI 0.49-0.96; p=0.03) were independent predictors of reduced MFR ≤2.0. ***Conclusion:*** Non-HDL-C and APTT levels are independent predictors of reduced MFR ≤2.0 in NOCAD patients. Prospects for further research include the use of dynamic SPECT-CT for the identification of high-risk groups based on MFR analysis and the assessment of prognosis and response to pharmacological therapy. ***References:*** 1. Mochula A, et al. The Influence of Kinetic Models and Attenuation Correction on Cadmium-Zinc-Telluride Single-Photon Emission Computed Tomography (CZT SPECT)-Derived Myocardial Blood Flow and Reserve: Correlation with Invasive Angiography Data. J Clin Med. 2024;13(5):1271. DOI: 10.3390/jcm13051271.2. Kopeva K, et al. Coronary Microvascular Dysfunction: Features and Prognostic Value. J Clin Med. 2023;12(8):2964. DOI: 10.3390/jcm12082964.

EP-0464

The evaluation of myocardial blood flow and reserve by dynamic SPECT CZT in patients with non-obstructive coronary artery disease: comparison with semiquantitative MPI data

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Aim/Introduction: Currently, myocardial perfusion imaging (MPI) is a well-established method for identification of myocardial ischemia. However, the data regarding the possibility of dynamic SPECT CZT for identification of coronary microvascular dysfunction in patients with non-obstructive coronary artery disease (NOCAD) is lacking. The aim of the study is to compare the results of standard perfusion MPI and quantitative parameters of myocardial blood flow and reserve by dynamic SPECT CZT in patients with non-obstructive coronary artery disease. ***Materials and Methods:*** Based on coronary computed tomography angiography results, patients with NOCAD (stenosis <50%) were included in the study. All patients underwent dynamic SPECT on cardiac hybrid system (CT-NM) with Cadmium-Zinc-Telluride (CZT), including MPI. Standard indexes of myocardial perfusion imaging (SSS, SRS, SDS) and quantitative global parameters (stress and rest myocardial blood flow (MBF), myocardial flow reserve (MFR), flow difference (FD)) were assessed [1,2]. The NetRetention model with attenuation correction was used for quantitative analysis. ***Results:*** The study included 58 patients (37 men, age 55.9±9.9 years) with stable angina pectoris and/or dyspnea. According to MPI, 15 (26%) patients had abnormal myocardial perfusion (SSS and SDS ≥2.0 or in two segments with SSS and SDS ≥1.0). Standard indexes of myocardial perfusion imaging were the following: SSS 0.0 (0.0;2.0), SRS 0.0 (0.0;0.0), SDS 0.0 (0.0;2.0). According to dynamic SPECT, 22 (38%) patients had reduced MFR <2.0. Quantitative global parameters were characterized greater variability compared to MPI: stress MBF 1.34 (1.03;1.64) ml/min/g, rest MBF 0.58 (0.42;0.73) ml/min/g, MFR 2.42 (1.48;2.85), FD 0.68 (0.36;1.09). A total of 7 (12%) patients showed matched results MPI and dynamic SPECT: SSS ≥2.0 and MFR <2.0; in 28 (48%) the results were opposite - SSS <2.0 and MFR ≥2.0. However, 15 (26%) patients had normal myocardial perfusion and reduced MFR <2.0, which may indicate the initial stages of the development of microvascular dysfunction before myocardial ischemia. ***Conclusion:*** Dynamic SPECT CZT allows identifying impairment of MFR in NOCAD patients with normal results of MPI in a quarter of cases. ***References:*** 1. Mochula A, et al. The Influence of Kinetic Models and Attenuation Correction on Cadmium-Zinc-Telluride Single-Photon Emission Computed Tomography (CZT SPECT)-Derived Myocardial Blood Flow and Reserve: Correlation with Invasive Angiography Data. J Clin Med. 2024;13(5):1271. DOI: 10.3390/jcm13051271. 2. Kopeva K, et al. Coronary Microvascular Dysfunction: Features and Prognostic Value. J Clin Med. 2023;12(8):2964. DOI: 10.3390/jcm12082964.

EP-0465

Identification of lower limb diabetic vasculopathy: a novel indication of 99mTc-MIBI perfusion imaging

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Aim/Introduction: Diabetes constitute one of the largest global health emergencies of the current century. Diabetic complications in lower extremities are a major cause of morbidity and mortality impacting heavily upon the public-health system. Diabetic vasculopathy is one of the prime drivers of lower-limb (LL) complications of diabetes. Early and accurate recognition of these abnormalities is crucial, enabling early initiation of treatment and thus avoiding or minimizing deformity, dysfunction, and amputation. Current practice relies mainly on clinical findings and conventional imaging. Unfortunately, these are highly subjective and can detect vasculopathy-related consequences that appear late in the pathogenesis, rather than actual disease processes. LL perfusion imaging performed with 99mTc-MIBI offers accurate functional assessment of LL perfusion. Thus, LL perfusion at maximal stress and perfusion reserve(PR) assessment can efficiently overcome this lacunae. It has the potential to identify the patients at risk of future LL vasculopathy at very stages of disease process where institution of lifestyle modification and other preventive measures can prove to be gamechanger. This study evaluated the utility of lower extremity 99mTc-MIBI imaging as a non-invasive imaging to assses the vasculopathy in diabetics compared to non-diabetic controls. ***Materials and Methods:*** The current study included a total of 40 patients including 20 patients with long-standing diabetes(>3years) and 20 controls matched for sex, age and BMI. 99mTc-MIBI perfusion scintigraphy was performed for calf muscles at stress and rest. PR for bilateral calves was calculated as: (average stress counts-average rest counts)/ average rest counts x 100. The mean-difference between diabetics and non-diabetics was evaluated and significance of difference of means was assessed using unpaired t-test. The p-value <0.05 were considered significant. ***Results:*** Forty patients(15 males and 5 females in each subgroup) with median age 55.5(range 33-69) years were included in the study. Mean PR for left and right calf muscles in diabetic group was 57.9%±40.8% and 59.4%±41.2% respectively while that for control group was 88.5%±33.4% and 89.7%±38.4% respectively. There was significant difference between PR of the two groups. Also, mean exercise time and METS achieved were similar in both groups (Table 1). ***Conclusion:*** Radionuclide imaging with 99m-Tc MIBI allows non-invasive assessment of changes in both macrovascular and microvascular perfusion under dynamic exercise and thus, can efficiently identify the diabetes related vasculaopathy early in the course of disease. This can aid in early institution of lifestyle modifications and preventive stratigies, thus, slowing down if not preventing diabetic vasculopathy complications.

EP-0466

Influence of attenuation correction on regional perfusion during low dose cardiac spect on a digital SPECT/CT

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Aim/Introduction: The benefit of attenuation correction (AC) in cardiac single photon emission computed tomography (SPECT) is well established and thoroughly described. It was nevertheless underused but since the availability of digital spect/ct cameras, the use of AC in clinical routine has augmented profoundly, and we wanted to examine the regional differences of perfusion in AC and non AC corrected cardiac perfusion images, since AC corrected and camera based normal databases are not yet available to calculate perfusion defects. ***Materials and Methods:*** We analysed 59 consecutives cardiac SPECT examinations from a 1-day low dose scan protocol, acquired on a digital SPECT/CT camera (Véritón, Spectrum Dynamics). Stress examinations were executed after a bolus of 5 ml Regadeson during clinical supervison with blood pressure and ECG monitoring. Stress acquisition was performed first with 2.5 MBq/kg, followed by rest acquisition with 7 MBq/kg. All scans were acquired 30-45 min after injection of Tc-Sestamibi. The reconstructed short axis slices were imported into the 4DM software version 2018, Invia, Ann Arbor, USA. ***Results:*** Perfusion of the left ventricle was segmented into the 17 segment model (American Heart Association) and into the vascular territory model (left anterior descendens LAD, left circumflex LCX and right corronary artery RCA). Perfusion was normalised to 100% within its segment. Perfusion was in every of the 17 segments of the left ventricle significantly higher in the AC corrected image compared to the non AC corrected ones, except segments 12 (mid anterolateral), 16 (apical lateral) and 17 (apex). When the heart was segmented into vascular territories, all three coronary teritories (LAD, LCX and RCA) showed significant higher perfusion in AC corrected compared to non AC corrected ones. There was a significant higher increase in inferoseptal regions (regions 3 and 9 with resp 16,2% and 10,5%) compared to inferolateral ones (regions 5 and 11 with resp. 10,9% and 7,3%). The highest increase in perfusion was seen in segment 4 (20,2%), basal inferior, what is in concordance with findings in literature. There were no significant differences found between man and women, and between low or high body mass index, but this could be due to the relatively small amount of scans included. ***Conclusion:*** On a digital SPECT/CT camera, regional perfusion differs substantially after AC correction, compared tot non AC corrected images, especially in the inferior wall and software packages should take these differences into account to create normal databases.

EP-0467

Sex-specific prognostic value of LVEF derived by SPECT MPI in patients with diagnosed or suspected ischemic heart disease

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Aim/Introduction: Ischemic heart disease (IHD) is the leading cause of death worldwide. LVEF is one of the commonly used prognostic indicators for IHD. Recent studies have found that supra-normal LVEF (snLVEF) is associated with poor prognosis in women, but some studies showed snLVEF was a protective factor in female patients. SPECT myocardial perfusion imaging (MPI) plays an important role in the diagnosis and treatment of IHD. However, the classification of LVEF mainly refers to the cutoff value of ultrasound, and there is no data on the sex-specific cutoff value of LVEF derived by SPECT MPI (hereafter referred to as LVEF). Therefore, the purpose of this study was to find sex-specific cutoff values for LVEF and investigate its prognostic value in patients of different genders. ***Materials and Methods:*** This study included patients who received SPECT MPI due to symptoms or signs of IHD from 2016 to 2021. Patients were followed up with MACE as the endpoint. The relationship between LVEF and MACE in patients

of different genders was analyzed. According to literature reports, 40% and 45% are the cutoff values for reduced LVEF in male and female patients, respectively. The optimal cut-off value of increased LVEF was obtained based on the receiver operation characteristics (ROC) curve. Then, patients of different genders were divided into the low, normal and high LVEF groups. The prognosis of the three groups was compared by Kaplan Meier (KM) survival analysis, and the prognostic factors of the patients with different genders were obtained by univariate and multivariate Cox regression analysis. ***Results:*** A total of 1292 patients (487 females) were enrolled. After a follow-up of 3.2 (1.7-5.0) years, 496 patients developed MACE. The optimal cutoff for increased LVEF was 52% for men and 72% for women. KM analysis showed the prognosis of male patients with low LVEF was the worst. The female patients with high LVEF had the worst prognosis. For men, univariate analysis showed low and high LVEF were predictors. High LVEF was still an independent protective factor after multivariate analysis. In women, age, diabetes, hypertension, and low and high LVEF were predictors. However, multivariate analysis showed only age and hypertension were independent predictors. ***Conclusion:*** This study preliminarily explored sex-specific SPECT LVEF cutoff values for patients with diagnosed or suspected IHD and showed men with reduced LVEF had a poor prognosis, while women with reduced or increased LVEF both had a poor prognosis.

EP-0468

Large-scale comprehensive analysis of factors affecting the coherence between results reported from low-dose stress myocardial perfusion imaging and coronary angiography

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Aim/Introduction: The reliability of cardiac stress imaging techniques is frequently perceived through the coherence of routinely reported results with those from coronary angiography, and factors affecting this coherence are not well known. This study aimed to analyze on a large scale (i) the coherence between results reported from coronary angiography and low-dose myocardial perfusion SPECT-imaging (MPI) and (ii) interacting factors, in a comprehensive way. ***Materials and Methods:*** Data extracted from reports of stress-MPI obtained with a high-sensitivity CZT-camera and low-dose Sestamibi protocol (4.5±2.1 mSv), involving no attenuation correction and favoring exercise (75%) rather than pharmacological stress, were compared with the coronary angiography data routinely reported for the same patients. ***Results:*** We considered 1070 pairs of coronary angiography and stress-MPI reported by 11 different physicians. The extent of MPI-ischemia was predictive of angiographic findings of (i) significant CAD, when defined by > 70% stenosis and excluding the 50-70% stenoses, and (ii) a severe CAD category encompassing multivessel and proximal left anterior descending > 70% stenoses ($p < 0.001$ vs. less severe > 70% significant CAD). Main independent stress-MPI predictors of such significant and severe CAD were moderate-to-severe MPI-ischemia (≥ 3 segments, $p<0.001$), low-to-mild MPI-ischemia (< 3 segments, $p<0.001$), and ST-segment depression ($p<0.001$), with MPI-infarction being only predictive for significant CAD detection ($p<0.001$). However, independently of stress-MPI results, the rates of significant and/or severe CAD were (i) increased in patients with previous CAD history and in male, elderly, and diabetic patients, and (ii) decreased in patients with left bundle branch block or pacemaker (LBB/PM) and in the obese. In the absence of any previous CAD history, the respective rates of significant and severe CAD were 27.9% (67/240) and 9.2% (22/240) for patients having neither ischemia nor infarction, and 76.2% (61/80) and 48.8% (39/80) for patients with MPI-ischemia of moderate-to-severe extent or associated to ST-segment depression. ***Conclusion:*** Reports from low-dose stress-MPI, preferentially scheduled with exercise stress and uncorrected for attenuation, are globally coherent with the coronary angiography data reported in the multi-observer, high-throughput conditions of current medical practices. However, this coherence may be affected by the definitions for classification of significant and severe coronary lesions, and environmental factors (LBB/PM, CAD history, age, gender, obesity, and diabetes). ***References:*** Perrin M, et al. Stress-first protocol for myocardial perfusion SPECT imaging with semiconductor cameras: high diagnostic performances with significant reduction in patient radiation doses. Eur J Nucl Med Mol Imaging. 2015;42(7):100411.

EP-0469

Left Ventricular Dyssynchrony in Patients with Viable and Non-Viable Myocardium: Insights from Global and Territorial Assessments

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Aim/Introduction: Phase analysis in gated Myocardial Perfusion Single-photon emission tomography (gMPS) has been used to non-invasively evaluate mechanical dyssynchrony in patients with Coronary Artery Disease (CAD). Our study aimed to evaluate left ventricular (LV) dyssynchrony parameters in patients with viable and non-viable myocardium using gMPS techniques, examining both global and territorial phases analyses. ***Materials and Methods:*** We retrospectively studied examinations evaluating myocardial viability during the period: January 2023-March 2024. When segmental loss of radiotracer's activity was ≥ 50% was associated to akinesia, we considered it as non-viable. The Phase standard distribution (PSD), phase histogram bandwidth (PHB), and entropy were computed from gMPS scans for LV dyssynchrony assessment. The range of normal values in QGS software were based on the database of the Japanese Society of Nuclear Medicine: PHB: 5 to 39°, PSD: 0 to 11° and the valid entropy range is 7-41%. ***Results:*** Examinations of 31 patients were included (26 men, 83.8%). Differences were observed between viable (n=14) and non-viable (n=17) groups in both global and territorial analyses. Non-viable myocardium exhibited higher mean PHB values both globally (85.4 ± 44.6) and per territory (75.7 ± 48.1) compared to viable myocardium (Global: 36.4 ± 16.9; Territory: 33 ± 21.5) with a statistically significant difference (p=0). Similarly, PSD values were higher in non-viable myocardium both globally (22.7 ± 11.9) and per territory (21.2 ± 15.9) compared to viable myocardium (Global: 9.6 ± 4.8 p=0.03; Territory: 8.9 ± 6.4; p=0). Entropy values also varied significantly between non-viable (Global: 56.2 ± 11.4; Territory: 51.3 ± 15.9) and viable territories (Global: 37.2 ± 9.2; Territory: 33.4 ± 12.4); p=0 for both. ***Conclusion:*** This study provides comprehensive insights into LV dyssynchrony patterns associated with myocardial viability status, highlighting significant differences in PHB, PSD, and entropy parameters both globally and per territory. These findings underscore the potential clinical utility of combining global and territorial analyses in more precise assessment of myocardial viability.

EP-0470

Myocardial Scintigraphy For Emergency Care In Patients Presenting With Acute Chest Pain And Negative High-Sensitivity Troponin

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Aim/Introduction: Acute chest pain (ACP) constitutes a significant portion of emergency department (ED) admissions worldwide, requiring thorough evaluations to assess and manage potential acute coronary syndrome (ACS) cases effectively. Patient history, physical examination, electrocardiogram (ECG), echocardiography, and serial high-sensitive troponin (hsTn) aid in ruling out ACS. However, further diagnostic testing may be necessary to guide patient management and potential hospitalization, especially for low to intermediate-risk patients. Myocardial perfusion scan (MPI) is a well known valuable tool in this scenario, offering a strong negative predictive value for identifying coronary artery disease (CAD). Our study aims to assess the utility of MPI in clinical decision making for ED patients with ACP, facilitating safe discharge for those at low to intermediate ACS risk. ***Materials and Methods:*** Between July 2017 and January 2024, we enrolled 77 patients presenting to the ED with ACP and suspected ACS who at the end of the standard work-out presented negative hsTn. We collected clinical data, risk factors, ECG, echocardiography results, troponin levels, and any prior cardiac events. Patients underwent stress and rest MPI using 99mTc-tetrofosmin/99mTc-sestamibi on a CZT tomograph. The study analyzed MPI results, ED physicians' decisions, and follow-up data. ***Results:*** Initial assessments revealed 36,36% of patients with echocardiographic abnormalities (hypo or akinesia), 1,3% with STEMI-indicative ECG findings, and 18,18% with moderate elevated hsTn levels. MPI was negative in 66,2% of cases, 15,6 % of scans showed ischemia, and 7,8% showed signs of both ischemia and necrosis. Accordingly, patients with MPI positive for ischemia were hospitalized. Coronary angiography was performed, showing discordance with MPI in only 4 cases. 86,3 % of patients with negative MPI were discharged. Follow up demonstrated that nearly all (92.6%) remained event-free. After discharge, the remaining 7,4% of patients required further evaluation, such as elective coronary angiography, revealing either microvascular disease or multivessel pathology. Notably, only 3,9% of MPI results were inconclusive. ***Conclusion:*** The study confirms the utility of MPI in the clinical acute setting for patients with negative hsTn at the standard work-out, revealing ischemia in approximately 15% of patients. Alignment between positive MPI findings and coronary angiography was very high, accurately identifying CAD-affected myocardial territories. Negative MPI results allowed ED clinicians to safely discharge patients as shown by long term follow-up data demonstrating no subsequent cardiac events. Larger-scale studies could better elucidate the clinical impact of MPI in the emergency setting and its cost-effective benefits, favoring early discharge over hospitalization.

EP-0471

Feasibility and first experience of cardiac flow calculation on a digital SPECT/CT with attenuation correction

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Aim/Introduction: The ability to acquire cardiac flow from SPECT data is possible with the digital SPECT/CT camera. The validation of these data is lacking, so we acquired cardiac SPECT in dynamic and gated SPECT mode, and compared perfusion with flow data. ***Materials and Methods:*** We analysed 51 consecutives dynamic cardiac SPECT examinations on a digital SPECT/CT camera (Véritón, Spectrum Dynamics). The scan protocol was: scout low dose CT scan, injection of bolus of 200 MBq Tc-Sestamibi immediately followed by a dynamic scan for 6 min, static gated SPECT/CT of 8 min. After 15 minutes, 5 ml Regadenoson and a bolus of 700 MBq Tc-Sestamibi was injected, followed by dynamic scan for 6 min and a static gated SPECT/CT of 4 min. All scans were reconstructed with 2 iterations and 16 subsets and attenuation correction and imported into 4DM software v2018, Invia, Ann Arbor, USA. Perfusion was visually analysed with the 5-point scale. The stress flow and flow reserve data were recorded in ml/min/g in polar maps and in vascular territories. ***Results:*** We had no impression of bad or low quality input curves. Three of the scans were not imported correctly into 4DM due to too high pixel values. Three other patients had to be corrected for Rate Pressure Product, when the latter was above the upper limit of 12000. All stress scans were subtracted for the counts in the previous rest study, this functionality is foreseen within 4DM. In 11 patients, data from perfusion agreed with flow measurements, including 8 patients with normal perfusion and normal flow, 2 patients with moderate and 1 with significant perfusion and flow abnormalities. In 13 patients, data from flow was in disagreement or of added value, compared to the perfusion data. Most of the flow evaluation resulted in a mix of different segments and walls going from mild and moderate reduced, to ischemia, steal and scar. Since flow is a representative of tracer activity going from one to another physiological compartment and perfusion is a reflection of tracer deposition in a perfused myocyte, resulting in different results is logical. ***Conclusion:*** On a digital SPECT/CT camera, flow measurement of perfusion with Tc-sestamibi is possible in a low dose and less than 1 hour imaging protocol. During processing, different factors seem to influence the flow substantially. Further validation of this technique is mandatory and will be helpful to introduce this technique into clinical practice.

EP-0472

The prognostic value of coronary flow reserve by CZT stress myocardial perfusion and PET/CT imaging in selected patients without history of CAD: a systematic review and meta-analysis

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Aim/Introduction: We performed a systematic review and meta-analysis of published studies evaluating the prognostic value of myocardial flow reserve (MFR) assessed by cadmium-zinc-telluride (CZT)-SPECT systems and cardiac positron emission tomography (PET) imaging in predicting adverse cardiovascular events in

patients with suspected coronary artery disease (CAD). ***Materials and Methods:*** Studies published until March 2024 were identified by database search. We included studies evaluating MFR by CZT-SPECT systems or PET providing data on adjusted hazard ratio (HR) for the occurrence of adverse cardiovascular events. Annualized event rates were calculated and the incidence rate ratios with 95% confidence interval (CI) were estimated to compare patients with impaired and preserved MFR. Summary risk estimates for impaired MFR by CZT-SPECT and PET imaging were derived in random effect regression analysis and causes of heterogeneity were determined in meta-regression analysis. ***Results:*** We identified 13 eligible articles (3 CZT-SPECT and 10 PET studies) including 12,766 patients with a mean follow-up of 2.6±0.48 years. The pooled HR for the occurrence of adverse cardiovascular events was 2.48 (95% CI 2.06-2.99) and no heterogeneity was found. Among the included publications, three studies reported the HR for the occurrence of adverse cardiovascular events evaluated by CZT camera. The pooled HR was 5.05 (CI 95% 2.63-9.69) and no heterogeneity was found, while seven studies reported the HR for the occurrence of adverse cardiovascular events evaluated by PET imaging with a pooled HR of 2.30 (CI 95% 1.92-2.76) and no heterogeneity. A total of 7 studies reported data calculating separately the incidence rate of adverse cardiovascular events in patients with impaired versus preserved MFR. The pooled IRR was 3.98 (CI 95% 2.92-5.41) and the heterogeneity was 34.42%. Among studies evaluated MFR by CZT camera, the pooled IRR was 5.87 (CI 95% 3.15-10.94) and no heterogeneity was found, while among studies evaluated MFR by PET imaging, the pooled IRR was 3.62 (CI 95% 2.53-5.16), and the heterogeneity was 47.2%. At meta-regression analysis no significant association was found between the hazard ratio for adverse cardiovascular events and demographic and clinical variables considered. ***Conclusion:*** The evaluation of MFR by both CZT-SPECT and PET showed a significant prognostic power in the evaluation of patients with suspected CAD, with a higher value for MFR by CZT-SPECT. This result suggests that the use of the CZT systems in clinical routine practice in this cohort of patients, also considering the improvements in acquisition time and radiation exposure reduction.

EP-0473

Comparing AI based attenuation correction (AC) in myocardial perfusion imaging (MPI) with a dedicated CZT SPECT system to the gold standard of CT based AC

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Aim/Introduction: Attenuation correction by CT is the gold standard in myocardial SPECT. Most dedicated cardiac SPECT cameras do not include a CT for attenuation correction (AC). Therefore an AI based software tool (TruCorr) has been introduced in MPI. The aim of this study is to test the quality of a new AI based AC tool in comparison to the standard of CT based AC. ***Materials and Methods:*** Using a cardiac phantom (Antropomorphic Torso PhantomTM) we made comparative images on a whole ring general purpose SPECT/CT (VeritonCT) and a dedicated cardiac SPECT (D-SPECT cardio). Both systems are equipped with CZT detectors. The images of the phantom were taken with and without a 90° insert mimicking a defect of tracer uptake in the posterior wall. ***Results:*** All of the SPECT images without AC showed a typical attenuation in the posterior wall being more dominant in the D-SPECT images than in those of on the whole ring system. Using CT for AC of the SPECT/CT images one can see a homogenous image of the phantom and a clear distinction of the posterior insert representing 2 % of the volume of the LV. Applying the CT data to the D-SPECT images significantly reduced the attenuation in the posterior wall and an even better reduction can be obtained using the AI based software. On one hand AI based AC improves of image quality in the posterior wall, on the other hand it reduces the homogeneity in the apex. The AI based AC seems to get closer to the gold standard of the general purpose SPECT/CT than the CT based AC of the D-SPECT images. ***Conclusion:*** AI based software seems to improve the diagnostic performance of MPI detecting attenuation artefacts in the posterior wall. ***References:*** Ochoa-Figueroa M., Valera-Soria C., Pagonis C., Ressner M., Norberg P., Sanchez-Rodriguez V., Frias-Rose J., Good E., Davidsson A.: Diagnostic performance of a novel deep learning attenuation correction software for MPI using a cardio dedicated CZT camera. Experience in the clinical practice. in REMNIM 43 (2024), 23-30.

EP-27

e-Poster Area

B: Imaging Clinical Studies -> B4 Cardiovascular Imaging Clinical Study -> B42 Metabolism and Innervation

EP-0474

Feasibility of shortening scan time on ^{18}F-FDG myocardial metabolism imaging using a total-body PET/CT scanner

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Aim/Introduction: To evaluate 18F-FDG myocardial metabolism imaging (MMI) using a total-body PET/CT scanner and explore the feasible scan time to guide the clinical practice. ***Materials and Methods:*** A retrospective analysis was conducted on 41 patients who performed myocardial perfusion-metabolism imaging to assess myocardial viability. The patients underwent 18F-FDG MMI with a total-body PET/CT scanner using a list-mode for 600 s. PET data were reconstructed and split to simulate images of 600-s, 300-s, 120-s, 60-s, and 30-s acquisition time (G600-G30). Images among different groups were subjectively evaluated using a 5-point Likert scale. Semi-quantitative evaluation was performed using standardized uptake value (SUV), myocardial to background activity ratio (M/B), signal to noise ratio (SNR), contrast to noise ratio (CNR), contrast ratio (CR), and coefficient of variation (CV). Myocardial viability analysis included indexes of Mismatch and Scar. G600 served as the reference. ***Results:*** Subjective visual evaluation indicated a decline in the scores of image quality with shortening scan times. All the G600, G300, and G120 images were clinically acceptable (score≥3), and their image quality scores were 4.9±0.3, 4.8±0.4, and 4.5±0.8, respectively (P>0.05). Moreover, the semi-quantitative parameters of SUV, M/B, SNR, CNR, CR, and CV decreased with reduced scan time, and significant difference was observed in G300-G30 groups when comparing to G600 group (P<0.05). For myocardial viability analysis of left ventricular and coronary segments, the Mismatch and Scar values of G300-G30 groups were almost identical to G600 group (ICC: 0.974-1.0, P<0.001). ***Conclusion:*** Sufficient image quality could be achieved at G120 for MMI using a total-body PET/CT scanner, while the image quality of G30 was acceptable for myocardial viability analysis.

EP-0475

The Effect of Non-Cardiotoxic Chemotherapy on Myocardial ^{18}F-FDG Metabolism in Patient with Non-Small Cell Lung Cancer

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Aim/Introduction: Cardiotoxicity occurs during therapy with several cytotoxic drugs in Non-small cell lung cancer (NSCLC). However, it is stated in different studies that non-cardiotoxic chemotherapeutics do not have a direct cardiotoxic effect. The aim of the study is to evaluate effect of non-cardiotoxic chemotherapy (paclitaxel, carboplatin, gemcitabine, cisplatine, pemetrexed, docetaxel) on myocardial ^{18}F-FDG metabolism in patient with NSCLC. ***Materials and Methods:*** A total of 29 patients (19 men, 10 women) were included in the study (mean age: 69.4±11.0 years). The patients did not have any chronic disease, coronary heart disease, risk factors for coronary disease (diabetes, smoking, etc.) and a history of continuous drug use. Patients with liver metastases were excluded from the study. The ^{18}F-FDG PET/CT study was performed before and after chemotherapy treatment. After 12 hours of fasting, ^{18}F-FDG was administered intravenously at a rate of 0.14 mCi/kg, and a whole body PET/CT study was performed approximately 60 minutes later. Images were evaluated by two nuclear medicine specialists. Semiquantitative SUVmax values were obtained from the anterior, septal, lateral and inferior walls of the heart by creating ROI on transaxial sections. To normalize myocardial ^{18}F-FDG uptake with liver (heart/liver ratio) ROI was generated in each ^{18}F-FDG PET/CT study to obtain SUVmax value from liver. Findings from the cardiac examination and ^{18}F-FDG PET/CT study were compared with findings before and after chemotherapy treatment. ***Results:*** During the time period of the studies, no cardiac complaints/symptoms occurred in the patients. No significant difference was observed in cardiac examinations (ECHO, EKG) before and after chemotherapy. Normalized myocardial uptake (heart/liver ratio) was higher in anterior, septal, lateral, and inferior cardiac walls after chemotherapy treatment ($P < 0.001$). ***Conclusion:*** The ^{18}F-FDG PET/CT study showed that non-cardiotoxic chemotherapeutic agents (paclitaxel, carboplatin, gemcitabine, cisplatine, pemetrexed, docetaxel) significantly increased myocardial ^{18}F-FDG metabolism in anterior, septal, lateral and inferior cardiac walls in non-small cell lung cancers.

EP-0476

Association between the Quantity of Hibernating Myocardium and Coronary Collateral Circulation in Patients with Chronic Total Occlusion

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Aim/Introduction: To explore the association between the quantity of hibernating myocardium (HM) and the grading of collateral circulation in patients with chronic total occlusion (CTO) of the coronary arteries. ***Materials and Methods:*** We conducted a retrospective analysis on 88 CTO patients who underwent evaluation for HM using 99mTc-MIBI SPECT myocardial perfusion imaging in conjunction with 18F-FDG PET myocardial metabolic imaging, as they considered coronary revascularization. During coronary angiography, based on the Rentrop grading, we categorized coronary collateral circulation into two groups: the poorly-developed collateral circulation group (PD group, Rentrop 0-1) and the well-developed collateral circulation group (WD group, Rentrop 2-3). After adjusting for the potential confounding factors and conducting a stratified analysis, we explored the correlation between the HM index in the CTO region and the grading of collateral circulation. ***Results:*** In the WD group, the HM index of the CTO region was notably higher than in the PD group (46.2±15.7% vs. 20.9±16.7%, $P<0.001$). When dividing the HM index of the CTO region into tertiles, the proportion of patients with well-developed collateral circulation was 17.4%, 63.3%, and 88.6% in Tertile 1, Tertile 2, and Tertile 3, respectively. After adjusting for potential confounders, we observed that the proportion of patients with well-developed collateral circulation rose in tandem with an increase in the HM index of the CTO region (OR: 1.099, 95% CI: 1.043-1.158, $P<0.001$). This increasing trend was statistically significant (OR: 1.088, 95% CI: 1.036-1.144, $P<0.001$), most notably between Tertile 3 versus Tertile 1 (OR: 3.724, 95% CI: 1.148-12.072, $P=0.028$). Curve fitting indicated that the HM index in the CTO region was linearly and positively correlated with the proportion of patients with well-developed collateral circulation. Importantly, this correlation was consistent across different left ventricular ejection fraction (LVEF) groups, with no significant interaction observed (P for interaction = 0.330). ***Conclusion:*** In CTO patients evaluating revascularization options, the HM index in the CTO region is an independent correlation factor for the grading of collateral circulation. A greater HM index in the CTO region corresponded to an increased likelihood of well-developed collateral circulation, displaying an almost linear positive correlation between the two.

EP-0477

Usefulness of visual classification for cardiac pathophysiology using count-washout rate polarmap in iodine-123-β-methyl-p-iodophenyl-pentadecanoic acid scintigraphy

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Aim/Introduction: Myocardial washout rate (WR) is utilized in nuclear cardiology to evaluate the clinical pathophysiology of the heart. WR is defined as the ratio of the difference between the count in the early image and the time-decay-corrected delayed image divided by the former. WR of iodine-123-β-methyl-p-iodophenyl-pentadecanoic acid (BMIPP) is an indicator of myocardial lipolysis, and a decreased WR (<10%) of BMIPP is one of the diagnostic criteria for triglyceride deposit cardiomyovasculopathy (TGCV), a rare cardiovascular disorder characterized by the accumulation of triglycerides in the myocardium [1, 2]. However, decreased BMIPP uptake in early images, such as old myocardial infarction (OMI), also causes markedly decreased WR. To address this, we developed a novel technique called the count-washout rate polar map (CWRM), a graphical representation of the count and WR values in a polar coordinate system. This map provides a comprehensive view of the myocardial distribution of counts and WR, allowing for more accurate and intuitive interpretation of the data. ***Materials and Methods:*** To differentiate between TGCV and non-TGCV with OMI, both of which show decreased BMIPP WR, we visually evaluated CWRM consisting of two axes: count in the early image and WR. The count window was set to the maximum of the mean plus two standard deviations and a minimum of 50 counts, and the WR window was set to a maximum of 30% and a minimum of -20%. The color scale used

was as follows: high count and high WR represents light blue, low count and high WR represents blue, high count and low WR represents orange, and low count and low WR represents black. ***Results:*** In normal cases, sufficient counts were observed in the early images, and the WR did not decrease; CWRM showed light blue. In TGCV, sufficient counts were observed in the early image, but the WR markedly decreased; CWRM showed orange evenly. In non-TGCV with OMI, the regions with decreased and preserved counts coexisted; CWRM showed light blue in the normal region and black in the OMI region. In TGCV with OMI, CWRM showed orange in the TGCV myocardium and black in the OMI region. ***Conclusion:*** CWRM is useful for visually differentiating TGCV from non-TGCV with OMI. CWRM can be applied to other cardiovascular diseases with count and WR variations for visual classification. ***References:*** [1] Li M, et al. Orphanet J Rare Dis. 2019;14:134. [2] Kobayashi et al. Ann of Nucl Cardiol. 2020;6:99-104.

EP-0478

The use of [18F] FDG PET/CT in the diagnosis and management of patients with sarcoidosis and suspected cardiac involvement.

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Aim/Introduction: While [18F]FDG PET/CT is not typically part of the usual evaluation for sarcoidosis, there is increasing evidence that it is valuable in determining the level of inflammation. Sometimes the initial, and occasionally the only, sign of sarcoidosis is cardiac involvement. Cardiac sarcoidosis is more common than expected and is linked to increased morbidity and mortality. The aim of this study was to evaluate the role of [18F] FDG PET/CT in the diagnosis and management of cardiac sarcoidosis in a single center receiving all sarcoidosis patients from the country. ***Materials and Methods:*** We retrospectively describe the clinical profile, age, sex, stage of the disease, and previously received treatment and indications used in real life for [18F] FDG PET/CT. Our center has a strict recommendation to have a low-carbohydrate and high-fat diet with prolonged fasting and mostly we achieve physiologic myocardial metabolism suppression. We compare clinical, imaging, and Scadding classifications before PET and analyze the additional diagnostic value of PET. We describe further management decisions after PET/CT and propose its role in the diagnostic pathway. ***Results:*** Our data indicates that the 49 patients referred to PET/CT in 2022 and 2023 are predominantly relatively young individuals, aged between 22 and 57, who have more or less active sarcoidosis. After clinical evaluation and conventional imaging results, patients have an unclear metabolic volume of the disease and an uncertain management plan, so they are referred to PET. In several patients (35%), PET/CT provided additional information on disease involvement in other lymph node groups, the liver, bone marrow, and a few cases of positive cardiac sarcoidosis. Most of the patients had a clinical indication to assess cardiac involvement in PET, and nearly all of them (95%) had active cardiac sarcoidosis ruled out. These patients were not referred to an additional MRI or SPECT/CT for further care due to the absence of any practical justification. ***Conclusion:*** In our clinical practice, [18F]FDG PET/CT has shown to be a useful imaging method for ruling out active cardiac sarcoidosis and figuring out how widespread and active the disease is throughout the body. The use of PET helps to minimize unneeded further imaging, particularly those that involve ionizing radiation, which is important for relatively young patients. We suggest utilizing [18F]FDG PET/CT as the initial imaging modality to assess disease metabolic volume and to rule out active cardiac sarcoidosis provided that the individual adheres to stringent dietary guidelines.

EP-28

e-Poster Area

B: Imaging Clinical Studies -> B4 Cardiovascular Imaging Clinical Study -> B43 Heart Failure (including Sarcoidosis and Amyloidosis)

EP-0479

Diagnostic utility of 99mTc-pyrophosphate (99mTc-PYP) scintigraphy in cardiac amyloidosis: a retrospective study

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Aim/Introduction: Cardiac amyloidosis (CA) poses a significant diagnostic challenge, necessitating noninvasive imaging modalities. 99mTc-pyrophosphate (99mTc-PYP) is a useful radiotracer that can specifically identify ATTR-CA. This study aims to assess the diagnostic efficacy of amyloid scintigraphy utilizing 99mTc-PYP in suspected CA patients. ***Materials and Methods:*** We retrospectively analyzed 150 patients with suspected CA who underwent 99mTc-PYP amyloid scintigraphy with static imaging of the thorax 60 min post-injection. Additionally, whole-body scintigraphy was performed 3-4 hours post-injection in 134 patients, with 41 patients undergoing SPECT/CT and two undergoing SPECT alone. Cardiac retention was evaluated using semi-quantitative (Perugini score 0-3) and quantitative (heart-to-contralateral lung ratio, H/CL ratio) methods, compared against myocardial biopsy and cardiac MRI results. ***Results:*** Myocardial biopsies (n=16) confirmed CA in 13 patients, with 7 of those diagnosed with ATTR-CA. Cardiac MRI (n=77) diagnosed CA in 44 patients. 99mTc-PYP scintigraphy demonstrated a sensitivity of 92.3% (Perugini score) and 53.8% (H/CL ratio), with a specificity of 33.3% and 66.7%, respectively, using myocardial biopsy as the gold standard. Compared to cardiac MRI, sensitivity was 90.9% (Perugini score) and 63.6% (H/CL ratio), with a specificity of 15.2% and 63.6%, respectively. Additional SPECT/CT or SPECT improved specificity to 85.7% when using cardiac MRI as the reference standard. Notably, a Perugini score of 3 and 2 exhibited 100% sensitivity in diagnosing ATTR-CA, while a H/CL ratio > 1.5 showed 85.7% sensitivity. ***Conclusion:*** 99mTc-PYP scintigraphy presents high sensitivity in diagnosing CA and excellent sensitivity in detecting ATTR-CA, offering a noninvasive diagnostic alternative in evaluating suspected CA cases. The application of SPECT/CT and SPECT enhances specificity, facilitating differentiation of blood pool and myocardial uptake. ***References:*** 1. Castano A, et al. Serial scanning with technetium pyrophosphate ((99m)Tc-PYP) in advanced ATTR cardiac amyloidosis. J Nucl Cardiol. 2016;23(6):1355-63. 2. Castano A, et al. Multicenter Study of Planar Technetium 99m Pyrophosphate Cardiac Imaging: Predicting Survival for Patients With ATTR Cardiac Amyloidosis. JAMA Cardiol. 2016;1(8):880-9.

EP-0480

Diagnostic accuracy of Tc-99m pyrophosphate scintigraphy in cardiac amyloidosis

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Aim/Introduction: This study aims to evaluate the accuracy of Tc-99m pyrophosphate (PYP) in diagnosing cardiac amyloidosis (CA) and examining the clinical and imaging features of amyloid transthyretin (ATTR) patients with positive results on Tc-99m PYP scintigraphy. ***Materials and Methods:*** In this retrospective study, 247 patients underwent Tc-99m PYP scintigraphy at West China Hospital, Sichuan University between January 2018 and December 2022, with the Perugini visual score1 utilized for interpretation. Patient demographics, clinical manifestations, myocardial biopsy, Tc-99m PYP scan results, and laboratory findings, including immunoglobulin light chain analysis, were meticulously recorded and analyzed. Only 75 patients had a final diagnosis of CA. The study further evaluated the sensitivity, specificity, accuracy, and positive predictive value of Tc-99m PYP scintigraphy for detecting CA-ATTR and the negative predictive value for cardiac amyloid light chain (CA-AL). ***Results:*** Tc-99m PYP scan had a sensitivity of 80%, specificity of 60%, accuracy of 67%, and positive predictive value of 50% in identifying CA-ATTR. The negative predictive value of the Tc-99m PYP scan for CA-AL was 86%. Peripheral neuropathy was observed in 10 out of 25 CA-ATTR patients and 7 out of 50 CA-AL patients. Autonomic neuropathy was observed in 13 out of 25 CA-ATTR patients and 9 out of 50 CA-AL patients. Only 1 of the 20 CA-ATTR patients with positive Tc-99m PYP scan results had low QRS voltage, while all 5 CA-ATTR patients with negative Tc-99m PYP scan results had low QRS voltage. In CA patients, an increased likelihood of CA-ATTR was associated with follows: troponin T levels ≤ 57.15 ng/L (sensitivity 82%, specificity 76%), NT-proBNP levels ≤ 2548 ng/L (sensitivity 73%, specificity 76%), and LVEF ≥ 55% (sensitivity 79%, specificity 58%). ***Conclusion:*** Tc-99m PYP scan is a reliable method for distinguishing CA-ATTR from CA-AL. Since CA-AL patients may exhibit positive Tc-99m PYP scan results, it is advisable for suspected CA-AL patients to undergo Tc-99m PYP scintigraphy2. For phenotype, CA-ATTR patients presented a more common autonomic neuropathy and peripheral neuropathy. Moreover, CA-ATTR patients with positive Tc-99m PYP scan results tend to have a lower prevalence of low QRS voltage than those with negative scan results. ***References:*** 1.Perugini E, Guidalotti PL, Salvi F, et al. Noninvasive etiologic diagnosis of cardiac amyloidosis using 99mTc-3,3-diphosphono-1,2-propanodicarboxylic acid scintigraphy. J Am Coll Cardiol. 2005;46(6):1076-1084.2.Lin H, Zhang X, Einstein AJ, Tang G. Serial Tc-99m MDP scintigraphy demonstrating increasing cardiac uptake over time in a patient with light-chain cardiac amyloidosis. J Nucl Cardiol. 2022;29(4):2024-2028.

EP-0481

Bone Scintigraphy Coupled To Heart Function Evaluation By First Pass Radionuclide Angiography

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Aim/Introduction: Chemotherapeutic drugs, particularly Anthracycline and its derivatives, are known to adversely affect heart function. This toxicity, which is dose-dependent, initially impacts diastolic function before progressing to affect systolic function. Given this risk, assessing left ventricular function becomes imperative by anatomical and/or isotopic imaging techniques. Equilibrium radionuclide angiography stands out as the gold standard among various isotopic imaging methods and is frequently used in our department. Recognizing that cancer patients often undergo bone scans for staging or follow-up, we propose a novel approach to enhance patient care. Our aim is to integrate the evaluation of cardiac function with routine bone scanning protocols. This involves modifying the bone scan injection protocol by administering the radiotracer bolus under the gamma-camera detector, allowing us to record its first pass through the heart and great vessels. ***Materials and Methods:*** Six cancer patients were referred to our department for bone scintigraphy for staging purposes. Given our dual objective of detecting bone metastases and evaluating heart function, these patients underwent radiopharmaceutical injection under the gamma camera detector, and we recorded the first pass of the radionuclide (Diphosphonate bone scanning agents) bolus through the heart and great vessels by synchronizing the data acquisition with the cardiac cycle. Three hours post-injection, we completed the protocol acquisition with whole-body bone scanning. ***Results:*** In addition to the conventionally acquired whole-body bone scans, we have obtained, for each patient, the time/activity curve, the left ventricular ejection fraction, the diastolic filling parameters, and the parametric images. These data inform us about the diastolic and systolic states of the left ventricle, similar to conventional first-pass radionuclide angiography with blood tracers. ***Conclusion:*** Bone scintigraphy combined with heart function evaluation can serve as a new follow-up protocol for patients undergoing cardiotoxic chemotherapy. It allows for the completion of two essential exams in cancer patients on the same day with a single radioactive product injection. Furthermore, it can enhance the existing arsenal of cardiac function follow-up and may present an alternative to currently available procedures.

EP-0482

Gender-dependent myocardial distribution patterns of ^{99m}Tc-DPD in patients with transthyretin amyloidosis (TTR-CA): Demonstration by SPECT-CT

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Aim/Introduction: To demonstrate whether the gender of patients with cardiac TTR amyloidosis influences the distribution of the radiopharmaceutical in the myocardium and whether SPECT-CT is able to detect it. ***Materials and Methods:*** SPECT-CT chest was performed on a sample of 65 patients with TTR-CA confirmed by 99mTc-DPD scintigraphy, immediately after the scan. CT and SPECT images were processed together using the Emory Cardiac Toolbox software (GE Healtcare®), which merged both studies, subjecting them to attenuation and motion correction and iterative reconstruction. Finally, polar maps were obtained for each patient, obtaining a score for each of the 17 myocardial segments based on 99mTc-DPD uptake. The score was divided into 5 levels (0=very high uptake, up to 4=very low/no uptake). Mean scores were obtained according to the sex of the patients and we sought statistically significant differences in the distribution pattern of the radiopharmaceutical. ***Results:*** 51 males (78.5%) and 14 females (21.5%) were assessed. Based on the Perugini visual uptake scale, 54 (83.1%) were classified as grade 3 and 11 (16.9%) as grade 2. The sum of the scores obtained on each polar map gave a result of 277 points in the female group

and 876 points in the male group. In detail, females showed lower 99mTc-DPD accumulation in the mid anterior (p=0.035) and basal anterior (p=0.001) segments, while males showed higher scores in the basal anteroseptal (p=0.009) and basal inferoseptal (p=0.009) segments, and lower scores in the lateroapical segment (p=0.039). ***Conclusion:*** Gender of patients with TTR cardiac amyloidosis is a variable that influences the distribution of the radiopharmaceutical in the myocardium. SPECT-CT is a useful and reliable tool in the evaluation of this characteristic, as well as in transforming it into a quantitative value.

EP-0483

Correlation between 123I-metaiodobenzylguanidine liver washout rate and plasma brain natriuretic peptide concentrations in the fontan patients

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Aim/Introduction: In planar 123-I metaiodobenzylguanidine (123I-MIBG) myocardial imaging of Fontan patients, the timing of liver accumulation varies from patient to patient. The aim of this study is to investigated on the relationship between the liver washout rate (LWR) of 123I-MIBG and plasma brain natriuretic peptide (BNP) concentrations in the Fontan patients. ***Materials and Methods:*** The consecutive 30 Fontan or Fontan candidate patients (including 18 patiens of Glenn : mean age, 2.1±0.82 years, and 12 patients of Total cavopulmonary connection(TCPC) mean age, 14.0±8.7 years) were entered in this study. We examined 123I-MIBG scintigrams for Fontan patients of suspect heart failure. 123I-MIBG planar images from an anterior view were obtained 20 minute and 3hour after an intravenous injection of 123I-MIBG . The injection activity in pediatric nuclear medicine were decided by "Japanese consensus guidelines for pediatric nuclear medicine". Cardiac sympathetic activity was assessed by 123I-MIBG planar images as the Washout Rate of heart (HWR).HWR and LWR was assessed by MIBG planar images (early and delayed). The washout rate of heart (HWR) and LWR were calculated using the following formula:{([H or L]-[M])× early-([H or L]-[M])× delayed} ÷ ([H or L]- [M])× early× 100 (%) :where [H] equals the mean count per pixel in the left ventricle, [L] equals the mean count per pixel in the liver and [M] equals the mean count per pixel in the upper mediastinum. In this study, time decay was not corrected for the calculation of WR. The relationships between BNP concentrations and HWR, or LWR were examined. ***Results:*** HWR was significantly positively correlated with logBNP in Glenn patients(r=0.580 p<0.01). In TCPC patients, HWR was not correlated with logBNP (r=0.430 p=0.163). LWR was significantly negatively correlated with logBNP in Glenn patients(r=0.465 p<0.05). In TCPC patients, LWR was not correlated with logBNP (r=0.253 p=0.428). ***Conclusion:*** There were significant correlations between the parameters of HWR and BNP concentrations. Moreover, there were significant negatively correlations between the parameters of LWR and BNP concentrations in Glenn patients.This finding indicated that liver accumulation timing of 123I-MIBG image is meaned of congestive circulation in the patients of Glenn.

EP-0484

Clinical and Scintigraphic Characteristics in Patients with Cardiac Amyloidosis

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Aim/Introduction: The two main forms of cardiac amyloidosis are light chain amyloidosis (AL) and transthyretin amyloidosis (ATTR). Different tracers make it possible to image cardiac amyloidosis, the most extensively studied being 99mTc-labeled bone-seeking tracers. The intensity of uptake in the heart is described with the Perugini score, which has four grades (0-3). In patients with specific clinical signs, changes on echocardiography or magnet resonance imaging and an uptake of grade 2 or 3, we can diagnose ATTR without biopsy, if AL was excluded. ***Materials and Methods:*** We included consecutive adult patients who underwent scintigraphy, due to suspicion of cardiac ATTR amyloidosis, between July 2023 and March 2024. Three hours after intravenous application of 500 MBq 99mTc-labeled 3,3-diphosphono-1,2-propanodicarboxylic acid ([99mTc]Tc-DPD) we obtained planar whole body images and single photon emission tomography with computed tomography (SPECT/CT) images of the chest. Uptake on planar images was scored visually while uptake on SPECT/CT images was scored in a semiquantitative manner measuring standardized uptake value (SUV). SUV of the whole heart, the anterior, lateral and inferior left ventricular wall, the apex, interventricular septum and the right ventricle wall was measured. The uptake pattern and the region with the highest SUV on SPECT/CT was noted. In the report we defined the intensity of tracer accumulation on a scale from 0 - 3 and described the presence of extracardiac amyloidosis. Clinical and scintigraphic data were collected prospectively. ***Results:*** 72 patients were included in the study. Among them, 36 were female (50%), with a mean age of 71.6 (± 13.9) years. Grade 2/3 uptake was observed in 18 patients (25%), with diffuse uptake in 11 (61.1%), focal in 4 (22.2%), and focal on diffuse in 3 (16.7%). Older age (79.7 ± 6.3 vs 69.0 ± 14.7) and male sex (66.7%) were more common in patients with grade 2/3 uptake. The heart regions with the highest uptake were the interventricular septum in 12 patients (66.6%) and the inferior and lateral wall with 3 patients each (16.7% each). Mean SUVs were 9.7 for the interventricular septum, 8.3 for the inferior wall, and 7.2 for the lateral wall. Extracardiac amyloidosis was detected in 10 patients (13.9% overall, 55.6% in patients with grade 2/3 myocardial uptake). ***Conclusion:*** In patients suspected of cardiac ATTR 25% showed signs of amyloidosis, with a higher prevalence in males and older individuals. Diffuse uptake was most common, with the interventricular septum exhibiting the highest uptake.

EP-0485

[99mTc]Tc-PYROPHOSPHATE (PYP) SCINTIGRAPHY FINDINGS OF CARDIAC AMYLOIDOSIS: IS IT A PREDICTOR FOR SURVIVAL?

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Aim/Introduction: Association [99mTc]Tc-pyrophosphate (PYP) uptake with survival of cardiac amyloidosis (CA) is still unkown. This study aimed to describe the scintigraphic findings of CA suspected cases and determine the prognostic value of scintigraphy. ***Materials and Methods:*** Between September 2020-December 2023, all [99mTc]Tc-PYP scintigraphy images of CA suspected cases were evaluated retrospectively. The scintigraphy images were obtained 1h and 3h after intravenous injection of 740 MBq [99mTc]Tc-PYP. The quantitative and semiquantitative results of scintigraphy were analyzed, and their correlation with clinical outcomes was explored. ***Results:*** Among the 268 cases

(147 female, 121 male; median age:65), 12 (4.5%) were diagnosed with ATTR CA, 19 (7.1%) with AL CA. The median follow-up time was 386 days. ATTR CA cases exhibited significantly higher [99mTc]Tc-PYP uptake than AL CA and non-CA cases. The 1h and 3h heart-to-contralateral lung ratios were positively high degree correlated each other and SPECT/CT imaging reduced equivocal results from 82% to 37%. Eight of 19 patients with AL CA, one of 12 with ATTR CA, and 15 of non-CA cases died on follow-up. Median survival was 22 days in ATTR CA, 201 days in AL CA, and 105 days in non-CA ex cases. Survival analysis indicated significantly lower survival in non-CA cases compared to ATTR CA and AL CA. ***Conclusion:*** [99mTc]Tc-PYP scintigraphy demonstrated varying uptake patterns in different CA forms. The study emphasizes the importance of combining scintigraphic findings with laboratory tests for accurate CA diagnosis and highlights the poor survival of individuals investigated for CA, even if the diagnosis is not confirmed.

EP-0486

Ventricular function assessment with gated-SPECT/CT using [^{99m}Tc]Tc-HDP in TTR Amyloidosis

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Aim/Introduction: Cardiac transthyretin amyloidosis (ATTR) is a disease characterized by abnormal deposition of altered transthyretin fibrils in the myocardium. Technetium-99m-labelled diphosphonates have been used for the non-invasive diagnosis of ATTR, obviating the need for invasive procedures such as cardiac biopsy in many patients. The aim of this study was to evaluate the usefulness of ventricular function assessment by gated-SPECT/CT with these tracers. ***Materials and Methods:*** This study included 29 patients with a non-invasive diagnosis of TTR amyloidosis. All patients underwent a thoracic gated-SPECT/CT study 3 hours after injection of technetium-99m hydroxydiphosphonate ([99mTc]Tc-HDP). We compared the obtained ventricular function parameters with those obtained by morphological studies (echocardiography and magnetic resonance). ***Results:*** A total of 29 patients with Perugini grade ≥2 were included in this study (22 males; mean age 82.48±7.04 years; 51.72% with Perugini grade 3). Mean left ventricular ejection fraction (EF) obtained by gated-SPECT/CT was 39.79±13.51%, mean end-systolic volume (ESV) was 57.72±35.39 mL and mean end-diastolic volume (EDV) was 89.79±38.33 mL. A moderately strong positive correlation was found between EF values obtained by gated-SPECT/CT and morphological studies (r=0.60; p=0.01), although gammagraphic results tended to underestimate the EF (mean difference -6.79±12.00%). A strong positive correlation between both methods was found for ESV and EDV (r= 0.81 and r=0.81, respectively; p<0.01). When taking into account only those patients with Perugini grade 3, a stronger positive correlation was found regarding EF values (r=0.82; p<0.01), ESV (r=0.90; p<0.01) and EDV (r=0.87; p<0.01). In these patients, mean difference between EF obtained by gated-SPECT/CT and by morphological studies was -6.73±2.06%. ***Conclusion:*** SPECT/CT is an essential technique in the diagnosis of TTR amyloidosis, being able to identify the presence of diphosphonate uptake in the myocardium and its distribution. Additionally, it may also have a role in ventricular function assessment, being able to simultaneously identify patients with impaired EF and abnormal ventricular volumes, thus providing prognostic value that may influence patient's management. This may obviate the need for further morphological procedures and may be of particular importance in cases where echocardiography or magnetic resonance aren't feasible options.

EP-0487

SPECT/CT Scintigraphy in the Diagnosis of ATTR Cardiac Amyloidosis - The Ultimate Noninvasive Tool

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Aim/Introduction: Amyloidosis is a systemic disease with poor prognosis when there is heart involvement. The most common inherited amyloidosis, is caused by a mutation in the transthyretin (TTR) gene that produces abnormal transthyretin protein fibril deposition in the heart. The aim of our study was to compare the use of SPECT and SPECT/CT scintigraphy, in the diagnosis of TTR-cardiac amyloidosis (Attr-CM) in patients with heart failure and preserved ejection fraction (HFpEF). ***Materials and Methods:*** A total of 91 patients with HFpEF, LVEF>50%, elevated proBNP levels, low ECG dynamics and an ultrasound image showing reduction in the longitudinal strain of the basal wall segments with normal strain levels in the apical segments (apical-sparing), were examined. Up to September 2023, imaging was performed with a dual headed SPECT γ-camera, but thereupon a SPECT/CT dual-headed γ-camera was used. Planar & SPECT and Planar & SPECT/CT imaging was performed in 53 and 38 patients, respectively. The protocol used in all patients was imaging with either 99mTc-PYP or 99mTc-DPD, at one hour and at three hours post radiopharmaceutical administration. All acquired images were visually assessed by two Nuclear Medicine physicians and myocardial uptake was also evaluated with the Perugini Grading Scale. ***Results:*** Nine (9) patients were positive for Attr-CM and 56 patients were negative. With SPECT/CT scintigraphy, there were no equivocal results. The 35 negative results from this group showed clearly no uptake to the heart muscle. Blood pool was easily distinguished from any heart uptake in the SPECT/CT fused images and the three hours delayed imaging helped to clear images even more. From the SPECT only group, 26 had an equivocal result and were categorized as Grade 1 or 2. A total of 17 patients with Grades 3 and 2 started therapy. ***Conclusion:*** Scintigraphic imaging of the heart is already an established tool in the differential diagnosis of Attr-CM from other causes of cardiomyopathy. Nowadays, planar imaging alone is considered to be inadequate and SPECT imaging should always be performed. When SPECT/CT is available the images obtained have better quality, correspond more accurately to visual assessment than SPECT only imaging and reduce false positive results which, in our opinion, makes SPECT/CT the ultimate noninvasive tool in the diagnosis of Attr-CM.

EP-0488

Quantification parameters in 99mTc-DPD-SPECT/CT imaging, in patients with suspected cardiac Amyloidosis by transthyretin, our experience.

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Aim/Introduction: To establish the usefulness of quantification parameters in hybrid SPECT/CT images and their correlation with analytical and ultrasound values in patients with suspected cardiac amyloidosis due to transthyretin (AcTTR). ***Materials and Methods:*** We retrospectively reviewed 243 scintigraphy scans

(153-men/90-women; mean age: 83 years) from January, 2022 to January, 2023, in patients with clinical suspicion of AcTTR. Planar images were obtained in anterior and posterior projections, after administration of 700-740 MBq of 99mTc-DPD and those who were positive according to Perugini visual scale, underwent SPECT/TCxQUANT, obtaining measures of cardiac quantification (SUV max, peak, mean) and adjacent areas (blood pool, sternum, vertebrae, ribs). Biochemical (troponins, probnp, total proteins and albumin), electrocardiographic and echographic (LVEF, E/E', TAPSE, GLS) findings were collected. Subsequently, the data were analyzed by Pearson correlation between SUV values, biochemical and echographic parameters, using SPSS v25 software. ***Results:*** Of the total number of patients, 76 presented positive scintigraphy. Of these, 45 were studied with ultrasound to confirm/rule out ventricular dysfunction (GLS). In these patients, correlation analysis was performed between these parameters of scintigraphic, biochemical and ultrasound quantification, with no statistically significant results (p>0.05). The percentage of cardiovascular processes present in the sample are also detailed: congestive heart failure (51%), HT (76%), dyslipidemia (67%) and diabetes (27%). Likewise, 64% had altered troponins and 89% had altered proBNP. 29% had AVB, 51% AF and 27% low voltage. ***Conclusion:*** These results show that, at this point, gammagraphic parameters cannot adequately stratify patients with AcTTR, probably because of the sample size. However, it is likely that, after further studies and enlargement of the sample, they could be predictors of disease associated with other parameters such as ultrasound and biochemical parameters.

EP-0489

Cardiac amyloidosis: comparison between visual analysis and quantification of uptake in cardiac scintigraphy with 99mTc-diphosphonates

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Aim/Introduction: Cardiac amyloidosis (CA) is an infiltrative disease due to protein deposition, which can cause restrictive cardiomyopathy. Cardiac scintigraphy (CS) with 99mTc-diphosphonates has diagnostic value by visual analysis. The aim of this study is compare patients with clinical suspicion of CA with the Perugini Score of CS, cardiac quantification by ratios and correlate these results with Cardiac Magnetic Resonance (CMR) variables. ***Materials and Methods:*** Retrospective study of 37 patients (p) with suspected CA (22 men), mean age 74 years (46-86), in whom CS and CMR were performed. Total body scintigraphy was performed in anterior and posterior projections at 3 hours of 99mTc-diphosphonates administration. Maximal cardiac uptake (CMC), maximal cardiac uptake/contralateral thoracic activity (CMC/HCL) and CMC/HCL indexes with background activity subtraction (CMC/HCL-Bkg) were calculated. Cardiac quantification results were correlated with Perugini Score. Interventricular septal thickness (IVS), ventricular ejection fraction (LVEF) of CMR variables were analyzed and correlated with the Perugini Score of the CS. ***Results:*** Of the 37p assessed, 21p were diagnosed with CA. 13p were diagnosed with ATTR (7p with Score 3, 1p with Score 2, 3p with Score 1 and 2p with Score 0), 5p had light chain amyloidosis (AL) (4p with Score 0 and 1p with Score 1) and 3p with other types of systemic amyloidosis (2p with Score 1 and 1p with Score 0). - Median CMC: 73 (36-1927). Score 0 with CMC: 66.8 (36-123). Score 1 with CMC: 279 (69-960). Score 2-3 with CMC: 699 (149-1927); p<0.01. - Mean CMC/HCL ratio: 1.22 (0.68-3.76). Score 0 the CMC/HCL ratio: 0.97 (0.68-1.13). Score 1 the CMC/HCL ratio: 1.13 (0.97-1.22). Score 2 and 3 the CMC/HCL ratio: 2.1 (1.20-3.76); p<0.01.- The average CMC/HCL-Bkg ratio: 3.27 (0.07-34.9). Score 0 the CMC/HCL-Bkg ratio: 1.26 (0.68-2.4). Score 1 CMC/HCL-Bkg ratio: 1.33 (0.26-2.1). Score 2 and 3 the ratio CMC/HCL-Bkg: 10.53 (1.26-34.4); p<0.01. - The mean IVS was 15.6mm (12-25) and LVEF was 55.1% (26-87%); without finding significant correlations with the Perugini Score. - A positive correlation (0.96) was identified between the cardiac uptake indexes and the Perugini Score. ***Conclusion:*** CS with 99mTc-diphosphonates is a useful method in the noninvasive assessment and classification of patients with CA. Quantitative methods based on CMC indexes, CMC/HCL and CMC/HCL-Bkg, are simple procedures and help in the classification of patients with Perugini Score. The IVS and LVEF obtained in MRI do not present statistically significant correlation with Perugini scores or CMC/HCL indexes.

EP-0490

Potential prognostic value of quantified right ventricle involvement in Cardiac Transthyretin Amyloidosis. A preliminary, single center case-control study.

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Aim/Introduction: To quantify right ventricle (RV) amyloid deposits in ATTR-CA patients referred to 99mTc-DPD scintigraphy and to estimate its potential prognostic value. Myocardial uptake of phosphate bone-seeking radiotracer 99mTc-DPD is remarkably sensitive for detecting transthyretin cardiac amyloidosis (ATTR-CA). However, the prognostic value of quantifying RV cardiac amyloid deposit is still unknown. ***Materials and Methods:*** Scintigraphic images were acquired in a sample of consecutive patients with ATTR-CA through a dual head hybrid SPECT/CT camera. Perugini score were obtained in each case. Cardiac SPECT/CT images were processed to quantify RV involvement applying a dedicated processing protocol. Through 12-16 pixels ROIs we calculated the ratio between maximal counts in RV and maximal counts in LV septum. RV/LVseptx100 ratio (%) was defined to estimate RV amyloid burden, both in attenuation corrected (iterative reconstruction: IRAC and filtered back projection: FBP) and non-corrected (NC) images. We compared RV/LVsept between dead patients ("cases") and alive ("controls"). ***Results:*** We included 22 patients with diagnosed ATTR-CA based on expert consensus criteria (Perugini score of 2 or 3); 77% males, mean age of 84 years. All patients presented 99mTc-DPD uptake in RV. A total of 14 patients died during follow-up (mortality: 64%). RV/LVsept activity ratio did not differed between NC and AC images. NC LVsept activity was 22.9 ± 4.4 % in cases vs. 20.0 ± 2.9 % in controls (p = 0.109). NC RV/LVsept was 41,4% ± 15.5 % in cases and 52.9 ± 13.6 % in controls (p = 0.098). A RV/LVsept ratio of at least 50% presented

an OR of 0.16 (95% CI: 0.0065 - 1.114) for the development of death during follow-up (p = 0.0815). ***Conclusion:*** RV involvement is a rule in patients with ATTR-CA. A more pronounced amyloid deposit in septal LV vs. RV supports the hypothesis of a greater prognostic value of quantified deposits in septum than in RV, with RV uptake as a later phenomenon with less influence in prognosis. The real prognostic value of different patterns of biventricular amyeloid deposit deserves further evaluation through larger, multicentric experiences.

EP-29

e-Poster Area

B: Imaging Clinical Studies -> B4 Cardiovascular Imaging Clinical Study -> B44 Other Cardiovascular Imaging (including Plaque)

EP-0491

Relationship of HF severity with mitochondrial dysfunction assessed by PBMC respiratory function and ^{99m}Tc-MIBI washout imaging in patients with CRT indications

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Aim/Introduction: The mitochondrial dysfunction (MD) is important mechanisms affecting the heart failure (HF) pathogenesis. The 99mTc-methoxy-isobutyl-isonitrile (99mTc-MIBI) scintigraphy has been reported to be a functional imaging tool for in vivo detection of MD in myocardium. According to studies is possible to evaluate the respiration activity of cardiomyocyte mitochondria by the respiration of mitochondria from peripheral blood mononuclear cells (PBMC). We aimed to evaluate the relationship of HF severity with MD assessed by PBMC respiratory function and 99mTc-MIBI washout imaging in patients with cardiac resynchronization therapy (CRT) indications. ***Materials and Methods:*** In this single-center study patients with HF of New York Heart Association (NYHA) II and III functional class (FC) and CRT indications underwent transthoracic echocardiography (TTE) and MD assessment using laboratory (respiratory function of PBMC mitochondria) and radionuclide (myocardial perfusion scintigraphy with 99mTc-MIBI) approach. Mitochondrial respiration rate (MRR) (pyruvate + malate + adenosine diphosphate; succinate + adenosine diphosphate; pyruvate + malate - adenosine diphosphate [V4.1]; succinate - adenosine diphosphate) and washout rate (WR) indicators were calculated. Correlations between HF NYHA FC, TTE, MRR and WR indicators were evaluated. Based on our data, we developed a risk model regarding HF severity. ***Results:*** In overall 26 (100.0%) HF patients, 11 (42.3%) had mild HF defined as NYHA FC II (1st group) and 15 (57.7%) had moderate-to-severe HF defined as NYHA FC III (2nd group). Patients with moderate-to-severe HF were likelier to have a lower V4.1 (p<0.001) values. This indicator was independently associated with moderate-to-severe HF in univariate and multivariate logistic regression (odds ratio 0.87; 95% confidence interval 0.77-0.98; p<0.001). The developed HF severity risk model allowed us to correctly predict the moderate-to-severe HF in our study cohort with an accuracy of 84.62%. The sensitivity of the model was 80.00%, while the specificity was 100.00%. ***Conclusion:*** The severity of HF is associated with PBMC mitochondrial respiratory dysfunction, but not correlated with WR assessed by 99mTc-MIBI scintigraphy in patients with CRT indications. Our HF severity risk model including V4.1 parameters is able to distinguish mild and moderate-to-severe HF patients. Further investigations of their predictive significance are warranted.

EP-0492

Evaluation of Clinical Feasibility of Preoperative Perfusion Scintigraphy in Patients with Peripheral Artery Disease

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Aim/Introduction: The purpose of this study is to investigate clinical feasibility of preoperative perfusion scintigraphy (PerS) in patients with peripheral artery disease (PAD) of lower extremity (LE). ***Materials and Methods:*** We enrolled a consecutive series of 49 patients (43 men, 6 women, 70.8±9.6 years, range 37-89) with PAD who underwent primary endovascular treatment of LE arteries and had preoperative PerS and ankle-brachial index (ABI). In PerS, we obtained the ratio of the LE blood pool to whole body bool pool (LE/WBratio). Blood flow to time (BF/T) ratios were also obtained by quantifying blood flow at 30, 60, 120, 180, and 300 seconds in each LE. We prospectively enrolled 28 normal subjects (5 men, 23 women, 43.0±10.2 years, range 25-58) with PerS as a control group. Thirty-eight patients have unilateral lesions, and 11 patients have lesions in both LE. Statistical analysis was performed on a total of 60 LE of patients and compared with 56 LE of normal subjects. Non-parametric test was used for statistical analysis. ***Results:*** When comparing patients and normal subjects, LE/WBratio was significantly lower in patients than that of normal subjects (3.7±0.7 vs. 4.3±0.6, p <0.001). In BF/T analysis, the ratios of 60-to-180 (0.178±0.054 vs. 0.194±0.040), 60-to-300 (0.086±0.029 vs. 0.100±0.024), 120-to-180 (0.553±0.107 vs. 0.575±0.049), 120-to-300 (0.264±0.045 vs. 0.296±0.028), and 180-to-300 (0.481±0.055 vs. 0.514±0.032) were significantly different between patients and normal subjects (p = 0.015, 0.002, <0.001, <0.001, and <0.001, respectively). The relationship between ABI and parameters of PerS was investigated, and there were significant mild to moderate correlations between ABI and LE/WBratio, BF/T of 30-to-120, 30-to-180, 30-to-300, 60-to-120, 60-to-180, 60-to-300, 120-to-180, 120-to-300, and 180-to-300 (p = <0.001, 0.035, 0.031, 0.004, 0.003, 0.001, <0.001, <0.001, <0.001, and <0.001, respectively). ***Conclusion:*** In this study, we demonstrated the clinical feasibility of preoperative PerS in patients with PAD of the LE. This quantitative method is objective and reproducible and could be a new complementary and diagnostic tool for patient management.

EP-0493

Coronary Sodium Fluoride PET Detects High-risk Plaque Correlating with Intravascular Ultrasound in Patients with Suspected Coronary Stenosis

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Aim/Introduction: 18F-Sodium Fluoride (NaF) positron emission tomography (PET) non-invasively detects micro-calcification, while 18F-fluorodeoxyglucose (FDG) PET detects active

inflammation, both are promising approaches for assessing vascular plaques. This study aimed to evaluate the value of NaF and FDG PET in evaluation of coronary atherosclerotic plaques, including detection and characterization of plaques by correlating with invasive coronary angiography (CAG) and intravascular ultrasound (IVUS). ***Materials and Methods:*** Patients with suspected coronary artery disease (CAD) who were scheduled for elective CAG were prospectively enrolled. All patients underwent dual cardiac and respiratory-gated NaF and FDG PET/computed tomography (CT) before CAG. IVUS were performed in all three coronary arteries. The maximum tissue to background ratios (standardized uptake value (SUV) max/SUVblood pool) were measured in each coronary segment according to the American Heart Association classification. Correlations between NaF positive, FDG positive lesions and CAG with IVUS were analyzed. The performance was compared using receiver operating characteristic (ROC) curves analysis. ***Results:*** A total of 33 patients (88% men, mean age: 65.7±10.3 years) were included. 24 patients were diagnosed CAD (3 left main, 11 left anterior descending,13 left circumflex and 15 right coronary artery stenoses). In patient-based analysis, NaF PET demonstrated a sensitivity and specificity of 1.000 (95% CI 0.631, 1.000) and 0.600 (0.147, 0.947), while FDG PET showed a sensitivity and specificity of 0.625 (0.245, 0.915) and 0.800 (0.284, 0.995), respectively. In vessel-based analysis, NaF PET yielded a sensitivity and specificity of 0.714 (0.719, 0.916) and 0.790 (0.627, 0.905), whereas FDG PET exhibited a sensitivity and specificity of 0.286 (0.084, 0.581) and 0.947 (0.822, 0.994), respectively, with significant differences (p=0.03 for sensitivity and specificity). The areas under ROC curves (AUCs) for NaF and FDG PET correlated with CAG with IVUS on a vessel basis were 0.752 (0.613, 0.861) and 0.617 (0.471, 0.748), respectively. In this pilot study with a small sample size, there was a trend of better diagnostic value of NaF PET (p=0.07) comparing between two AUCs. Additionally, combining FDG PET may enhance the specificity of detecting plaques. ***Conclusion:*** In the current study, we have demonstrated that dual-tracers, dual-gated PET with NaF and FDG are clinically feasible to non-invasively detect coronary plaques within the heterogeneous lesions. NaF shows advantages comparing FDG with better lesion-to-background ratio regarding cardiac region, and combination of NaF and FDG PET might enhance the ability to distinguish vulnerable plaques especially in intermediate coronary stenoses; which should be further validated in the future.

EP-0494

^{18}F-NaF PET/CT guides complete revascularization of multi-vessel coronary artery disease and the prognostic value study

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Aim/Introduction: coronary atherosclerotic plaque progression, rupture, and erosion are important causes of poor prognosis in patients with coronary artery disease (CAD) . In acute coronary syndrome (ACS), about 40%-65% of ST-elevation myocardial infarction patients show coronary multi-vessel disease, and the mortality and morbidity are higher in patients with multi-vessel coronary disease.However, CR based mainly on coronary angiography (CAG) and clinical guidance still fails to obtain the best prognosis, possibly because CAG examination based on anatomical perspective cannot eally identify the histological features of vulnerable coronary plaques . 18F-NaF PET/CT coronary imaging can identify and quantify plaque vulnerability by targeting microcalcification .Therefore, this study aims to explore the clinical value of 18F-NaF PET/CT guiding revascularization therapy for multi-vessel coronary artery disease and its evaluation of long-term prognosis. ***Materials and Methods:*** In this study, patients with clinically confirmed CAD were selected from multiple centers. The enrolled patients underwent 18F-NaF PET/CT and CAG examination within one week. The 18F-NaF PET/CT coronary plaque quantitative analysis used SUVmax and TBRmax to determine the degree of lumen stenosis at the site of coronary lesions according to CAG. The clinical cardiovascular MDT team selected treatment strategies according to the guidelines and followed up major adverse cardiovascular adverse events (MACE). ROC curve was established to obtain the optimal threshold of SUVmax and its cumulative value (S-SUVmax) for predicting MACE. Cox proportional hazard regression model and Kaplan-Meier method were used to analyze the predictive value of PET parameters to MACE. ***Results:*** 54 CAD patients (37 males and 17 females) completed the clinical study with a median follow-up of 6 years, of whom 13 (24.1%) developed MACE, including 7 deaths, 5 myocardial infarction and 1 readmission due to severe arrhythmia. The cumulative value of coronary lesions SUVmax (S-SUVmax) in MACE patients was significantly higher than that in the non-MACE group, and S-SUVmax (cut-off=2.05, AUC=0.690, P=0.041) was a strong predictor of MACE (HR=1.856, 95%CI: 1.323 ~ 2.604, P<0.001); Among the 25 patients further screened, the incidence of MACE was significantly higher in those with positive 18F-NaF uptake (SUVmax≥0.55) than in those with negative 18F-NaF uptake (35.71% vs. 0, $\chi 2$=6.07, P=0.014). ***Conclusion:*** 18F-NaF PET/CT can be used as an independent predictor of MACE in CAD patients. In the future, complete revascularization based on 18F-NaF PET/CT guidance may improve the long-term prognosis of patients with multi-vessel coronary artery disease to some extent.

EP-0495

First in Southeast Asia (Singapore) clinical study utilizing an automated synthesis of [^{11}C] Martinostat on Tracerlab FX MeI & FX M in compliance with PIC/S GMP

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Aim/Introduction: [^{11}C]Martinostat ([^{11}C]MSTAT) potential as a radiotracer for epigenetic imaging has been reported by Martinos Centre1. It is able to exhibit the expression and activity of histone deacetylase (HDACs). In collaboration with Cardiovascular Research Institute (CVRI)1, patients will undergo HDAC inhibitor therapies and evaluate with [^{11}C]MSTAT as a HDAC inhibitor biomarker by imaging using PET/MR and/or PET/CT. Herein is the report of the fully automated synthesis of [^{11}C]MSTAT with compliance to PIC/S GMP at CIRC in Singapore to support the first clinical study in Southeast Asia. ***Materials and Methods:*** [^{11}C]CO2 obtained via the 14N(p,a)11C reaction (GE PETtrace 860 cyclotron) were delivered to GE TRACERlab FX-MeI unit, where the catalytic reduction of [^{11}C]CO2 to [^{11}C]CH4, and radical reaction of [^{11}C]CH4 with I2 occurred, producing [^{11}C]CH3I. [^{11}C]CH3I was bubbled through a solution of desmethyl precursor (2.0 mg) in DMSO-d6 (300 mL) and allowed to react for 5 minutes at 120°C. The crude mixture was then diluted with 0.8mL mobile phase (70% 0.01M HCl / 30% EtOH) and purified using a reverse phase semi-preparative HPLC (Gemini 5mm NX-C18, 110A, 10x250 mm2) at 2 mL/min. The radioactive fraction was collected and diluted with saline (0.9%, 8.6 mL), 0.01M HCl (1.0 mL) and EtOH (0.7 mL). The resulting formulation solution was filtered through a 0.2mm sterile filter and dispensed using Eckert & Ziegler ModularPharm

dispensing system into 4 separate vials; patient, sterility, QC, and retention. ***Results:*** Process validation of [^{11}C]MSTAT was carried out on three consecutive batches in accordance with PIC/S GMP. Average synthesis time was 35 minutes, with patient vial activity of 283.0 ± 92.4 MBq (n=3) at the time of injection (TOI). Good radiochemical of >90% was observed on analytical HPLC, with specific activity of 32-2677 GBq/mmol at the TOI. The formulated product met ICH requirements notably for residual solvents and sterility. The QC analysis of [^{11}C]MSTAT can be completed within 20 minutes. Product can be released within three half-life for [^{11}C]-radioisotope. The validation demonstrated the prospect of using [^{11}C]MSTAT for human trials. ***Conclusion:*** A fully automated radio-synthesis of [^{11}C]MSTAT has been successfully validated in compliance with PIC/S GMP. Human PET imaging of this radiopharmaceutical are in plan to commence at CIRC. The findings will be pivotal to evaluate the efficacy of HDAC imaging. ***References:*** This work has been funded by Cardiovascular Research Institute (CVRI) of Yong Loo Lin School of Medicine.[1] Wang et al., J. Med. Chem. 2014, 57, 7999 - 8009.

EP-30

e-Poster Area

B: Imaging Clinical Studies -> B5 Neurological Imaging Clinical Study -> B51 Neurodegeneration

EP-0496

Computer aided diagnosis of Alzheimer's Disease from brain perfusion scans using interpretable AI

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Aim/Introduction: Perfusion SPECT is used to detect subtle changes in regional brain perfusion which can help identify neurodegeneration. In this study, we used interpretable AI to develop a computer aided diagnosis system for Alzheimer's Disease from brain perfusion scans. ***Materials and Methods:*** 420 participants' brain perfusion SPECT scans from a heterogenous clinical cohort were used to train two interpretable artificial intelligence models. The models were subsequently prospectively validated on a clinical cohort of 444 scans separate to the training set. To extract input features for training the models, the scans were registered to the Montreal Neurological Institute template and counts were normalised to the cerebellar maximum. The input features represent regional brain perfusion, for regions of interest defined by the Automated Anatomical Labelling Atlas, averaged over the left and right hemisphere. Feature selection was performed using a Minimum Redundancy Maximum Relevance (MRMR) algorithm. Two regularised logistic regression models were trained to identify: 1. Abnormal scans, 2. Alzheimer's Disease. The clinical report served as ground truth. ***Results:*** The training set of 420 scans included 318 (76%) abnormal scans and 210 (50%) scans from participants with Alzheimer's Disease. The prospective validation dataset of 444 scans included 321 (72%) abnormal scans and 183 (41%) scans from participants with Alzheimer's Disease. The MRMR algorithm selected the following regions of interest (ROIs) for Model 1: supramarginal gyrus, medial temporal gyrus, lingual gyrus, supplementary motor area, caudate and for Model 2: precuneus. Model 1 identified abnormal scans with an Area Under the Receiver Operator Characteristic curve (AUROC) of 0.89, a sensitivity of 76% and a specificity of 87%. Model 2 identified Alzheimer's Disease with an AUROC of 0.86, a sensitivity of 87% and a specificity of 72%. ***Conclusion:*** The MRMR algorithm selected clinically relevant ROIs for the two models. These ROIs were subsequently represented as z-scores further supporting interpretability of the computer aided diagnosis models, alongside the prediction probability and odds ratio for each model. The proposed models demonstrated good overall performance in identifying abnormal brain perfusion scans and detecting Alzheimer's disease in prospective validation on a heterogenous clinical cohort.

EP-0497

Ultra-fast Amyloid PET Scan with uMI Panorama PET/CT Scanner

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Aim/Introduction: [^{18F}]Florbetapir positron emission tomography (AV45 PET) is commonly utilized to detect cerebral amyloid-β (Aβ) deposition, with a 10-minute static scan recommended for clinical settings. There is a need for faster amyloid PET scans to reduce patients' discomfort, minimize movement artifacts, and increase throughput. The recently introduced uMI Panorama PET/CT (United Imaging Healthcare) featuring enhanced spatial resolution and sub-200ps TOF offers the potential for shorter scan duration without sacrificing image quality or efficacy to detect Aβ. This study aims to determine the minimal scan duration necessary to maintain Aβ detectability and improve scanning efficiency with uMI Panorama PET/CT. ***Materials and Methods:*** In this cross-sectional study, 38 participants (29 Aβ positive and 9 Aβ negative) from an ongoing prospective dementia cohort at Peking Union Medical University Hospital were enrolled. Each participant underwent a 10-minute AV45 PET scan with the uMI Panorama PET/CT scanner and a 3D T1-weighted brain MRI scan within three days. The list-mode PET data were reconstructed into varying durations: 10 minutes, 2 minutes, 1 minute, 45 seconds, and 30 seconds (G10min, G2min, G1min, G45s, G30s). Two trained nuclear physicians independently evaluated the randomized PET images using a 5-point scale (uninterpretable to excellent: 1-5) and provided a binary diagnosis. Standardized uptake value ratios (SUVr) of the composite cortex (frontal, lateral parietal, lateral temporal, and cingulate cortices) with the whole cerebellum as a reference were calculated to objectively discriminate Aβ status. The coefficient of variation (CoV) of the composite cortex was assessed for objective image quality. Statistical comparisons of image quality and Aβ detectability between the various fast scan groups and the G10min group were conducted. ***Results:*** There was a high level of agreement on subjective scores between the two physicians (Kappa = 0.851, P<0.001). The subjective and objective image qualities of the G2min scans were comparable to G10min scans, whereas the shorter duration scans displayed declines in image quality. Nevertheless, acceptable image quality (≥3 points)was achieved with G1min and G45s scans. The objective detection of Aβ status by cortex SUVr across all scan durations maintained consistent discriminatory efficacy (AUC = 1.00, Sensitivity = 100%, Specificity = 100%). Subjective visual

diagnosis yielded consistent accuracy for G10min, G2min, and G1min, while lower specificity was observed with G45s and G30s scans. ***Conclusion:*** A 1-min AV45 PET scan on the uMI Panorama PET/CT scanner yields adequate image quality and Aβ diagnostic efficacy for clinical use.

EP-0498

Simulation of Different Progression Stages of Alzheimer's Disease in Amyloid PET: First Study Using an Anatomical Brain Phantom

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Aim/Introduction: Research using human imaging to find markers of neurodegenerative diseases is a major global health challenge. In diagnostic imaging, anatomical phantoms play a crucial role in equipment characterization, including the standardization of PET scanners for multicenter studies, when quantitative images simulating different tracer concentration gradients can be generated.This study aims to evaluate the efficacy of the innovative anatomical brain phantom, StepBrain (SB) (Human Shape Technologies S.r.l., Naples, Italy), in accurately representing different stages of Alzheimer's disease (AD) as in real patients studied with an amyloid tracer. ***Materials and Methods:*** SB, a 3D-printed brain phantom replicated the anatomy of three compartments, allow simulation of the in-vivo activity distribution of gray matter (GM), white matter (WM), and dorsal striatum (DS). Two PET/CTs of the phantom were acquired using ^{18}F-FDG on the Siemens Biograph mCT scanner, in list mode, to be able to reconstruct the images with different counting statistics. In the first scan, 18F-FDG was introduced into the WM while in the second into the GM and DS, with appropriate doses to obtain concentrations equal to 120% of WM.The CT volume of the first scan was co-registered with the CT volume of the second scan using Statistical Parametric Mapping software (SPM12) to provide the second PET volume in the same space as the first one. Afterward, weighted sums of the two PET volumes were carried out to simulate twelve different phantom PET volumes with GM/WM concentration ratios from 0 to 120%, finally compared with amyloid PET of AD patients with increasing progression stages. PET images of phantom and AD patients were evaluated by three experienced independent observers. ***Results:*** Qualitatively, the phantom PET images were unanimously evaluated to be extremely realistic when compared to AD patients' images. Real patients negative for AD were well represented by the phantom with a GM/WM concentration up to 30%. Real patients with advanced AD were well represented by the phantom with GM/WM concentration from 90% to 120% ***Conclusion:*** The SB phantom can simulate both the physiological distribution of the tracer and various pathological distributions, providing simulated PET images very similar to real patients, as well as useful reference images for various AD progression degrees, even for multicenter studies. Furthermore, it could allow hypothesizing the in-vivo quantitative relationships between the amyloid accumulations of the GM and the non-specific ones of the WM, the discriminability thresholds on real images, also in the perspective of semi-quantitative analyses.

EP-0499

Differential diagnosis of occipital hypometabolism with ^{18}F-FDG PET-CT: dementia with Lewy bodies or posterior cortical atrophy?

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Aim/Introduction: Posterior cortical atrophy (PCA) and Dementia with Lewy bodies (DLB) are neurodegenerative entities both associated with occipital metabolism on ^{18}F-FDG PET-CT studies. Relative sparing of posterior cingulate has been described as a differentiating feature of Lewy body Dementia, but although some additional areas have been described (ej. frontal in DLB), the literature is sparse and series are small (Whitwell JL et al. JNM, 2017). We aimed to identify differential regional patterns of 18F-FDG PET-CT hypometabolism that allow differential diagnosis of PCA and DLB. ***Materials and Methods:*** 22 patients with a diagnosis of PCA and 61 with disgnosis of DLB, who underwent 18F-FDG PET-CT scans between may-2012 and november-2024 were included. The pattern of involvement of both entities was analyzed based on voxels with SPM12, T test for two independent samples ($p<0.001$). Regional hypometabolism was assessed compared with a control cohort (n= 62). The covariates were sex and age. ***Results:*** The mean age of patients with PCA was 61.55 years (sd 6,617); 77.3% women, DLB mean age of 74.93 (sd 7,127); 45.9% women. Compared to healthy controls, a lower bilateral temporo-parieto-occipital metabolism was observed in both groups. The DLB group showed lower metabolism compared to the PCA in the frontal lobe (bilateral superior frontal gyrus, superior, medial and orbital frontal lobe, and right anterior cingulate). Regarding DLB, PCA showed lower metabolism in the right occipital, temporal, cuneus/precuneus, superior parietal, and right fusiform and angular gyri. ***Conclusion:*** DLB and PCA show an important overlap in the pattern of hypometabolism that makes differential diagnosis difficult based solely on visual assessment, but the extent of hypometabolism at the frontal lobe or the greater right involvement suggests the diagnosis of DLB or ACP respectively.

EP-0500

Whitematter impairment distinctly associated with cerebral metabolism in Parkinson's disease

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Aim/Introduction: Patients of Parkinson's disease (PD) may suffer with heterogeneous white matter integrity damage and metabolic disruption. The purpose of this study was to investigate white matter microstructure injury and its relationship with cerebral metabolism in Parkinson's disease. ***Materials and Methods:*** A total of 37 subjects were included in this study, including 25 patients with PD and 12 age- and sex-matched healthy individuals. Basic clinical information and clinical cognitive scale assessments were collected, including the Mini-Mental State Examination (MMSE) and Montreal Cognitive Assessment (MoCA). All subjects underwent an integrated ^{18}F-fluorodeoxyglucose

(18F-FDG) PET/MR scan, acquiring high-resolution T1-weighted structural images, diffusion-tensor images and 18F-FDG images. Normalized PET standardized uptake value ratio (SUVR) images were obtained using the FSL. Brain region without significant SUVr difference between PD and HC subjects was set to be reference region. Anatomical Automatic Labeling (AAL) atlas was utilized in ROI-wise analysis to evaluate abnormalities in brain metabolism. Auto Fiber Quantification (AFQ) was utilized to calculate tract-wise diffusion properties of 20 major white matter tracts and further divide each fiber into 100 nodes. ***Results:*** PD patients showed reduced mean MMSE and MoCA scores compared to HC subjects ($P < 0.05$). PD patients showed higher mean diffusivity (MD) and axial diffusivity (AD) along right corticospinal tract (CST) compared to HC. The microstructural change of CST was mainly located in parietal part (node 67-100). Hypermetabolism was found in right paracentral lobule, which connects with the parietal part of right CST, and positively correlated with MD and AD. ***Conclusion:*** We observed microstructural change and hypermetabolism in PD patients. Change of white matter microstructure in CST, which was related to the control of random muscle movement, was significantly correlated with cerebral metabolism. We further found that there was structural connection between region with metabolic disruption and white matter injury. These results may provide imaging evidence for investigating the pathology of PD.

EP-0501

The association of sleep spindles and Alzheimer's disease pathology

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Aim/Introduction: Accumulating evidence suggests that Alzheimer's disease (AD) is associated with decreased deep sleep (N3) and lower sleep spindle expression, which may be due to a bi-directional relationship between disturbed sleep and the accumulation of AD pathology. In this study, we investigated the regional link between AD pathology and changes in sleep spindle characteristics using PET imaging and a portable sleep-monitoring device. ***Materials and Methods:*** 14 healthy controls (HC; M(Age) = 63.57 (7.23), Sex (M/F) =4/10) and 14 patients with MCI/early AD (M(Age) = 64.79 (7.42), Sex (M/F) =7/7) were included from the "Tau Propagation Over Time" (T-POT) study. For all participants, [^{11}C]-PIB (amyloid) and [^{18F}]-AV1451 (tau) PET scans were available, which were normalized and intensity standardized to the whole cerebellum. Sleep monitoring was performed at home of the participants using the portable EEG-headbands by Beacon Biosignal, which is a reliable alternative to the gold-standard polysomnography (PSG). Sleep recordings were performed within six months of the PET acquisition and for three consecutive nights. For the current analysis, only recordings of sufficient quality (> 80%) were included. Sleep spindle characteristics were defined based on the raw EEG data using a self-implemented python script based on the 'spindle detect' algorithm of the Yasa toolbox. Spindle parameters including number, duration, amplitude and frequency were extracted and averaged across the recordings with sufficient quality and across the five EEG channels. First, respective spindle characteristics were compared between the groups using non-parametric tests. Next, whole-brain voxel-wise analyses were conducted in SPM12 to assess the association between spindle parameters and regional tau and amyloid burden (pFWE < .005). All analyses were corrected for age and N3 duration (given the dependence of spindle occurrence during N3 phase). ***Results:*** MCI/AD patients showed significantly higher amplitudes than HC ($p = .033$), but no differences in terms of spindle number, frequency or duration. The whole-brain voxel-based analysis yielded that spindle amplitude was linked to greater tau burden in the left hippocampus. Interestingly, no significant association was observed in terms of amyloid burden. ***Conclusion:*** The current findings provide evidence for changes in sleep spindle characteristics being linked to hippocampal tau pathology. This may be due to the initial location of tau aggregation in AD (i.e., entorhinal cortex/hippocampus). It remains unknown whether this observation represents a causal or consequential relationship.

EP-0502

Assessing the Predictive Capability of FDG-PET in Primary Progressive Aphasia

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Aim/Introduction: Primary progressive non-fluent primary aphasia (PPNFA) may be the onset of several neurodegenerative diseases. These symptoms may progress to syndromes such as frontotemporal dementia (FTD), corticobasal degeneration (CBD) or progressive supranuclear palsy (PSP). The aim of this study was to assess whether variations in brain metabolism observed on initial PET/CT-^{18}F-FDG can predict progression to the different clinical syndromes. ***Materials and Methods:*** We performed a retrospective study including 67 patients diagnosed with PPNFA between 2011-2022, who had undergone PET/TC-^{18}F-FDG after first symptoms manifestation. Images were spatially normalized to a brain template and corrected to whole brain uptake using PMOD software. Subsequently, images from patients in different progression groups were compared with a group of healthy controls using Statistical parametric mapping (SPM), corrected for multiple comparisons. ***Results:*** Of the 67 patients (56% women; mean age: 72 years), 17 developed PSP, 7 CBD, 13 FTD and 3 ALS (the latter not included in the analysis). When analyzing the images in SPM, we observed that patients in all groups showed hypometabolism affecting to different degrees the frontal lobe, temporal lobe and insula compared to the control group. However, patients who developed CBD showed a right prevalence and involvement of the caudate and putamen, while patients with PSP did not present this laterality but showed hypometabolism in the thalamus and central sulcus. Patients who progressed to FTD showed the characteristic pattern of this syndrome with left laterality and preservation of the basal ganglia. ***Conclusion:*** In summary, brain PET/CT-^{18}F-FDG might contribute to predict which syndrome patients diagnosed with PPNFA will develop, by showing specific patterns of metabolic alteration months before they progress.

EP-0503

^{89}Zr-DFO-AP-101 PET/CT first in human imaging for amyotrophic lateral sclerosis

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Aim/Introduction: Amyotrophic lateral sclerosis (ALS) is a neurodegenerative disease resulting from the loss of motor neurons. Mutations in superoxide dismutase-1 enzyme (SOD1) are the second most common genetic cause of ALS and misfolded SOD1 (mSOD1) is also increased in sporadic forms of ALS.1 Currently, there is no approved diagnostic tool for ALS. We previously reported, in a transgenic mouse model, that 89Zr-DFO-AP-101 could detect mSOD1 involved in apoptosis and ALS.2 The aim of this study is to evaluate 89Zr-DFO-AP-101 biodistribution and dosimetry in humans by PET imaging. ***Materials and Methods:*** This ongoing study follows patients with ALS and healthy participants for 10 days after 89Zr-DFO-AP-101 injection. Whole-body PET/CT are performed at 120 minutes, 1, 3, 7 and 10 days on a Siemens Biograph Vision 600, along with clinical biochemistry and vital signs measurements. Biodistribution and dosimetry are performed from regions of interest to obtain organ time-integrated activity. We assess both the kinetic of 89Zr -DFO-AP-101 in the different organs, and the absorbed and effective doses. So far, five healthy participants have been recruited and imaged. Two ALS patients have been recruited and will be imaged in the upcoming weeks. The study should be completed by the fall of 2024. ***Results:*** Five healthy volunteers (2 males, 3 females) aged 63±8 years with a BMI of 27±5 kg/m2 were imaged. They received 41±4 MBq of 89Zr -DFO-AP-101 by intravenous injection without any serious adverse or clinical effect. Total urinary excretion was 4%, and hepatobiliary excretion was 2%. At 2h post-injection, 44±5% of the radiotracer remained in the blood pool, with an effective half-life of ± 53 h. According to sex-specific dosimetry, the liver is the dose-limiting organ with 2.24 mSv/MBq (male) and 2.65 mSv/MBq (female). The effective dose was 0.48 mSv/MBq (male) and 0.54 mSv/MBq (female). ***Conclusion:*** The PET 89Zr-DFO-AP-101 tracer is safe, its clearance is predominantly physical, with an early urinary excretion. Therefore, this tracer can be safely used in patients. Upcoming data in ALS patients will validate its capacity to measure mSOD1 levels in vivo for diagnosis and treatment monitoring. ***References:*** 1. Maier M, et al. Sci Transl Med. 2018;10(470). 2. Guérin B. et al. Eur J Nucl Med Mol Imaging. 2023, 50 (Suppl 1), 1-898.

EP-0504

PET-amyloid in newly diagnosed multiple sclerosis: biomarker of white matter damage and disease activity

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Aim/Introduction: To evaluate amyloid uptake in damaged white matter (DWM) and normal-appearing WM (NAWM) in patients with newly diagnosed multiple sclerosis (MS) and the relation to clinical status. ***Materials and Methods:*** This observational and prospective study enrolled patients with recent MS onset between March to May 2023. Participants underwent a neurological examination, disability (EDSS), neuropsychological (SDMT) and quality of life (EQ-5D) assessment, brain MRI and $^{[18F]}$-florbetaben PET in early (0-10') and late phase (90') post-i.v. Patients were classified as having highly active MS if they had ≥2 relapses (with/without sequelae) and increasing lesional burden, or a relapse with severe sequelae (EDSS score≥ 2). MRI and PET images were co-registered, and results are presented as standardized uptake values (SUV), using cerebellum (SUVRc) and NAWM (SUVRwm) as the reference region. ***Results:*** ten patients were included (35.10±11.32 years; 70% women). We found, both in early- and late-phase, a lower mean SUVR in DWM compared to NAWM ($p<0.01$) in all patients. SUVRwm correlated with EQ-5D index ($r:0.652$, $p=0.041$). A trend toward lower SUVRwm was observed in the highly active onset group compared to the non-highly active group (0.62±0.43 vs. 3.62±3.20, $p>0.05$). Considering only highly active onset patients, SUVRwm correlated with EDSS score (rho = -0.896, $p=0.0031$). The lesions analysis showed a negative correlation between SUVmean in DWM with EDSS and SDMT scores (rho: -0.534, $p=0.004$ and rho: -0.670, $p=0.006$, respectively); and SUVRc with SDMT (rho: -0.585, $p=0.022$). ***Conclusion:*** Preliminary results of this work in progress suggest that amyloid PET could be a promising tool to monitor myelin changes in patients with MS and may have a predictive role in disease activity and quality of life.

EP-0505

Utilizing Amyloid PET SUVr's as features in an RF classifier to aid in the prognosis of Alzheimer's Disease

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Aim/Introduction: Early diagnosis of Alzheimer's Disease (AD) is a key step in the development of appropriate treatment for this disease. Current diagnoses and prognoses clinicians make are aided by standard cognitive tests that assess a patient's function. Amyloid PET is a sensitive but not specific early marker of AD. In this paper, we build a Machine Learning (ML) model to improve the current prognosis method and identify potential markers that indicate a patient's future decline from Mild Cognitive Impairment to Alzheimer's Disease. We hypothesise that patients can be differentiated to a higher accuracy through a model that combines amyloid Positron Emission Tomography (PET) Standard Uptake Value ratios (SUVr) with current cognitive test scores than by a cognitive test score model alone. ***Materials and Methods:*** We process and analyse 462 PET images taken from the Alzheimer's Disease Neuroimaging Initiative (ADNI) database and extract from them the amyloid burden of that patient in the form of an SUVr. We build an ML model trained on a combination of patient information (age, sex and education), baseline cognitive test scores and these amyloid PET SUVr to classify patients on whether they will progress from MCI to AD within 24 months. We are interested in potential information within the 166 clinical regions of the brain in terms of determining the future cognitive state of a patient. We use a feature selection algorithm in the

form of a Maximum Relevance, Minimum Redundancy (mRMR) to determine the most relevant brain regions to the task. This is backed up by an Explainable Artificial Intelligence (XAI) model in the form of a Local Interpretable Model-Agnostic Explanations (LIME) plot that determines regions important to individual patient classifications. ***Results:*** The Area under the Receiver Operating Characteristic (auROC) for cognitive tests alone is 0.78, for amyloid PET alone it is 0.83. When we combine cognitive tests and amyloid PET the auROC is 0.91. LIME suggests that the Precuneus left, Anterior cingulate cortex pregenual left, middle temple left, superior frontal gyrus (medial orbital) left and inferior temporal gyrus left are all important regions in the differentiation of patients along the Alzheimers timeline. ***Conclusion:*** The results suggest that our model improves on the current methods for prediction of progression to AD with increased accuracy and higher auROC score for the combination model. We found several regions appear to be indicators of cognitive function and decline of patients.

EP-0506

Amyloid PET: Discrepancies between Visual and Quantitative Analysis in a Cognitively Normal Elderly Population.

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Aim/Introduction: Quantitative analysis of amyloid PET is gaining ground in clinical practice. However, contrasting visual analysis with quantitative methods is necessary to establish the clinical value of such quantification. The aim of this study is to compare visual assessment and two quantitative analysis methods in a population of cognitively normal older adults. ***Materials and Methods:*** This cross-sectional study included 90 participants from the AGUEDA trial (Code: NCT05186090). Amyloid PET scans ([18F]-florbetaben) were evaluated visually (by two expert readers masked to any type of information) and quantitatively using centiloid methodology (positive >12 centiloids) and standardized uptake value ratio (SUVR) estimation in consensus target regions (VOIs) extracted from the syngo.via platform. ***Results:*** The mean age of participants was 71.75 ± 3.96 years, 57.8% female, and a mean education level of 11.54 ± 4.90 years. Of the total studies, 66 (73.3%) were considered negative and 8 (8.9%) positive both visually and quantitatively. Six (6.7%) cases were visually considered 'indeterminate': quantitatively, 5 were negative and 1 positive. In the remaining 10 (11.1%) studies, there were discrepancies between visual assessment (considered negative) and centiloid scale. In this subgroup of discrepant cases, centiloid value showed a strongly positive correlation with SUVR in parietal (r=0.893; p<0.001) and temporal (r=0.864; p<0.001) VOIs and a moderate correlation with frontal VOI (r=0.831; p=0.003). Additionally, mean SUVR values in all locations were significantly higher compared to the SUVR of scans considered negative visually and quantitatively (p<0.017). ***Conclusion:*** Preliminary results of this study show discrepancies between visual and quantitative assessment of amyloid PET in 1 out of 10 cognitively normal older adults, with greater magnitude in parietal and temporal regions.

EP-0507

Early-phase [18F]FBB PET vs [18F]FDG PET in atypical dementia: preliminary data from a multicentric study (AMY-ITA).

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Aim/Introduction: [18F]Amyloid PET is routinely used to ascertain if the patient is in the Alzheimer continuum filling the "A" portion of the ATN classification. In this context MR or [18F]FDG PET or early frames of [18F]amyloid PET (FBB - perfusion-like information) could be used to fill the "N" portion of the classification. In patients with a clinical suspicion of an atypical form of Alzheimer's disease, the presence or absence of Amyloid plaques and the pattern of neurodegeneration are crucial for a definite diagnosis. We aimed at investigating whether the early frames of the FBB are comparable to the FDG PET images in atypical forms of AD and to assess the optimized protocol to be used. ***Materials and Methods:*** Recruitment of the AMY-ITA multicenter study (conducted in 8 Italian centers) has been closed. 107 patients have been scanned, and data from brain magnetic resonance imaging (T1 3D 1mm isotropic acquired less than 3 months from PET scans), FBB (early frames acquired from 0 to 15 min and reconstructed at 0-5, 0-10 and 0-15 min/frame and late frames acquired from 90 to 110 and reconstructed at 90-100 and 90-110 min/frame) and FDG PET scan were collected. Clinical data including initial clinical suspect and final clinical diagnosis at follow up (1 year later) were collected. FDG and FBB were visually and semi-quantitatively compared after segmenting MR and PET using Freesurfer. ***Results:*** Spearman test of visual scores (between early-frame FBB PET and FDG PET) showed statistically significant correlations (p< 0.0001)Although semi-quantitatively some areas (for example cerebellum and pons) showed (expected) significant differences between FDG and FBB, on a whole, cortical similarity was very high. When comparing 0-5, 0-10 and 0-15 minutes acquisitions with FDG, the 0-5 minute frame showed the highest pearson correlation (>96). Semi-quantification using know methods (SUVr, ELBA and TDR) showed however no statistical differences between 0-5, 0-10 and 0-15 frames. ***Conclusion:*** Early-phase FBB PET acquisitions, in atypical AD forms, correlated qualitatively and semi-quantitative well with FDG PET demonstrating its possible use as a surrogate marker. The 0-5 minutes of FBB correlated better than 0-10 and 0-15 minutes with FDG. ***References:*** Eur J Nucl Med Mol Imaging 2022 Oct;49(12):4097-4108. doi: 10.1007/s00259-022-05846-1. Epub 2022 Jun 2. A comparison of advanced semi-quantitative amyloid PET analysis methods

EP-0508

Dual energy X-ray Absorptiometry (DXA) Scan in Young and Newly Diagnosed Multiple Sclerosis Patients; impact of High-Dose Intravenous Steroid Treatment on Bone Metabolism

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Aim/Introduction: High-dose intravenous steroid treatment (HDIST) represents the first choice of treatment for multiple sclerosis (MS) relapses. Chronic oral glucocorticoid (GC) administration correlates with bone loss whereas data regarding HDIST in MS are still conflicting. The aim of this study was to evaluate Bone Mineral Density (BMD) values in newly diagnosed MS patients before HDIST and during a 12-month follow-up in correlation with bone turnover markers (BTMs) and a direct comparison with healthy control subjects. ***Materials and Methods:*** 25 newly diagnosed MS patients (12-women) and 13 age-matched (9-women) healthy controls were prospectively enrolled meeting the following eligibility criteria: age 18-45yrs, fully ambulatory, women with normal menstruation. Exclusion criteria: history of any chronic disease, previous GC-treatment in any dosage regimen. Patients received 1000mg Methylprednisolone intravenously daily for 5 consecutive days. 3/25pts were excluded due to mobility impairment, 4/25 were lost to follow-up. In the remaining 18pts (9-women) as well as in the healthy controls serum levels of:Calcium, Phosphorus, Albumin, Magnesium, Creatinine, 25-OH-D, Parathyroid Hormone, Thyroid Hormones, Bone-fraction Alkaline-Phosphatase (BALP), N-terminal propeptide procollagen type-1 (P1NP), C-terminal peptide type of collagen (CTx), Receptor-Activator of Nuclear Factor Kappa-β-Ligand (RANK-L), Osteoprotegerin, Sclerostin, Dickkopf-1 (DKK-1), Periostin, Interleukins (IL)-1β,6,17 were determined prior to GC-administration and consecutively the days:2-4-6-90 and months:6-12. BMD of both hips and lumbar spine as well as whole-body measurement of adipose/lean tissue were assessed with Dual-X-ray-Absorptiometry-(DXA)-scan, prior to GC-administration and consecutively every six months. ***Results:*** In the patient group a significant decrease in total left hip BMD was observed between baseline and month 12 (mean difference:0,0113±0,0045g/cm2,p=0.022). No significant differences between patients and healthy controls were observed at baseline while at 12-month f-up left femoral neck BMD was marginally higher in the healthy controls group (mean difference:0,098±0,047g/cm2,p=0.053). Bone formation markers, P1NP and BALP, showed an initial non-significant fall (P1NP day 6:-0.414±0.128ng/mL, BALP day 4:-0.864±0.334μg/L) followed by a significant increase in day 90 (P1NP:+0.567±0.13ng/mL,BALP:+1.838±0.464μg/L,p<0.05). ***Conclusion:*** Despite the small sample size we aimed to elucidate the impact of HDIST on BMD and simultaneously on biochemical parameters of bone metabolism in newly diagnosed MS patients; HDIST seems to have a long term negative effect on BMD in this group of patients. The observed transient increase in bone formation markers -90 days after GC administration- probably indicates a high bone turnover phase as a "response" to the adverse effects of GC on bone-metabolism. More prospective studies with larger sample size on similarly selected patients should be performed.

EP-0509

Combining [18F]PI-2620 tau PET binding characteristics to quantitative susceptibility mapping in progressive supranuclear palsy

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Aim/Introduction: Progressive supranuclear palsy (PSP) is a neurodegenerative disease and one of the common causes in atypical Parkinsonism. Hidden onset, rapid progression, difficulty in direct diagnosis together with poor prognosis, all bring obstacles to the proper diagnosis and differentiation of PSP in clinical practice. Based on the four-repeat (4R) tauopathy in PSP, it is beneficial for second-generation tau PET tracers in visualizing its pathophysiological features, thus shedding light on the early and precise diagnosis of the disease. In this study, we aimed to investigate the performance of [18F]PI-2620 tau PET uptake characteristics combined with quantitative susceptibility mapping (QSM) in patients of PSP. ***Materials and Methods:*** Seventeen participants (nine patients diagnosed with PSP and eight age-matched healthy controls) were retrospectively enrolled for this study. All participants underwent [18F]PI-2620 PET imaging together with 3.0 T brain multimodal MRI scans. SUVR of tau uptakes in brain regions including bilateral pallida, midbrain and pons were analyzed, with inferior cerebellum cortex as the reference region. For QSM data, regions of interest were manually drawn within bilateral caudates, pallida, subthalamic nuclei (STN), substantia nigra and red nuclei, to generate mean magnetic susceptibility (MS) values. Unpaired t tests were used to compare the differences of SUVR and MS values in each brain region between the two groups. ***Results:*** Quantitative findings on [18F]PI-2620 PET images determined that patients with PSP had definitely higher tau uptakes in the left pallidum ($p<0.01$), right pallidum ($p<0.001$), and mean value of bilateral pallida ($p<0.001$), when compared to the healthy controls. The MS values of right caudate ($p<0.05$), left pallidum ($p<0.01$), mean value of bilateral pallida ($p<0.05$), left STN ($p<0.001$), right STN ($p<0.001$), and mean value of bilateral STN ($p<0.001$) were significantly higher in PSP than the healthy participants. ***Conclusion:*** A combined use of second-generation [18F]PI-2620 tau PET imaging and QSM modalities preliminarily revealed the unique tau deposition and iron quantification in the diagnosis of PSP, rendering a promising basis for further study of the radiological-pathological mechanism of pallido-nigro-luysian axis.
Acknowledgements: The study was supported by the construction project of Shanghai Key Laboratory of Molecular Imaging (18DZ2260400). ***References:*** 1. Kovacs GG, Lukic MJ, et al. Distribution patterns of tau pathology in progressive supranuclear palsy. Acta Neuropathol. 2020;140(2):99-119. 2. Brendel M, Barthel H, et al. Assessment of 18F-PI-2620 as a Biomarker in Progressive Supranuclear Palsy. JAMA Neurol. 2020;77(11):1408-1419. 3. Mazzucchi S, Frosini D, et al. Quantitative susceptibility mapping in atypical Parkinsonisms. Neuroimage Clin. 2019;24:101999.

EP-0510

Evaluation of visual and quantitative assessment of PI-2620 PET scans using different mass doses

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Aim/Introduction: PET image analyses can be biased by mass dose effects, where cold tracer binds to an excessive proportion of the target molecules. If target density is low, as for example for tau pathology in progressive supranuclear palsy (PSP), the mass dose could have an impact on tracer binding. This study aimed to estimate the effect of tracer mass doses on ^{18}F-PI-2620 scans from Alzheimer's disease (AD) and PSP patients. ***Materials and Methods:*** Five AD and five PSP patients underwent two dynamic ^{18}F-PI-2620 PET scans. Every patient received a low tracer mass injection (0.31 ± 12 µg PI-2620) at the first PET visit, and a high mass dose (44.56 ± 2.82 µg PI-2620) at the second PET visit. Activity values (180 ± 11 MBq 18F-PI-2620) were kept similar for both injections. Three blinded readers evaluated the scans independently. MRTM2 was used to estimate DVRs, using a relevant set of ROIs [1]. A model of target occupancy as a function of mass dose was fitted to the data [2]. The possible bias in DVR values was assessed using a real-world range of mass doses. ***Results:*** Visual assessment (positive/negative) was not impacted by high mass dose administration in any region. The real-world mass doses for ^{18}F-PI-2620 were <1 µg/mL for 98% of the batches, as determined from the global tracer productions during the last years. This implies that the maximum injected mass dose would be <10 µg, when using the maximum allowed volume (10 mL). Under these conditions, the averaged results of the occupancy model for AD patients show that the bias in DVR values would be <2%. This degree of bias is below the test-retest variability measured for ^{18}F-PI-2620 [1]. As DVR values for both scans were very similar for PSP patients, no relevant effect of mass dose could be measured, even at the highest mass dose used. ***Conclusion:*** The effect of ^{18}F-PI-2620 high mass doses on visual and quantitative PET readouts is negligible for both AD and PSP in real-world conditions, allowing tracer Usage several half-lives after the end-of-synthesis (e.g. after longer dose transportation). This provides compelling support for the use of ^{18}F-PI-2620 to detect AD and PSP tau over a broad range of mass doses in future studies and clinical evaluations. ***References:*** [1] Bullich et al., JNM, 2020;61(6):920-927; [2] Madsen et al., Nuc Med Biol, 2011; 38(8):1085-1091.

EP-0511

Interobserver agreement in the visual analysis of brain PET/CT studies with Tau tracer [18F]PI-2620 in patients with Down syndrome.

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Aim/Introduction: Down syndrome (DS) is considered a genetic form of Alzheimer's disease (AD) and a unique model for the study of its pathophysiology. The [18F]PI-2620 PET tracer reflects the neurofibrillary deposition of the Tau protein.The aim of the study was to assess interobserver agreement in the visual analysis of brain PET studies with [18F]PI-2620 in patients with DS. ***Materials and Methods:*** 80 brain PET/CT studies (20 healthy controls and 60 subjects with DS) performed 45 minutes after e.v. administration of 5 mCi of [18F]PI-2620 were analyzed. The images were visually evaluated by six independent nuclear medicine physicians with different levels of experience according to the presence/absence of tracer deposits in the mesial temporal (MT), fusiform gyrus (FG), lateral anterior temporal (LAT), lateral posterior temporal (LPT), occipital, posterior cingulate/precuneus (PC), parietal, frontal, dentate nucleus (ND) and striatum. We considered a positive study for AD if detected deposits in LAT, occipital, PC, parietal and frontal. Interobserver agreement (Fleiss Kappa coefficient) was assessed in the analysis of the described regions and in the final PET/CT categorization for the diagnosis of AD. ***Results:*** The interobserver agreement for the diagnosis of AD was very high (Kappa 0.9; p <0.001). A high agreement was also observed in the assessment of the LPT, PC, frontal and parietal regions (Kappa>0.9; p<0.001). The agreement for the diagnosis of AD was equal between expert and non-expert observers (Kappa 0.9; p< 0.001). In the assessment of areas not relevant to AD, the agreement was greater between experts (MT region: Kappa 0.7 vs 0.2; p< 0.001 and FG: Kappa 0.6 vs 0.2; p< 0.001). ***Conclusion:*** PET/CT with [18F]PI-2620 is a highly reproducible technique with high interobserver agreement in the diagnosis of AD in patients with DS, mainly in the evaluation of the areas relevant to its diagnosis.

EP-0512

Predicting antiepileptic drug response through the coupling of glucose metabolism and cerebral blood flow in temporal lobe epilepsy patients

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Aim/Introduction: Anti-epileptic drugs (AEDs) therapy is the first line treatment scheme for temporal lobe epilepsy (TLE). However, even with the use of a combination therapy of multiple appropriate AEDs at a reasonable dosage and sufficient duration, approximately 30%-40% of patients still are still unable to control seizures. The development of resistance to AEDs is related to multiple factors, but the impact of these factors on newly diagnosed epilepsy patients who have not taken AEDs is still unclear, and there is a lack of feasible methods for early prediction of AEDs response in clinical practice. ***Materials and Methods:*** 32 newly diagnosed TLE patients were prospectively enrolled, and 23 healthy volunteers matched in age and gender were also included. ^{18}F-FDG positron emission tomography (PET) and arterial spin labeling (ASL) magnetic resonance imaging (MRI) were obtained from a simultaneous PET/MRI scanner, and CBF was calculated based on ASL. The changes in seizure frequency of TLE patients after 2 years of appropriate AEDs treatment were compared with the situation during PET/MRI scans. Patients were divided into drug response group (seizure frequency reduction ≥ 50%) and drug resistance group (seizure frequency reduction<50%). By spatial standardization and data normalization, the CBF, SUV to SUV/CBF ratio within the gray matter mask of all subjects were obtained, and further normalized to Z score for comparison between different subjects. ***Results:*** Compared with healthy controls, patients with TLE showed a decrease in CBF-SUV coupling and a significant difference in SUV/CBF ratio within the gray matter mask. In patients with TLE, the decrease in SUV/CBF ratio mainly occurs in the thalamus, insula, hippocampus, and superior temporal gyrus, while the increase in SUV/CBF ratio

mainly occurs in the middle frontal gyrus, posterior central gyrus, cerebellum, and occipital lobe (P<0.05, FDR corrected). Compared with the drug response group, there was a significant difference in SUV/CBF ratio among patients in the drug resistance group. In the drug resistance group, the increase in SUV/CBF ratio mainly occurred in the frontal and occipital lobes (P<0.05, FDR corrected). ***Conclusion:*** There are differences in glucose metabolism and CBF coupling among TLE patients with different AEDs response. Based on the coupling of glucose metabolism and CBF, it is helpful to predict AEDs response in TLE patients.

EP-0513

Understanding the Interplay Between Cerebral Glucose Metabolism and Functional Connectivity in the Healthy State and Alzheimer's Disease

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Aim/Introduction: Regional glucose hypometabolism and disrupted functional connectivity (FC) at rest have been proposed as biomarkers of Alzheimer's disease (AD). However, there are ongoing debates about the nature of disrupted FC in AD: if it is an independent process or an epiphenomenon of regional neurodegeneration. In the latter case, one would expect a stronger association of regional glucose hypometabolism and FC in AD than in the healthy state. To address this question, our study summarized evidence on associations between regional glucose metabolism and FC in the healthy state and AD. ***Materials and Methods:*** We conducted a comprehensive literature search on Google Scholar and PubMed using various combinations of keywords " PET," "fMRI," "functional connectivity," "healthy," and "Alzheimer's disease". It resulted in 10 studies in healthy subjects and 8 studies in patients with AD (in comparison with healthy control individuals). ***Results:*** Overall, the results were consistent across the studies. In the healthy state, FC and glucose metabolism were associated positively (Table 1). In AD, the strength of the (positive) association was consistently weaker than in control subjects, the association was not significant or negative (Table 2). No study reported a stronger positive association in AD than in control subjects. Both in the healthy state and AD the above associations were evident at the regional and global (whole brain) level. ***Conclusion:*** Our study provides unequivocal evidence for a positive association between glucose metabolism and FC in the healthy state. Furthermore, this coupling is consistently disrupted in AD, where weaker positive associations, not significant or even negative associations between glucose metabolism and FC have been reported. Thus, functional disconnectivity in AD is not an epiphenomenon of regional degeneration. In fact, studying patterns of decoupling between glucose metabolism and FC might provide valuable insights into the mechanisms of neurodegenerative disorders, beyond AD.

EP-0514

Skull glucose uptake as a novel biomarker for Parkinson's disease

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Aim/Introduction: Parkinson's disease (PD) is often accompanied with osteoporosis. Additionally, the impairment of motion and coordination abilities in PD can further impact bone health. A growing number of studies have demonstrated that the skeleton is an endocrine organ that is involved in glucose metabolism and plays a significant role in glucose homeostasis. However, it remains unclear whether metabolic changes occur in the bones of PD patients. The aim of this study was to investigate whether glucose uptake alterations occur in the skulls of patients with PD using the integrated positron emission tomography/magnetic resonance (PET/MR) scanner. ***Materials and Methods:*** 18F-fluorodeoxyglucose (18F-FDG) PET and T1-weighted structural MR data from PD patients (n = 34) and healthy controls (HC) (n = 25) were acquired by an integrated PET/MR scanner. Standardized uptake value ratio (SUVr) maps were calculated from 18F-FDG PET images by dividing voxel-wise SUV maps by the mean global SUV value. Skulls were automatically delineated from T1-weighted structural MR data using a recently-proposed approach [1], and were further separated into 8 regions of interest (ROIs), including the bilateral frontal, temporal, parietal and occipital bones. T1-weighted MR data were co-registered to the SUVr maps, and the transformation matrix was applied to the skull ROIs. Then, mean SUVr values of the skull ROIs were extracted, and were compared between PD and HC groups via the independent t-test. In addition, correlation analysis was performed between the mean SUVr values of the 8 skull ROIs and clinical ratings including Hoehn and Yahr stage (HY stage), Unified Parkinson's Disease Rating Scale-part III (UPDRS-III) and disease durations. ***Results:*** The two groups were well-matched for age and sex, as shown in Table 1. In terms of SUVr comparisons, PD patients demonstrated increased glucose uptake in the right frontal bones (PD SUVr: 0.0959 ± 0.0404, HC SUVr: 0.0721 ± 0.0487, T = 2.0526, p = 0.0487). Furthermore, although not statistically significant, PD patients exhibited slight increases in SUVr values in other bone ROIs. No significant associations were observed between mean SUVr values of the skull ROIs and clinical ratings. ***Conclusion:*** Compared to HC, patients with PD exhibited significant changes in the skull glucose uptake, which has the potential to serve as a novel biomarker for PD and warrants further investigation. ***References:*** [1] Zhang J, Treyer V, Sun J, et al. Automatic analysis of skull thickness, scalp-to-cortex distance and association with age and sex in cognitively normal elderly. Brain Stimul. 2023;16:653-656.

EP-0515

A Comparative Study of Tau Deposition and Glucose Metabolism in Anti-IgLON5 Disease Versus Progressive Supranuclear Palsy

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Aim/Introduction: The anti-IgLON5 disease is a rare neurological disorder characterized by the combination of autoimmunity and neurodegeneration, with prominent tau protein deposits primarily observed in the brainstem and hypothalamus. Its clinical manifestation similarity to other neurodegenerative diseases, such as progressive supranuclear palsy (PSP).^{18}F-Florzolotau is a second tau PET tracer characterized by high binding affinity for 3- and 4-repeat tau protein deposits that has not yet been applied in anti-IgLON5 disease.The aim of this study was to distinguish anti-IgLON5 disease from PSP by analysis of tau deposition and metabolic activity in vivo using ^{18}F-Florzolotau and ^{18}F-FDG PET. ***Materials and Methods:*** We enrolled three groups: patients with anti-IgLON5 disease (n=10), patients diagnosed with PSP (n=20), and healthy controls (n=40). The ^{18}F-Florzolotau and ^{18}F-FDG PET

imaging was analyzed by visual and semi-quantitative analysis. ***Results:*** Patients with anti-IgLON5 disease identified a significant uptake of ^{18}F-Florzolotau in the midbrain, pons, cerebellum, caudate, putamen, thalamus and parietal lobe. Similarly, in patients with PSP, significant tau deposition was observed in the midbrain, pons caudate, putamen, thalamus, and frontal lobe. The ^{18}F-FDG PET images of patients with anti-IgLON5 disease demonstrate diffuse metabolic reduction in the cerebral cortex. However, PSP patients exhibit reduced metabolic activity in the frontal lobe, caudate, putamen, midbrain and pons. ***Conclusion:*** This study revealed distinct tau protein deposition patterns and FDG metabolic alterations between anti-IgLON5 disease and PSP. The combination of ^{18}F-FDG and ^{18}F-Florzolotau PET further improves diagnostic confidence.

EP-0516

May FDG-PET imaging be predicted by comprehensive neuropsychological assesment in Alzheimer's disease and Frontotemporal dementia? A machine learning study

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Aim/Introduction: We aimed to evaluate the capacity of neuropsychological assessment to predict the regional brain metabolism in patients with amnestic Alzheimer's disease (AD) and behavioral variant frontotemporal dementia (bvFTD) using Machine Learning algorithms. ***Materials and Methods:*** We included 360 participants, including 186 patients with AD, 87 with bvFTD and 87 cognitively healthy controls. This included a cohort of training and an independent cohort of validation. We trained several Machine Learning algorithms, including artificial neural networks (ANN) and traditional Machine Learning models that incorporate genetic algorithms (GAs), to predict the presence of regional hypometabolism in FDG-PET imaging based on cognitive testing results. ***Results:*** The models were able to predict the presence of regional hypometabolism with adequate accuracy, especially in the temporal lobe, followed by parital, and some regions of frontal and occipital lobe. Some areas (e.g. ventromedial prefrontal cortex) were not adequately predicted. Diagnosis played a significant role in the estimation of hypometabolism, and several neuropsychological tests were identified as the most important predictors for different brain regions. In our experiments, classical ML models, such as support vector machines enhanced by a preliminary feature selection step using Gas outperformed ANNs. ***Conclusion:*** A successful prediction of regional brain metabolism of patients with AD and bvFTD was achieved based on the results of comprehensive neuropsychological examination and Machine Learning algorithms, although some areas remain unpredicted. These findings support the neurobiological validity of neuropsychological examination and the feasibility of a topographical diagnosis in patients with neurodegenerative disorders, and the complementary value between cognitive testing and FDG-PET imaging for the diagnosis.

EP-0517

[18F] FDG PET/CT in patients with Niemann-Pick type C: Relationship between the pattern of hypometabolism and neurological symptoms

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Aim/Introduction: Niemann-Pick disease Type C (NPC) is a rare, genetic, and progressive neurological disorder. NPC is caused in most cases (95%) by mutations in NPC1 protein, resulting in an intralysossomal cholesterol storage that causes neuronal dysfunction. [18F] FDG PET/CT (FDG-PET) is a well-established tool for imaging neurodegenerative diseases and prior studies have demonstrated its usefulness in NPC disease. The study aimed to assess the pattern of hypometabolism detected on FDG-PET of NPC patients and to evaluate the relationship between the location of hypometabolism and neurological symptomatology. ***Materials and Methods:*** Sixteen patients (11 males; mean age: 38 years ±11,9) with genetically confirmed NPC (adult-onset form) were included. The average symptom onset was 19yrs (±11,5) and the average time between the clinical onset and the study was 18,5yrs (±10,1). All patients underwent an exhaustive neurological and neuropsychological assessment (MMSE and the disability, dysphagia, and ataxia scales). FDG-PET was performed the same week as the clinical assessment. The evaluation of the FDG-PET images was visual (from two experienced nuclear medicine physicians) and semiquantitative (SMQ), using Cortex ID. Linear regression analysis was performed comparing the Z-scores with the average symptom's onset time and aforementioned scales ***Results:*** Both visual and SMQ assessments of the images showed a pattern of hypometabolism in the cerebellum, the prefrontal cortex, and the cingulate gyrus ($p<0,05$). The thalamus and brainstem showed hypometabolism in most patients based on visual assessment, areas where the software does not conduct SMQ analysis. Cerebellar involvement was observed in most patients (75%; 12/16p). In addition to cerebellar involvement, thalamic, cingulate gyrus, and prefrontal cortex involvement were also identified in 56% (9 out of 16 patients). The mean values of the MMSE and disability, dysphagia, and ataxia scales were 22,2 [16-29], 9,2 [2-14], 2,06 [0-15], and 10,97 [1-21,5], respectively. Linear regression analysis showed a moderate relationship between pons region ($R2adj=0,55$; $p<0,001$), cerebellar Z-scores values and ataxia ($R2adj=0,38$; $p=0,004$), and medial prefrontal cortex ($R2adj=0,19$; $p=0,036$) and posterior cingulate Z-scores ($R2adj=0,34$; $p=0,005$) with MMSE values. No significant relationship was found between

the Z-scores of the different brain regions and the dysphagia and disability scales nor with the average symptom's onset time. ***Conclusion:*** Our findings contribute to the growing body of evidence supporting the integration of FDG-PET as a valuable tool for assessing neurodegeneration in NPC. This enables the identification of hypometabolic patterns and their correlation with neurological symptoms, thereby enhancing our understanding of the disease progression.

EP-0518

APOE4 Association with Amyloid and Tau Positron Emission Tomography and Cognitive Decline

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Aim/Introduction: The apolipoprotein E4 (APOE4) is the strongest genetic risk factor for Alzheimer's disease. Presence of at least one APOE4 allele has been related to earlier and faster deposition of amyloid plaques in the brain, and faster cognitive decline. However, further studies disentangling genotype influence on amyloid and tau deposition in memory clinic populations are still necessary. The aim of this study was to evaluate the association between amyloid and tau pathology and cognitive decline with APOE4 carriership. ***Materials and Methods:*** A cohort of 237 individuals from two memory clinics underwent amyloid- and tau-PET, APOE genotyping, and neuropsychological assessment was selected. Amyloid uptake was converted into centiloid values, and tau was quantified as SUVR in a global and medial, lateral and superior temporal (MTL, LTL, and STG) regions, normalised to cerebellar crus. Subjects were classified as APOE carriers if they had at least one E4 allele, or non-carriers. Positivity for amyloid deposition was based on a centiloid threshold of 19. A Wilcoxon test was used to assess differences between carriers and non-carriers for amyloid and tau SUVR. A mediation analysis was performed to assess the mediation effects of centiloid in the association between global tau and APOE4 carriership in the whole sample and by amyloid status, corrected for age, sex, and cognitive stage. A subsample of 95 individuals underwent follow-up MMSE examination at least 1 year after baseline. A linear mixed model was used to assess the predictive value of APOE4 carriership for cognitive decline, corrected by age, sex, global tau, and centiloid. ***Results:*** Mean (SD) age of participants was 71.8 (7.9) years, 57% were men, 32% were APOE4 carriers, 38% were amyloid-positive (A+), and 47% were cognitively unimpaired. Carriers, compared to non-carriers, showed significantly higher centiloid and tau SUVR values in all regions ($p<0.01$). In A- individuals, the association between APOE4 carriership and global tau was not mediated by centiloid, but there was a significant direct association between tau and APOE4 ($p<0.01$). No mediation by centiloid or direct effects between tau and APOE4 were found in the A+ group. The linear mixed effect model showed that APOE4 carriers showed a faster cognitive decline compared to non-carriers ($B=-0.82, p<0.01$). ***Conclusion:*** APOE4 carriers present a significant increase of both tau and amyloid load with respect to non-carriers, and declined significantly faster than non-carriers. Importantly, carriership was a predictor of cognitive decline regardless of amyloid and tau deposition.

EP-0519

Early-phase [18F]Flortaucipir tau-PET as a measure of neurodegeneration in Alzheimer's disease: a comparison with [18F]FDG-PET and early-phase amyloid-PET

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Aim/Introduction: Alzheimer's disease (AD) is characterized by several neuropathologic changes, including β-amyloid (A) deposition, pathologic tau (T), and neurodegeneration (N). While [18F]FDG PET is widely used for investigating N by detecting changes in cerebral glucose metabolism, dual-phase amyloid-PET offers the possibility to assess both A and N with a single tracer injection. Moreover, through regional analysis, distinct patterns of brain metabolism and perfusion that indicate neurodegeneration can be identified throughout the spectrum of AD, frontotemporal, and Lewy body dementias. Dual-phase tau-PET could also offer insights into both T and N. Our study aims to evaluate the association of tau-PET early frames with [18F]FDG PET and amyloid PET early frames, and determine their comparability in discriminating AD patients and in their ability to discern different neurodegenerative patterns. ***Materials and Methods:*** We included 58 subjects, spanning from no cognitive impairment (n=10) to mild cognitive impairment (n=34) and dementia (n=14), from the Geneva Memory Center. Within a year, they underwent dual-phase [18F]Flortaucipir-PET (eTAU) and [18F]FDG-PET. Additionally, a subsample of 36 participants underwent dual-phase amyloid-PET using either [18F]Florbetapir (eFBP) (n=21) or [18F]Flutemetamol (eFMM) (n=15). Uptake distribution images were visually inspected by a nuclear medicine expert blinded to clinical diagnoses and classified into hypometabolism and hypoperfusion patterns suggestive or not of neurodegenerative diseases. Standardized uptake value ratios (SUVR) were extracted from key regions sensitive to AD (metaROI) to evaluate the correlation of eTAU with their respective [18F]FDG-PET and eFBP/eFMM scans. Receiver operating characteristic analyses were performed to compare the discriminative power of eTAU, FDG and eFBP/ eFMM SUVR between A-/T- and A+/T+ participants. ***Results:*** Strong positive correlations were found between eTAU and FDG SUVR ($r=0.711$, $p<0.001$) and eTAU and eFBP/eFMM SUVR ($r>0.713$, $p<0.001$), independently of T status. Visual classification of eTAU uptake distribution revealed clusters of significant hypoperfusion with good correspondence to hypometabolism topography and eFBP/eFMM hyperfusion patterns ($k>0.57$), independently of the underlying neurodegenerative pattern. Both eTAU and FDG SUVR significantly distinguished A+/T+ patients from A-/T- (AUCeTAU=0.604, AUCFDG=0.748) with FDG performing better than eTAU ($p=0.04$). eFMM/eFBP and eTAU SUVR showed a comparable discriminative power (AUC>0.587). ***Conclusion:*** Our findings suggest that eTAU offers perfusion information closely linked to regional brain glucose metabolism and perfusion measured by early amyloid-PET phases, supporting their utility as a surrogate biomarker for neurodegeneration in clinical settings.

EP-0520

Characterizing sporadic early-onset Alzheimer's disease using dual-probe PET/CT and fluid (CSF and plasma) AD core biomarkers.

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Aim/Introduction: Early-onset Alzheimer's disease occurs before 65 years old and accounts for about 10% of all AD cases. Previous studies mainly focused on familial forms of EOAD, while sporadic EOAD have been under-studied.PET/CT can be used not only to improve sEOAD diagnostic acumen but also enhance our understanding of fundamental pathobiological changes before the onset of symptoms. We endeavor to integrated dual-probes PET/CT and fluid biomarkers, with the goal of showing how the described approaches can be used to improve our understanding of diagnostic acumen for sEOAD and its heterogeneous clinical presentations. ***Materials and Methods:*** Patients were recruited between 2019 and 2023 from the CANDI study, a prospective cohort study on AD. It included 76 patients with sEOAD, 51 with late-onset AD, 21 young controls, and 11 older controls. All AD patients met the ATN diagnostic criteria. Patients with familial EOAD or non-AD dementia were excluded.Single molecule array technology was used to measure fluid biomarkers,cerebral glucose metabolism and β-Amyloid burden were further assessed by using dual-probes PET/CT(18F-FDG-PET and 18F-AV45-PET) for sEOAD biological definition. PET imaging data were analyzed by SPM12 software implanted in MATLAB 2020b. ***Results:*** The cerebral hypometabolism pattern of sEOAD was limited to bilateral precuneus and the cerebral hypermetabolism pattern was observed in medial supra- frontal gyrus [$p < 0.05$, family-wise error (FWE) corrected with cluster size (KE) above 20 contiguous voxels]. The same hypermetabolism pattern was detected in comparisons between young healthy controls and older healthy controls. It was also showed that sEOAD acounts for lower Aβ. burden in the bilateral precuneus, anterior cingulate gyrus, posterior cingulate gyrus, and medial superior frontal gyrus ($p < 0.05$, FWE corrected, KE>20). However, there was no significant Aβ deposition observed in the same cortical areas in healthy controls group. CSF P-tau181 levels (t=3.696, p=0.0003)was elevated in patients with sEOAD, while other AD core biomarkers (plasma P-tau181, plasma T-tau, Aβ42,Aβ40, Aβ42/Aβ40,etc.) accounts for no statistically significant differences. SUVR values calculated from the precuneus ROI region based on FDG imaging showed the most significant differences (t=3.783, p =0.0002) and showed the best efficacy for diagnosing sEOAD from sLOAD (AUC=0.768, p <0.0001). ***Conclusion:*** As a result of these preliminary findings, we can conclude that the spatial metabolic profile and Aβ heterogeneity discriminated sEOAD from sLOAD .The bilateral precuneus hypometabolic and lower Aβ deposition pattern may integrated as one potential neuroimaging biomarker for characterizing sporadic early-onset Alzheimer's disease.

EP-0521

Metabolic Disparities Between Patients with Suspected non-Alzheimer's Pathophysiology Exhibiting AD Clinical Features and AD-like Hypometabolism, and Patients Diagnosed with AD.

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Aim/Introduction: Patients with suspected non-Alzheimer's pathophysiology (SNAP) with clinical signs resembling Alzheimer's disease (AD) and an AD-like metabolic pattern (AD-like SNAP) represent a distinct subgroup posing diagnostic challenges, sparking debate over their characterization. While some may suffer from dementia of non-AD origin (e.g., Lewy body disease), others may fall within the spectrum of AD-related processes, yet lack sufficient amyloid deposits detectable by amyloid PET imaging. This study aims to assess the metabolic alterations in these patients and compare them with those observed in AD. ***Materials and Methods:*** This retrospective study examined 12 patients with AD-like SNAP (10 male, age 67.8 ± 7.6 years, MMSE 25.8 ± 2, symptom duration 2.0 ± 2 years, mean ± SD) and 19 patients with AD (12 women, 65.5 ± 9.1 years, MMSE 24.3 ± 3.9, symptom duration 3.0 ± 2.4 years) who underwent 18F-FDG and 11C-PIB PET/CT scans. While all patients exhibited an hypometabolic pattern consistent with AD, all SNAP patients were PIB-negative, and all AD patients were PIB-positive. Groups were compared to each other and to age- and gender-matched normal controls using ANCOVA in SPM8 ($p<0.001$ non corrected). ***Results:*** As expected, patients with AD displayed hypometabolism in bilateral posterior parietal and temporal cortex, precuneus, posterior cingulate and frontal cortex compared to normal controls. AD-like SNAP patients exhibited decreased metabolism in these same regions. Direct comparison between AD-like SNAP and AD revealed lower metabolism in the inferior and anterior frontal and right anterior cingulate cortex, and higher lateral temporal metabolism in the former group. ***Conclusion:*** These findings suggest metabolic differences between AD-like SNAP and AD, particularly in frontal and temporal cortex, aiding in the characterization of these contentious subtype of patients. Further characterization using tau PET is warranted, although other abnormal proteins such as alfa-synuclein and TDP-43 may also contribute to their pathophysiology.

EP-31

e-Poster Area

B: Imaging Clinical Studies -> B5 Neurological Imaging Clinical Study -> B52 Cognitive Impairment

EP-0522

Increased blood-brain barrier permeability and cognitive impairment in patients with chronic kidney disease

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Aim/Introduction: Chronic kidney disease (CKD) is associated with an increased risk of cognitive impairment. We previously demonstrated that this cognitive impairment is associated with an increased permeability of blood-brain barrier (BBB) in rodents

with CKD, linked to activation of aryl hydrocarbon receptor (AhR) by indoxyl sulphate (IS)(1). The objective of BREIN study is to confirm the increased BBB permeability in humans with CKD. ***Materials and Methods:*** The BREIN comparative study (NCT04328415) prospectively included patients with end-stage kidney disease (ESKD), and healthy volunteers (Ctrl) matched in age, gender, and educational level to a patient. In all participants, BBB permeability was quantified by brain 99mTc-DTPA SPECT/CT as percentage of injected activity (%IA). A battery of neurocognitive tests was performed, serum uremic toxins accumulation and AhR activation were assessed. ***Results:*** Fifteen ESKD patients and 14 healthy volunteers were analysed. ESKD patients had higher BBB permeability compared to controls: 0.29±0.07 vs. 0.14±0.06 %IA, p=0.002. ESKD patients displayed lower MoCA score: 22.0±5.0 vs. 27.3 ± 2.8, p=0.008, impaired short-term memory (doors test): 12.5±3.4 vs. 16.5±3.4, p=0.005, higher Beck depression score 8.1±9.1 vs. 2.7±3.4, p=0.046, and slightly more daily cognitive complaints: 42.5±29.3 vs. 29.8±14.0 p=0.060. ESKD patients displayed higher IS levels (86.1±48.4 vs. 3.2±1.7 µmol/L, p=0.001) and AhR activating potential (37.7±17.8% vs. 24.7±10.4%, p=0.027). BBB permeability was inversely correlated with MoCA score (r=-0.60, 95%CI [-0.772; -0.339], p=0.001) in the overall population. ***Conclusion:*** ESKD patients display an increased BBB permeability compared to matched healthy volunteers. Association with uremic toxins and cognitive impairment needs to be assessed in larger cohorts of patients. ***References:*** (1) Bobot M, Thomas L, Moyon A, Fernandez S, McKay N, Balasse L, et al. Uremic Toxic Blood-Brain Barrier Disruption Mediated by AhR Activation Leads to Cognitive Impairment during Experimental Renal Dysfunction. J Am Soc Nephrol JASN. 2020 Jun 11.

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Combined Brain Perfusion SPECT with Cognitive Stress using LASSI-L for Prediction of Brain Amyloid Status

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Aim/Introduction: This study was aimed to use cognitive stress (Loewenstein-Acevedo Scale for Semantic Interference and Learning, LASSI-L) combined with brain perfusion SPECT for the detection of brain amyloid positivity which reflects Alzheimer's pathology. ***Materials and Methods:*** Brain SPECT using Tc-99m ECD were performed at baseline and during cognitive stress test (LASSI-L) in amyloid positive (AP) and amyloid negative (AN) subjects. F^{18} florbetaben amyloid PET scan was used as a gold standard to determine Alzheimer's pathology. Brain SPECT perfusion changes in both groups during cognitive stress compared to baseline were assessed by paired t-test on statistical parametric mapping. Positive and negative perfusion in each group were defined with statistically significant of p<0.05 at cluster level. ***Results:*** We analyzed 72 subjects (25 AP with age 71.16±8.54 years, 47 AN with age 69.19±5.80 years). There was no significant perfusion change in the AP group for both the positive contrast (Cognitive Stress-Baseline) or negative contrast (Baseline-Cognitive Stress). In the AN group, there were significant positive perfusion changes after cognitive stress at bilateral anterior prefrontal cortices (BA10), left visual association cortex (BA19), right secondary visual cortex (BA18), left premotor & supplementary motor area (BA6). There was significant negative perfusion change at right dorsal posterior cingulate cortex (BA31). ***Conclusion:*** Brains with amyloid deposition have blunt brain perfusion response to cognitive stress using LASSI-L, while amyloid negative brains are able to respond. Combining brain perfusion SPECT with LASSI-L can be used for segregation of brains with amyloid positive and negative with potential application for early detection of Alzheimer's disease in those with mild cognitive impairment. ***References:*** 1. Beer JC, Snitz BE, Chang C-CH, Loewenstein DA, Ganguli M. Does a cognitive stress test predict progression from mild cognitive impairment to dementia equally well in clinical versus population-based settings? International Psychogeriatrics. 2018;30(10):1435-45. 2. Loewenstein DA, Acevedo A, Luis C, Crum T, Barker WW, Duara R. Semantic interference deficits and the detection of mild Alzheimer's disease and mild cognitive impairment without dementia. J Int Neuropsychol Soc. 2004;10(1):91-100. 3. Loewenstein DA, Curiel RE, Duara R, Buschke H. Novel Cognitive Paradigms for the Detection of Memory Impairment in Preclinical Alzheimer's Disease. Assessment. 2018;25(3):348-59. 4. Loewenstein DA, Curiel RE, Greig MT, Bauer RM, Rosado M, Bowers D, et al. A Novel Cognitive Stress Test for the Detection of Preclinical Alzheimer Disease: Discriminative Properties and Relation to Amyloid Load. Am J Geriatr Psychiatry. 2016;24(10):804-13.

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Validation of a Brain Dedicated PET Scanner for Amyloid Imaging

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Aim/Introduction: With the advent of new anti-amyloid therapies, a considerable increase in brain PET studies is expected. Amyloid tracers make it possible to select candidates for therapy and evaluate their efficacy. Moreover, quantitative analysis of these images can improve diagnostic reliability and is indispensable for response assessment. The aim of this work is to compare the image quality and resolution of Siemens Biograph mCT (wbPET) vs PET dedicated to CareMiBrain (CMB) brain. ***Materials and Methods:*** Ten amyloid-PETs were included in this study, of which 7 were healthy controls without known neurological pathology and 3 patients with a definitive diagnosis of neurodegenerative disorder. An 18F-Florbetaben PET-CT was first performed on the Siemens wbPET machine 90 minutes after injection and consecutively after signing the informed consent on the dedicated CMB machine. PET images were normalized to ^{18}F-florbetapir template and SUV-corrected in Pmod 4.1. Subsequently, image contrast was quantified using the centiloid cortex ROI and an ROI in the white matter. In addition, centiloid was calculated for each image. The results were compared using the Student's t-test. ***Results:*** The white matter-to-cortex ratio shows a similar contrast between both systems [PB1] (1.53 vs. 1.53, p = 0.94). However, centiloid calculation shows expected values in Siemens images (controls: [-27, -1]; patient: 93[PB2]), whereas a higher variability is observed in CMB images with values not corresponding to the centiloid scale (controls: [-12, 35]; patient: 523). ***Conclusion:*** Image quality on dedicated PET is sufficient for clinical diagnosis with contrast similar to our reference equipment (Siemens). However, the centiloid calculated with CMB images is overestimated, probably due to underestimation of the reference region because of its proximity to the field-of-view limits.

EP-0525

Characterization of glymphatic system and early-phase amyloid metabolism in Alzheimer's disease: a simultaneous PET/MR study

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Aim/Introduction: The damage to the glymphatic system, pathological amyloid (Aβ) deposition, and cognitive impairment are closely related in patients with Alzheimer's disease (AD). Early-phase Aβ imaging reflects cerebral perfusion and its relationship with the glymphatic system damage in the progression of AD is not well understood. The purpose of this study, which utilized the simultaneous PET/MRI, was to assess the glymphatic system and early-phase Aβ imaging in relation to cognitive impairment among patients with healthy control (HC), prodromal Alzheimer's disease (pAD), and AD. ***Materials and Methods:*** A total of 33 subjects were included in this study, including 11 patients with AD, 11 patients with pAD, and 11 age- and sex-matched healthy individuals. Cognitive assessments, including the Mini-Mental State Examination (MMSE) and Montreal Cognitive Assessment (MoCA), were collected along with clinical information. Every enrolled subject underwent an integrated 18F-Florbetapir (18F-AV45) PET/MR scan. High-resolution T1-weighted structural images, diffusion-tensor images and early-phase 18F-AV45 images were acquired for all subjects. Normalized PET standardized uptake value ratio (SUVR) images, with whole cerebellum as the reference region, and an index for diffusivity along the perivascular space (ALPS-index) were obtained using the FSL. Anatomical Automatic Labeling (AAL) atlas was utilized in ROI-wise analysis to evaluate abnormalities in brain metabolism. ***Results:*** AD patients showed reduced mean MMSE and MoCA scores compared to HC and PAD subjects (both $P < 0.01$). Compared to HC, lower mean ALPS-index was found in AD patients ($P < 0.01$). AD patients showed hypometabolism of early-phase Aβ in bilateral hippocampus, parahippocampal gyrus and caudate (all $P < 0.001$). Mean ALPS-index was correlated with early-phase Aβ metabolism in bilateral hippocampus, caudate, amygdala, left cingulate gyrus and right pallidum (all $P < 0.001$) ***Conclusion:*** We observed lower mean ALPS-index and cerebral perfusion level of early-phase Aβ imaging and higher cognitive impairment in the patients of AD as compared with participants of HC or pAD group. The glymphatic system damage is positively correlated with early-phase Aβ imaging. These results may provide imaging evidence for the early diagnosis and personalized management of AD.

EP-0526

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Aim/Introduction: To investigate the impact of the correlation between plasma glial fibrillary acidic protein (GFAP) levels and subcortical Tau-PET uptake on cognitive function in patients with Alzheimer's disease (AD). ***Materials and Methods:*** This cross-sectional study recruited 47 cognitive impaired patients (22 AD, 25 MCI)and 17 control subjects. Plasma based biomarkers, including amyloid-β 42 (Aβ42), Aβ40, phosphorylated-tau (p-tau181, p-tau217, p-tau231), neurofilament light (NfL) and GFAP of all participants were measured. Participants underwent amyloid-β (11C-PIB) and tau (^{18}F-MK6240) PET as well as cognitive testing. SUVR maps of Aβ and Tau-PET were obtained using cerebellum gray matter as reference region. SUVR of subcortical regions were extracted to perform ROI- and voxel-wise comparison between groups. Correlation between plasma biomarkers and cognitive performance were calculated using multiple regression, with controlling effect of age and sex. Correlation between image measurement and cognitive performance were studied as well. Mediation analysis was performed to investigate the role of plasma GFAP played in relationship of Tau pathology and cognitive decline. ***Results:*** Results showed that plasma GFAP, NfL, Aβ42/40 ratio, p-tau 217 and p-tau 181 of AD group and MCI group were higher than NC group. Aβ-PET load at amygdala, accumbens, caudate, putamen, pallidum, PHG, thalamus and olfactory of AD and MCI group were higher than NC group ($p<0.05$). Tau-PET load at amygdala, putamen, hippocampus and PHG of AD and MCI group were higher than NC group ($p<0.05$). In CI group, higher Tau-PET load at amygdala (β=-0.389, p=0.029), accumbens (β=-0.396, p=0.025), hippocampus (β=-0.376, p=0.035), PHG (β=-0.408, p=0.021), and olfactory (β=-0.423, p=0.015) was associated with lower global cognitive scores. Mean subcortical Tau-PET load was negatively correlated with global cognitive scores (β= -0.389, p=0.029), in CI group. Higher plasma GFAP (β=-0.579, p=0.001), NfL (β=-0.46, p=0.013), p-tau 217 (β=-0.352, p=0.055) and p-tau 181 (β=-0.473, p=0.008) was associated with lower global cognitive scores in CI group. Higher mean subcortical Tau-PET load was associated with higher plasma GFAP (β=0.313, p=0.068), NfL (β=0.476, p=0.003), p-tau 217 (β=0.485, p= 0.004) and p-tau 181 (β=0.382, p=0.026) in CI group. Results of mediation analysis showed that about 36.7% of relationship between mean subcortical Tau-PET load and cognitive impairment could be explained by increase of plasma GFAP, in CI group. ***Conclusion:*** This study shows that plasma GFAP is an early marker associated with subcortical Tau pathology, contributing to cognitive impairment in AD. This study also highlights the importance of quantifying subcortical regional Tau retention values in these individuals.

EP-0527

Gray-White Matter Contrast of ^{11}C-PIB uptake in a cognitively unimpaired population: relationship to Aβ1-42/Aβ1-40 ratio of amyloid peptides in the cerebral spinal fluid

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Aim/Introduction: In the normal brain, amyloid tracer uptake occurs in white matter (WM) but not cortical gray matter (GM), creating a clear GM-WM contrast (G-WC). We investigated changes in global and regional 11C-PIB G-WC in cognitively unimpaired subjects, correlating with Aβ1-42/Aβ1-40 ratio in cerebrospinal fluid. ***Materials and Methods:*** We selected 13 healthy subjects (mean age: 64.2 years) from a cohort of cognitively unimpaired volunteers with normal MRI and CSF amyloid values obtained within the past year. Subjects underwent dynamic PET/CT imaging for 45 minutes starting 40 minutes post-administration of 11C-PIB. Volumes of interest (VOIs) were delineated in cerebellar, frontal, temporal, occipital, and parietal regions of both hemispheres.

SUVmean values in GM and WM were measured at sequential time points. Aβ1-42/Aβ1-40 ratio was considered normal > 0.07. Regional G-WC was calculated as SUVmean in GM/SUVmean in WM for each region, and global G-WC was the average of all cortical regional G-WC values in each subject. ***Results:*** In the total group (n=13) the better G-WC was obtained in latest phases and correlated with Aβ1-42/Aβ1-40 ratio values (r= -0,736). In 7/13 subjects Aβ1-42/Aβ1-40 ratio was normal showing global G-WC of 0,729 ± 0,093 and in 6/13 it was pathologic showing global G-WC of 0,908 ± 0,152 (p< 0,05) at 85 minutes. Regional differences were observed between subgroups: right frontal (0.722 ± 0.150 vs. 0.888 ± 0.119) (p< 0.05); left frontal (0.660 ± 0.158 vs. 0.934 ± 0.246) (p<0.001); right parietal (0.669 ± 0.170 vs. 0.898 ± 0.150)(p<0.05); left parietal (0.719 ± 0.149 vs. 0.805 ± 0.200) (p=ns); right temporal (0.673 ± 0.112 vs. 0.908 ± 0.304) (p=ns); left temporal (0.680 ± 0.126 vs. 0.829 ± 0.250) (p=ns); right occipital (0.821 ± 0.217 vs. 1.014 ± 0.150) (p<0.1) and left occipital (0.888 ± 0.204 vs. 1.057 ± 0.233) (p=ns).PIB retention assessed as SUVmean in GM increased in the pathological subgroup (0,69 ± 0,148 vs 0,395 ± 0,065; p< 0,001) and in WM globally (0,708 + 0,062 vs 0,565 ± 0,143) (p< 0.1), with high correlation between regional G-WC and Aβ1-42/Aβ1-40 ratio in frontal and parietal areas (r= 0,931 and 0,908 respectively). ***Conclusion:*** In cognitively unimpaired subjects with abnormal Aβ1-42/Aβ1-40 ratio in CSF, the G-WC in 11C-PIB tracer decreased significantly showing a characteristic topographic pattern. This alteration, affecting gray and white matter, differs from others known conditions, making it a potentially valuable early parameter in preclinical cognitive neurodegenerative disease evaluation.

EP-0528

Visual Assessment and Semi-Quantitative Parameters of ^{18}F-FDG in the Clinical Diagnosis of Alzheimer's Disease among Patients with Memory Impairment: A Comprehensive Study

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Aim/Introduction: The objective of this study was to assess the diagnostic performance of ^{18}F-FDG PET visual assessment and semi-quantitative parameters in Alzheimer's disease (AD) among patients with memory impairment. ***Materials and Methods:*** A retrospective analysis was conducted on 96 initially diagnosed memory impairment patients. The ATN criteria, based on ^{18}F-AV-45+^{18}F-PI-2620 PET/CT+MRI imaging results, were employed as the diagnostic standard for AD patients. A visual analysis of the temporoparietal and posterior cingulate cortex (PCC) hypometabolism and semi-quantitative analysis methods, including PET-SCORE scoring and NeuroQ software analysis, were employed to assess the diagnostic performance of ^{18}F-FDG PET/CT imaging in AD patients. A Chi-square test was employed to assess the accuracy, sensitivity, and specificity of visual assessment and semi-quantitative parameters. Pearson correlation analysis was conducted to determine the relationship between PET-SCORE and the cognitive scale. ***Results:*** Of the 96 patients initially diagnosed with memory impairment, 61 were clinically diagnosed with Alzheimer's disease (AD), while 35 patients were excluded from the AD diagnosis (18 for vascular dementia, 14 for frontotemporal dementia and 3 for dementia with Lewy bodies). There were statistically significant differences in the sensitivity and specificity of visual assessment and semi-quantitative analysis of ^{18}F-FDG PET/CT imaging for diagnosing AD (χ2=5.8229.03, P<0.05). The visual assessment of temporoparietal hypometabolism demonstrated the highest sensitivity (91.80%), while the semi-quantitative assessment using PET-SCORE exhibited the highest specificity (100.00%). A ROC curve (AUC=0.69) was constructed for the diagnosis of AD according to PET-SCORE. The optimal threshold was determined to be 3.20, with a sensitivity of 40.98%, a specificity of 100%, and an accuracy of 62.5%. PET-SCORE exhibited statistically significant correlations with patient cognitive scale scores, including MMSE, MoCA, and ADL (R = -0.380.31, P < 0.01). ***Conclusion:*** Among patients initially diagnosed with memory impairment, visual assessment in ^{18}F-FDG PET/CT imaging analysis demonstrated higher sensitivity, while semi-quantitative analysis using PET-SCORE exhibited higher specificity. PET-SCORE scoring demonstrated a statistically significant correlation with the severity of cognitive decline in AD patients.

EP-0529

The significance of SUVR in ^{18}F-PI-2620 PET imaging for the diagnosis of different cognitive disorders, alongside cognitive correlation analysis

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Aim/Introduction: The objective of this study was to evaluate the values of ^{18}F-PI-2620 PET/CT brain imaging with SUV ratio (SUVR) in the assessment of tau protein deposition in the brain of patients with different cognitive disorders and to determine its correlation with cognition. ***Materials and Methods:*** A total of 67 subjects were enrolled in the study, which included 54 patients with Alzheimer's disease (AD; 21 males, 33 females, age (68.6±7.8) years), 7 patients with mild cognitive impairment (MCI; 1 male, 6 females, age (63.1±11.2) years) and 6 healthy controls (HC; 4 males, 2 females, age (69.0±5.8) years). All participants underwent examination by ^{18}F-PI-2620 PET/CT. SUVR of brain regions were analysed with inferior cerebellum cortex serving as the reference region. All participants were evaluated using cognitive scales, including the Mini-Mental State Examination (MMSE) and Montreal Cognitive Assessment (MoCA). One-way analysis of variance and t-test were employed to compare the differences in SUVR in each brain region between the HC, MCI and AD groups. ROC curve analysis was used to determine the optimal cutoff value for differential diagnosis of SUVR. Pearson correlation analysis was employed to examine the correlations of SUVR with cognitive scale scores. ***Results:*** The SUVR of the whole brain was 1.40±0.31 in the AD group, 1.08±0.19 in the MCI group, and 1.01±0.12 in the HC group. SUVR analysis of the whole brain and each brain region was able to distinguish AD from HC (F values: 1.76-10.09, t values: 2.98-7.47, all P<0.05), but not HC from MCI (t values: 0.17-1.53, all P>0.05). ROC curve analysis revealed that the optimal cutoff value of SUVR for differential diagnosis of AD-HC group was 1.18 for the whole brain (AUC=0.89), 1.13 for the amygdala (AUC=0.94) and 1.26 for the parahippocampal gyrus (AUC=0.94). The ROC curve analysis revealed that the optimal cutoff value for differential diagnosis of AD and MCI was 1.06 for the whole brain (AUC=0.82), 1.18 for the amygdala (AUC=0.88) and 1.28 for the infratemporal gyrus (AUC=0.88). The SUVR of the whole brain, frontal, occipital, parietal, temporal and insula were found to be significantly negatively correlated with MMSE and MoCA cognitive scale scores (r values: from -0.64 to -0.40, all P<0.01). ***Conclusion:*** SUVR quantitative analysis in ^{18}F-PI-2620 PET imaging could assist the differential diagnosis of AD and HC, AD and MCI. The SUVR of the whole brain and five lobes demonstrated a negative correlation with MMSE and MoCA scores.

EP-0530

Tracking changes in cerebral activity in patients with lymphoma receiving chemotherapy using sequential [18F]FDG PET/CT

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Aim/Introduction: Patients commonly describe having troubles with thinking after chemotherapy, but the mechanism of "chemo brain" is not fully understood. [18F]FDG PET/CT can serve as a proxy for neural activity of the brain. This study aimed to assess changes in cerebral activity with chemotherapy using [18F]FDG PET/CT of lymphoma patients. ***Materials and Methods:*** [18F]FDG PET/CT of 93 consecutive newly diagnosed lymphoma patients were assessed. All had three sets of [18F]FDG PET/CT: at BASELINE, after 3 cycles (INTERIM) of standard R-CHOP regimen, and after 6 cycles (END-of-TX). The PET slices of the brain were separated, spatially normalized using the PET template, smoothened, and gray matter-extracted using SPM12 of MATLAB. Intensity normalization of each voxel was performed by calculating the standardized uptake value ratio (SUVR) with whole brain the reference region. Clusters were identified according to AAL3 using the REX toolbox, the mean SUVR computed for each cluster, and the values from three time points were compared by paired T-test. P-value < 0.01 after Bonferroni correction was considered significant. ***Results:*** [BASELINE to INTERIM] Activity significantly decreased in multiple clusters - bilaterally in inferior frontal pars orbitalis, gyrus rectus, lateral/posterior-orbital, middle temporal, and anterior cingulate. Unilateral decrease was noted in areas of the thalamus, middle cingulate, and parahippocampal gyrus, all in right side. Increased activity was observed bilaterally in postcentral, superior/middle/inferior-occipital and lingual gyruses, and unilaterally in left supramarginal gyrus. [BASELINE to END-of-TX] All of the clusters that showed decrease at INTERIM showed significant decrease at END-of-TX. All clusters showing unilateral decrease at INTERIM showed decrease in the contralateral cluster as well at END-of-TX. New clusters in the olfactory cortex, medial/anterior-orbital, superior frontal gyruses, and areas of the thalamus and basal ganglia showed decreased activity at END-of-TX. The clusters with increased activity at INTERIM showed increased activity at END-of-TX, in all but the lingual gyruses. The inferior parietal gyrus and cuneus, all in left side, were new clusters with increased activity at END-of-TX. [INTERIM to END-of-TX] Activity decreased from INTERIM to END-of-TX in the posterior-orbital gyruses and anterior cingulate. ***Conclusion:*** Chemotherapy was associated with decreased [18F]FDG activity in clusters in the frontal and temporal lobes (especially the orbital gyruses), thalamus and limbic system, with more clusters showing diminished activity at END-of-TX. Several clusters in the parietal and occipital lobes showed increased activity, possibly as compensation. These changes in neural activity may be depictions of the chemo brain in lymphoma patients.

EP-0531

Potential Utility of Amyloid and Metabolic PET Imaging in Differentiating Cerebral Amyloid Angiopathy from Alzheimer's Disease

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Aim/Introduction: Amyloidogenic proteins can undergo conformational changes, resulting in the formation of insoluble amyloid fibrils, which are implicated in several central nervous system disorders, such as Alzheimer's disease (AD) and cerebral amyloid angiopathy (CAA). In both conditions, amyloid β (Aβ) is the primary amyloidogenic protein. This retrospective study aimed to investigate whether the complementary information provided by ^{18}F-florbetapir PET, which detects Aβ deposition, and ^{18}F-FDG PET, which measures glucose metabolism, can enhance the differential diagnosis between CAA and AD. ***Materials and Methods:*** Patients with CAA (n = 37), AD (n = 30), and cognitively healthy controls (HCs, n=14) underwent ^{18}F-florbetapir and ^{18}F-FDG PET imaging within a one-month period. Region of interest and voxel-wise analyses were performed to compare Aβ deposition and glucose metabolism patterns among the three groups. Standardized uptake value ratios were calculated using white matter and brainstem as reference regions for ^{18}F-florbetapir and ^{18}F-FDG PET, respectively. ***Results:*** Patients with CAA exhibited significantly higher ^{18}F-florbetapir uptake in the cerebellum, global cerebral cortex, and various cortical regions compared to both patients with AD and HCs. Voxel-wise analysis revealed that patients with CAA had greater ^{18}F-florbetapir uptake predominantly in the cerebellum and occipital cortex compared to those with AD. The patterns of glucose hypometabolism in CAA did not differ significantly from those observed in AD. ***Conclusion:*** The distinct patterns of Aβ deposition, particularly the increased amyloid burden in the cerebellum and occipital cortex, could serve as a valuable biomarker for differentiating CAA from AD. However, the absence of significant differences in glucose metabolism patterns between CAA and AD limits the clinical utility of ^{18}F-FDG PET imaging for distinguishing between the two disorders. Further investigation in larger, well-characterized cohorts of patients with various CAA subtypes is warranted.

EP-0532

PET-CT with ^{18}F-FDG: a tool for ruling out neurodegenerative causes in assessing unclear cognitive decline

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Aim/Introduction: This study aimed to assess the effectiveness of PET-CT with ^{18}F-FDG in examining patients presenting with cognitive symptoms but lacking a definitive diagnosis. By focusing on cases with uncertain clinical manifestations, this research aimed to highlight the significance of normal PET-CT findings in guiding diagnostic and therapeutic approaches. ***Materials and Methods:*** A retrospective analysis was conducted on a cohort of patients presenting with cognitive symptoms without a clear etiology, all referred from neurology to our nuclear medicine department. Patients were referred for PET-CT studies with ^{18}F-FDG between January and April 2024. PET-CT studies were performed using a digital PET-CT scanner, and images were acquired 30 minutes after radiopharmaceutical administration. Analysis was exclusively performed on those patients whose studies showed normal findings on PET-CT, and their demographic characteristics, clinical presentation, and neuropsychiatric comorbidities were described. ***Results:*** Among 189 brain studies conducted from January to April 2024 for cognitive decline, 42 (22%) revealed

normal PET-CT findings. All of them showed ambiguous cognitive symptoms, with mild cognitive complaints, such as forgetfulness and attention difficulties. Patients exhibited normal metabolic activity, suggesting non-neurological origins for their cognitive complaints. These patients tended to be younger, with a mean age of 70.6 years, and predominantly female (69%). The mean Mini-Mental State Examination (MMSE) score was 25/30, with no significant differences between genders. A majority (54.76%) of patients had a history of psychiatric pathology, with anxious-depressive syndrome being the most common. Additionally, 28.57% of patients had an associated neurological disorder, such as trigeminal neuralgia, headache, or recovered stroke. Radiological studies (CT/MRI) were age-appropriately normal in 92.85% of patients. Interestingly, 52.38% of patients lived alone. These findings underscore the complexity of cases of cognitive decline with uncertain clinical presentations. Despite the absence of abnormal findings on PET-CT, a significant proportion of patients had a history of psychiatric pathology and associations with other neurological diseases. The prevalence of living alone in this group suggests possible social and support implications that may influence the management and prognosis of these patients. ***Conclusion:*** The findings underscore the significance of normal PET-CT results in the evaluation of patients with unclear clinical presentation of cognitive decline, particularly in the context of comorbid anxious-depressive syndrome. By excluding neurodegenerative etiologies clinicians can provide targeted management strategies and enhancing patient care. This highlights the importance of comprehensive imaging assessments in guiding clinical decision-making and optimizing patient care.

EP-32

e-Poster Area

B: Imaging Clinical Studies -> B5 Neurological Imaging Clinical Study -> B53 Movement Disorders

EP-0533

Enhancing Lewy-body disease diagnosis using probability assessment: The SMILe index for 123I-mIBG imaging

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Aim/Introduction: Sympathetic 123I-metaiodobenzylguanidine (mIBG) imaging, typically analyzed via the heart-to-mediastinum ratio (H/M), has been extensively employed in diagnosing Lewy-body diseases (LBD), such as Parkinson's disease and dementia with Lewy bodies. However, variable threshold values for the H/M ratio have limited its practical utility. Our study aims to develop a more pragmatic diagnostic tool, the SMILe index (Sympathetic mIBG Index for LBD), which quantifies the likelihood of LBD directly through a standardized, outpatient-friendly H/M-based model. This index also aims to establish criteria that could exempt patients from undergoing late imaging. ***Materials and Methods:*** We collected early and late mIBG images from 92 consecutive patients suspected of LBD, excluding those with young-onset Parkinson's disease (age < 50 years) and genetic transthyretin-type amyloidosis. The initial step involved standardizing the H/M ratio for collimator differences using a phantom-based cross-calibration method prevalent in Japanese and partly European clinical settings. Logistic models were then developed to incorporate H/M ratios with or without additional variables like age or washout rate, leading to the creation of the SMILe index for LBD. This index categorizes LBD likelihood on a scale from 0 (lowest) to 1 (highest). Its diagnostic accuracy was evaluated using the area under the receiver operating characteristic (ROC) curve (AUC), and its performance was compared with traditional H/M ratios. The necessity for late imaging was also assessed with the early SMILe index. ***Results:*** The SMILe index, using just the H/M ratio, effectively differentiated between LBD and non-LBD cases. Additional variables such as age or washout rate did not enhance the diagnostic value. The AUC values for the early and late SMILe indexes were 0.88 and 0.89, respectively, both statistically significant ($p<0.0001$). Patients with/without LBD showed proportional errors between early and late H/M ratios, while Bland-Altman plots confirmed the absence of fixed and proportional errors between early and late SMILe indexes. Furthermore, sensitivity and specificity for both early and late indexes at a 0.5 threshold were 90% and 73%, and 87% and 76%, respectively. Notably, only 16% of patients with an early SMILe index between 0.3 and 0.7 required late imaging for the correct mIBG diagnosis. ***Conclusion:*** The 123I-mIBG-derived SMILe index demonstrates excellent diagnostic accuracy for LBD at a 50% threshold. It successfully identifies patients who do not require late imaging, with thresholds of < 0.3 or > 0.7, thus enhancing patient comfort and streamlining the clinical process in mIBG imaging for LBD.

EP-0534

Optimization of acquisition time for [^{123}I]-FP-CIT SPECT examination

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Aim/Introduction: Dopamine transporter (DAT) imaging using [123I]-FP-CIT SPECT is a pivotal examination in assessing patients with Parkinson's disease (PD). Motor and non-motor related challenges such as tremor, rigidity and cognitive disorders often limit patients from remaining still during imaging. These issues necessitate an optimal acquisition time to minimize motion artifacts and enhance patient comfort while maintaining diagnostic accuracy. ***Materials and Methods:*** Ninety-two patients with clinically uncertain parkinsonian syndrome underwent DAT SPECT imaging. Patients were administered with 185 MBq of [123I]-FP-CIT and imaged 3-hours post-injection using a digital dual-head SPECT/CT system capable of list-mode acquisition. The acquisition protocol, adhering to EANM recommendations, included 120 projections with an original frame-time of 35 s, a zoom of 1.28, and a matrix size of 128x128

resulting in a total imaging time of approximately 38 min. Data were reframed using a commercial listering software to create three additional sinograms per acquisition with frame times of 21, 15 and 10 s. All 368 sinograms were similarly reconstructed using 3D OSEM-based iterative-algorithm including Chang's attenuation, collimator and Monte-Carlo-based scatter correction and Gaussian post-filtering.Regional specific-binding ratios (rSBRs) were defined using a commercial semi-automatic software. Four striatal volume-of-interests (VOIs) (the right (RP) and left putamen (LP) and the right (RCN) and left caudate nucleus (LCN)) and a reference occipital VOI were delineated in the reference image and transferred into a registered patient image to derive the rSBR values. Mean and standard deviation (SD) of rSBRs were calculated. Statistical normality assumptions were confirmed and a mixed model was used to evaluate differences between rSBRs using four different frame times. ***Results:*** The mean (SD) rSBRRCNs for frame times of 10-35 s ranged between 2.035 - 2.079 (0.481 - 0.539) and the mean (SD) rSBRLCNs between 2.043 - 2.068 (0.488 - 0.515). The corresponding rSBRRP values ranged between 1.717 - 1.740 (0.592 - 0.621) and the rSBRLP values between 1.576 - 1.604 (0.510 - 0.577). No statistically significant differences were observed in rSBRs between difference frame times (pRCN = 0.11, pLCN = 0.53, pRP = 0.67 and pLP = 0.58). ***Conclusion:*** Semi-quantitative DAT imaging results remain stable despite reducing frame time from 35 to 10 s in SPECT examination. This reduction in frame time promises significant enhancement in DAT imaging practices. Further validation through visual analysis is warranted in future studies.

EP-0535

Correlation between I-123 mIBG myocardial uptake and dopamine-related clinical symptoms in Parkinson's disease patients

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Aim/Introduction: The prevalence of Parkinson's disease (PD) increases as the senior population grows. I-123 mIBG cardiac scintigraphy has a clinical role in the early detection of autonomic failure in PD patients. However, it is not well elucidated whether there exists a correlation between myocardial mIBG uptake and dopamine-related clinical symptoms. Therefore, the aim of this study is to evaluate the correlation between myocardial uptake in mIBG scintigraphy and clinical symptoms related to dopaminergic degeneration. ***Materials and Methods:*** In this retrospective study, one hundred-four consecutive PD patients, from March of 2018 and March of 2024, were enrolled in this cohort. All included subjects underwent F-18 FP-CIT PET/CT and showed diminished dopamin transporter (DAT) activity in at least one of the striatum. The intensity of I-123 mIBG myocardial uptake was calulated with heart-to-mediastinal ratio (H/M ratio) at 30 and 120 minutes, respectively. Clinical data including age, sex, education years, tremor/rigidity severity scores from Unified Parkinson's Disease Rating Scale (UPDRS), Clinical Dementia Rating (CDR), Korean Mini-Mental State Examination (K-MMSE) were acquired and compared with H/M ratio. After dichomotizing the subjects at the cutoff value of 1.8 for the H/M ratio, clinical data were compared between the high mIBG uptake group and the low mIBG uptake group. Pearson correation test and student T-test was performed. ***Results:*** The H/M ratio of each 30-minute (r=-0.259, p=0.008) and 120-minute (r=-0.227, p=0.021) images showed weak negative correlation with age. No significant correlation was observed between H/M ratio and other clinical data including rigidity (r=0.070, p=0.479) and tremor severity scores (r=-0.142, p=0.149). In the dichotomized group analysis, there were no significant differences between the high mIBG uptake group (n=34) and the low mIBG uptake group (n=70). ***Conclusion:*** Our results, using mIBG myocardial scintigraphy, indicate that autonomic degeneration slowly occurs with age, rather than severity of dopamine-related clinical symptoms in PD patients.

EP-0536

The role of 123I-MIBG cardiac scintigraphy in the patients with movement disorders (MD).

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Aim/Introduction: The differential diagnosis between Parkinson's disease (PD) and atypical parkinsonism disorders (APD) is often difficult with undeniable prognostic and treatment repercussions. 123I-Ioflupane SPECT is usually employed to distinguish degenerative parkinsonism from essential (ET) and vascular (VT) tremors, but in the last years 123I-MIBG scintigraphy, which evaluates cardiac sympathetic denervation, proved good performance in discriminating PD from APD (PSP, MSA and CBD), improving Ioflupane imaging accuracy. ***Materials and Methods:*** Among a large series of over 300 MD patients submitted to 123I-MIBG cardiac scintigraphy, in the present study, we retrospectively enrolled 135 consecutive patients who had vascular damage in basal ganglia at MRI and pathologic but inconclusive 123I-Iofluopane SPECT for definitive differential MD diagnosis. After 111 MBq of 123I MIBG i.v. injection, cardiac scintigraphy was performed (anteroposterior and anterior-left oblique planar views) after 15 min (early-E) and 240 min (delayed-D). The images were analyzed by qualitative and quantitative methods, the latter with heart/mediastinum (H/M) ratio calculation in interest regions with 1.55 cut-off value. ***Results:*** At qualitative evaluation, MIBG uptake was slight to severe reduced in 77/135 patients (Group 1), while preserved uptake was observed in 58/135 cases (Group 2). The quantitative method showed H/M ratio <1.55 in 75/77 Group 1 patients, in both E (1.32±0.16) and D (1.27±0.18) phases, not statistically significant (p=0.074). These patients were classified as PD. The remaining two Group 1 patients had borderline H/M ratio in both E and D phases and APD was diagnosed. In Group 2 patients, H/M ratio was >1.55 in all 58 cases, mean values being 1.71±0.16 (E) and 1.75±0.22 (D), not statistically significant (p=0.25). APD was diagnosed in 47 Group 2 patients and VT in 11 cases. Comparing H/M ratio of Group 1 with Group 2 patients in both phases, the difference was statistically significant (p<0.0001). H/M comparison between all 49 APD and 75 PD patients, in both phases, showed a significant (p<0.0001) difference as well as between PD and VT. Patient diagnosis was confirmed with careful clinical long-term follow up during specific treatments. ***Conclusion:*** In the present study, 123I-MIBG cardiac scintigraphy proved a valuable tool for discriminating PD from APD and VT. In particular, H/M ratio showed better performance than qualitative diagnostic method. No statistical difference was found comparing E and D phases, thus suggesting that E evaluation alone can be sufficient for disease diagnosis. A larger cardiac 123I-MIBG scintigraphy use is suggested in the diagnostic MD strategy.

EP-0537

Digital SPECT with123 I-Ioflupane and analog image-based normality databases - The Semi-QuantifiQuestion

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Aim/Introduction: Despite the typically straightforward nature of cerebral the [123I]I-FP-CIT(123I-ioflupane) brain SPECT images' visual interpretation, semi-quantitative parameters such as the striatal binding ratio (SBR) enhance diagnostic certainty, particularly in borderline cases. Given their improved spatial resolution, sensitivity, signal-to-noise ratio, and the utilization of new reconstruction algorithms, the introduction of digital gamma-cameras in clinical practice allows for increasingly accurate and reproducible SBR calculation. However, their comparison with normality values obtained from the analog gamma-camera data provided by most commercial softwares is questionable. In this study we aimed to compare SBR values from healthy control analog gamma-camera images with those calculated from normal case clinical images acquired on a CZT 3D-ring detector gamma-camera. ***Materials and Methods:*** Bilateral SBR values for the striatum, caudate, whole putamen, anterior putamen, and posterior putamen were analyzed. SBR values from healthy controls were obtained from non-attenuation corrected ordered subset expectation maximization (OSEM) reconstructions available on the PPMI (Parkinson Progression Markers Initiative) database. Normal case images were reconstructed without attenuation correction using OSEM (same parameters as the healthy controls' images) and block sequential regularized expectation maximization (BSREM) algorithms, with SBRs calculated using a dedicated software. ***Results:*** Thirty-five normal cases (mean age 69±10 [47-86] years) and 70 healthy controls (mean age 66±9 [44-84] years) with a statistically similar age distribution between groups (p>0.05) were processed. No statistically significant difference was found between the mean SBR OSEM values of the normal cases and the controls for any of the analyzed regions (p>0.05). However, BSREM images showed statistically higher SBR values in all regions when compared to the same cases' OSEM reconstructions (p<0.05; 2-10% increase). ***Conclusion:*** Our results indicate that, using the same reconstruction algorithm, it could be acceptable to use analog gamma-camera normality databases to aid in the visual analysis of state-of-the-art CZT gamma-camera images. However, new reconstruction algorithms may require dedicated databases.

EP-33

e-Poster Area

B: Imaging Clinical Studies -> B5 Neurological Imaging Clinical Study -> B54 Neurotransmission and Receptors

EP-0538

Striatal Dopamine Transporter Binding in Individuals With 22q11.2 Copy Number Variants: An [^{123}I]FP-CIT SPECT Study

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Aim/Introduction: 22q11.2 deletion syndrome (22q11Del) is a relatively common genetic disorder associated with an increased risk of developing early-onset Parkinson's disease (PD). It is unknown whether individuals with 22q11.2 duplication syndrome (22q11Dup) have an altered risk of PD. As PD is characterized by loss of striatal dopamine transporter (DAT) binding, we explored the striatal DAT availability in non-psychotic individuals with 22q11Del, 22q11Dup and healthy controls (HC). We hypothesized that striatal DAT binding ratios would be highest in 22q11Del and lowest in 22q11Dup, since studies suggest higher striatal DAT expression in subjects at risk to develop PD. ***Materials and Methods:*** Six individuals with 22q11Del (age 36.5 years, 4F/2M), four individuals with 22q11Dup (age 37.3 years, 2F/2M), and eight HC (age 39.1 years, 4F/4M) not taking any psychopharmacological medication were included. [123I]FP-CIT single photon emission computed tomography was administered for determination of DAT binding ratios. ***Results:*** After correction for age and sex, we found statistically significant overall group differences in left and right putamen (p=0.025 and p=0.014 respectively), and left and right caudate (p=0.014 and p=0.010 respectively). Post hoc analyses revealed significantly increased DAT binding ratios in 22qDel versus 22q11Dup in all four subregions (left putamen p=0.02, right putamen p=0.012, left caudate p=0.026, right caudate p=0.005). Effect sizes were large (ηp2≥0.577) in all regions. ***Conclusion:*** Our preliminary results are in line with a previously reported hyperdopaminergic state in 22q11Del. This hyperdopaminergic state, which may be partially driven by COMT haploinsufficiency in 22q11Del, might eventually cause auto-neurotoxicity and subsequent death of dopaminergic neurons, which could explain the increased occurrence of PD in individuals with 22q11Del. Future larger studies are necessary to replicate our findings and investigate whether DAT imaging could be used as a predictor of progression to PD in individuals with 22q11Del.

EP-0539

Synthesis and evaluation of ^{11}C-phenethylamine analogues as PET tracers for the imaging of 5-HT$_{2A}$ receptors

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Aim/Introduction: In recent years, a renewed interest in psychedelics for treatment of disorders such as depression or anxiety has emerged.[1] Classical psychedelics stimulate the brain's G protein-coupled receptor (GPCR) serotonin 2A receptor (5-HT2AR). However, animal studies have indicated that not all 5-HT2AR agonists have psychedelic effects. These differences in pharmacological profiles might originate from a favored modulation of either the β-arrestin2 signaling pathway or the GPCR-pathway via biased signaling.[2] The development of new positron emission tomography (PET) tracers that are biased towards specific 5-HT2AR signaling pathways is crucial to elucidate mechanisms of such drugs and offer insight on their therapeutic benefits. ***Materials and Methods:*** Four PET tracers based on structures of phenethylamines previously found to be biased towards the β-arrestin2 signaling pathway were synthesized along with their corresponding reference compounds. 11C-labelings of precursors were performed using [^{11}C]methyl triflate following the radiolabeling protocol of [1^{11}C]CIMBI-36. Briefly, [^{11}C] methyl triflate was formed from [^{11}C]methane and trapped

in a reaction vessel containing the precursor dissolved in a solution of acetone and sodium hydroxide. The reaction time was one minute and deprotection was carried out by adding a 1:1 solution of acetone and trifluoracetic acid (TFA), followed by heating at 80 °C for 10 minutes. After neutralization, the products were purified via preparative HPLC using 25% EtOH in milliQ water and 0.1% of phosphoric acid on an Onyx Monolithic semi-PREP C18 HPLC column (100 × 10 mm, Phenomenex). ***Results:*** The four PET tracers were obtained with activities ranging from 0.5 to 2.0 GBq, with RCY over 30% and with molar activities ranging from 115 to 800 GBq/µmol. A radiochemical purity above 98% was detected for all compounds. ***Conclusion:*** Four new PET tracers biased towards the β-arrestin2 signaling pathway were successfully synthesized. The ligand-receptor interactions will be assessed to determine the in vitro affinity to the target, association and dissociation constant, as well as the half-life of residence time. Their pharmacokinetics and selectivity for 5-HT2AR will be determined in pigs via pre-dosing studies with volinanserin, a 5-HT2AR antagonist, and compared to each other and 11C-CIMBI-36. These tracers might be useful tools in uncovering mechanisms underlying therapeutic benefits of psychedelics for disorders such as depression or anxiety. ***References:*** [1]Goodwin, G. M. et al. Single-dose psilocybin for a treatment-resistant episode of major depression. New England Journal of Medicine 2022, 387 (18), 1637-1648.[2]Wacker, D. et al. Structural features for functional selectivity at serotonin receptors. Science 2013, 340 (6132), 615-619.

EP-0540

Mapping multimodal connectomes to neurocognition and neurological diseases across shared modular architecture

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Aim/Introduction: The brain is characterized by heterogeneous patterns of connectivity, abstracting away biological and pathological hallmarks of the neural population. Yet the shared organization underlying unimodal brain networks, and the mapping principle between network architecture, flexible neurocognition, and progressive neurological disorders remain unclear. ***Materials and Methods:*** Here we integrate multiscopic measures ranging from transcription to metabolism, identifying the shared anatomic structure and anterior-posterior/midline hierarchy across connectomes. ***Results:*** We find unimodal and cross-modal gradients separate cognitive processes alongside the putative perceptual/motor-affective axis, bridging connectomes to the metadata of neurocognition. Finally, we determine the dominance of networks to the typical progressive neurological diseases, temporal lobe epilepsy (TLE), and amyotrophic lateral sclerosis (ALS). We find the opposite distribution pattern of metabolic abnormality in TLE and ALS, and the unique or shared contributions. ***Conclusion:*** Collectively, our work bridges heterogeneous connectomes to cognitive functions and neurological diseases, laying the foundation for the next-generation cross-modal studies.

EP-34

e-Poster Area

B: Imaging Clinical Studies -> B5 Neurological Imaging Clinical Study -> B55 Other Neurological Imaging

EP-0541

Brain Incidentalomas in PET CT: a Meta-Analytic Literature Review

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Aim/Introduction: Various structural and functional imaging modalities have been largely helpful in the discovery of incidentalomas. The identification of incidentalomas in the brain, a critical organ, and their management, make it possible to apply appropriate therapeutic means early, thus improving the prognosis of patients, particularly when they are malignant. Positron emission tomography (PET) has seen considerable innovation in recent decades in the diagnosis of cancer and systemic diseases, increasing among others, the rates of cerebral incidentalomas. This fact urges to investigate their etiologies and prevalence in order to improve their recognition by nuclear medicine physicians, depending on the radiotracers used. It therefore becomes important to establish a global synthesis of the data available in the literature regarding cerebral incidentalomas observed in PET. ***Materials and Methods:*** Following the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) checklist guidelines, a systematic review and a meta-analysis were undertaken. Literature was searched through several main engines including PubMed, CORE, and Web of Science. Our reviewers navigated the literature and extracted the adequate information. Data synthesis consisted of qualitative and quantitative analyses. Quality of bias was assessed using the Newcastle-Ottawa Scale for observational studies, and Joanna Briggs Institute Critical Appraisal Checklist For Case Reports. ***Results:*** A total of 1218 studies were singled out; however, only 33 articles meet the inclusion criteria, of which 10 articles are retrospective cohorts and 23 are case reports. Descriptive and qualitative analyzes have revealed that the most common brain incidentalomas are metastatic tumors (24%), meningiomas (21.9%) and pituitary adenomas (10,7%) for observational studies, which were mostly detected with F18-FDG and Ga68-DOTA-peptides. The metastatic incidentalomas are predominantly related to cancers of lung (53.7%) and breast (11.9%). As for the cohort of 23 case reports, 6 cases were diagnosed with meningiomas. Meta-analysis has reported a pooled prevalence rate of 2.4% among the cohorts, with a heterogeneity I^2 index of 96.6% indicating a major variability within selected studies. ***Conclusion:*** This review is the first to have gathered and summarized findings available in the literature on the identification of brain incidentalomas using PET. It certainly has fulfilled its main objective by presenting the compiled findings derived from the literature and deducing a pooled prevalence rate along with a description of their etiologies, while highlighting investigative radiopharmaceuticals. Results undeniably solicit more research and studies for a better management of these entities whose etiologies are quite diverse.

EP-0542

Temporal CBF changes in patients with moyamoya disease and non-moyamoya steno-occlusive disease on a day after bypass surgery evaluated by ^{99}mTc-ECD SPECT

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Aim/Introduction: To investigate temporal cerebral blood flow (CBF) changes in the moyamoya disease (MMD) and non-moyamoya steno-occlusive disease (NMSOD) patients on a day after bypass surgery. ***Materials and Methods:*** Patlak plot 99mTc-ECD SPECT studies were performed on 68 hemispheres in 51 MMD/ NMSOD patients (range 6-74 years) who underwent superficial temporal artery-middle cerebral artery double anastomosis on a postoperative day (POD) 1. We investigated pre to post-operative focal CBF (qualitative CBF ratio) changes using three-dimensional stereotaxic ROI template. We evaluated the incidences, degrees, patterns, and major complications of hyper perfusion (HP) and compared the differences among the 44 hemispheres in adult MMD (≧20 years), 13 in young MMD (< 20 years), and 11 in NMSOD patients. When HP was suspected, a subsequent SPECT study was performed on a next day to assess CBF changes. ***Results:*** In total, mild (≧30 to < 50% increase than pre-operative CBF), moderate (≧50 to < 100%) , and severe (100%≧) HP were observed in 7.4% (5/68), 14.7% (10/68) and 2.9% (2/68) of the patients, respectively. Most of HP occurred with frontal lobe dominant (70.6%, 12/17), and the incidence (17.6%, 12/68) of frontal lobe dominant HP was significantly higher than those of temporal (2.9%, 2/68) or parietal lobe (4.4%, 3/68) dominant HP ($p < 0.01$ for both). In 17 hemispheres with HP, focal CBF increase (%) were higher in frontal lobe (58.7±50.1%, mean±SD) than those of temporal (27.4±26.1%) and parietal lobes (28.8±26.1%) ($p = 0.01$ for parietal lobe). The 9 subsequent brain SPECT studies on a POD 2, eight hemispheres showed CBF reduction, while one hemisphere developed to a moderate HP. A cerebral hemorrhage and an infarction occurred in 2 hemisphere of the adult MMD patients with moderate to severe HP, but no none in the mild HP, NMSOD and young MMD patients. The incidence of moderate to severe HP was significantly higher in hemispheres of the adult MMD patients than those of the non-adult MMD patients (22.7% vs. 4.2%, $p < 0.05$). ***Conclusion:*** HP could sometimes occur mainly in frontal lobe in adult MMD patients on POD 1, while rarely occur in young MMD and NMSOD patients, and most of them could improve on a next day. Increased focal CBF≧50% than pre-operative condition could be a risk of major complication in adult MMD patients.

EP-0543

Cerebral Hypometabolism in Left-Ventricular Assist Device (LVAD) Recipients: Evaluation of a Most Suitable Intensity Normalization Method

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Aim/Introduction: Left ventricular assist devices (LVAD) have gained importance in the therapy of severe heart failure. Stroke is a common post-implantation complication of LVAD patients. However, apart from stroke-related consequences the effect of LVAD therapy on neurocognitive function remains ambiguous.18F-FDG-PET/CT is a widely used non-invasive imaging method that enables the investigation of various neurocognitive disorders of the brain. Using state-of-the-art parametric imaging 18F-FDG-PET/CT as gold standard, we aimed to clarify changes in absolute brain metabolism, as well as validate a simple intensity normalization method for regional metabolic alterations in larger cohorts of LVAD patients. ***Materials and Methods:*** We evaluated the results of whole body dynamic 18F-FDG-PET/CT images of 9 LVAD patients with and without a history of stroke (meanage=52years, range 30-74y). Single-subject statistical parametric mapping (SPM) against a control group consisting of 16 subjects (meanage=58,7y, range 36-77y) without conditions influencing the cerebral metabolism was performed after intensity normalization based on proportional scaling (PS) and the pons as reference region (Pons). The parametric images of the cerebral metabolic rate of 18F-FDG (MRFDG) calculated using the Patlak-plot method was determined as gold standard (Patlak) for comparison. ***Results:*** SPMs two-sample t test ($p<0.001$) of the Patlak images between the LVAD patients and the control group revealed a widespread hypometabolism (106235 suprathreshold voxel (sVx)) and no hypermetabolism (0sVx) in the LVAD-group. PS could not reproduce the widespread hypometabolism (165sVx), contrary to the Pons method (55367sVx), but found hypermetabolic clusters (PS: 2565sVx, Pons: 323sVx). In single subject analyses PS showed considerably more hypermetabolic clusters than Pons, reflected by deviant sensitivity (PS: 70%; Pons: 100%). The hypermetabolic clusters were presumably artefacts as they were not prevalent in the Patlak results. Comparing the three methods revealed significant differences in both hypo- ($p=0.027$) and hypermetabolism ($p=0.001$). In the Dunn-Bonferroni post-hoc-test PS and Pons did not show significant differences with Patlak for total hypometabolic volume (pPS=0.075, ppons=0.055; effect size rPS=0.352, rpons=0.37). Contrary to Pons (ppons=0.102, rpons=0.333), PS showed significant difference with Patlak for total hypermetabolic volume (pPS=0.001, rPS=0.556). ***Conclusion:*** The absolute measurement of the MRFDG reveals a widespread cerebral hypometabolism in LVAD patients. The PS method is not applicable for LVAD patients, as it fails to reproduce the widespread hypometabolism and additionally creates hypermetabolic artefacts. As groundwork for our subsequent neurocognitive studies, we will propose the Pons as reference region, as it most adequately reproduces the widespread hypometabolism as well as the regional MRFDG results.

EP-0544

Neuronal mechanisms underlying cochlear implant performance in single-sided deafness: a [^{15}O]water PET study

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Aim/Introduction: We examined regional cerebral blood flow (CBF) changes as a marker of neuronal activity in single-sided deaf (SSD) cochlea implant (CI) recipients and normal-hearing (NH) controls to unravel neuronal mechanisms underlying CI performance. ***Materials and Methods:*** Twenty right-handed SSD-CI subjects (CI left) and 10 right-handed NH

controls underwent [15O]water PET (12 scans each). For auditory stimulation we used sentences of the Oldenburg Sentence Test played forward or backward (semantic and non-semantic condition, respectively), either presented unilaterally to the right (i.e., NH ear in all subjects) or bilaterally. Voxel-wise comparison between stimuli in all subjects were performed to identify regions with significant activation caused by 'Listening' (bilateral vs. unilateral) and 'Processing' (semantic vs. non-semantic). Relative CBF in these regions was then compared between groups of SSD-CI subjects with high and low CI benefit (CI benefit: bilateral speech recognition in PET minus unilateral speech recognition in PET) and NH controls. ***Results:*** Voxel-wise analyses across all subjects yielded strong activations of the right primary auditory cortex (PAC) for 'Listening' and of the left superior temporal gyrus (STG) for the 'Processing'. The activation of the right PAC (pooled semantic and non-semantic conditions) was comparable and significant in all groups (all $p \leq 0.001$). In contrast, a highly significant activation of the left STG was only observed in SSD-CI subjects with high CI benefit ($p < 0.001$ for both, uni- and bilateral stimulations) and NH controls ($p = 0.001$ and $p = 0.006$, respectively), while a significant activation of the left STG was not observed in SSD-CI subjects with low CI benefit, neither for unilateral (NH ear) nor bilateral stimulation. ***Conclusion:*** The comparable activation of the PAC across groups suggests that the CI provides quantitatively comparable auditory input in SSD-CI subjects. In contrast, SSD-CI subjects with low CI benefit lack activation of the left STG, not only with bilateral but also unilateral stimulation (i.e., NH ear only). Future studies need to clarify if this abnormal recruitment of the left STG is a result of CI treatment or exists already before CI treatment, thus being a possible predictor of CI performance.

EP-0545

How is the rs6971 polymorphism accounted for in clinical studies using second-generation PET radiopharmaceuticals targeting TSPO?

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Aim/Introduction: The 18kDa translocator protein (TSPO) is the most used biomarker of microglial activation and has contributed to the understanding of the role of neuroinflammation in numerous pathologies. However, the clinical use of second-generation TSPO radiopharmaceuticals has been impacted by their sensitivity to the TSPO rs6971 polymorphism in human discovered in 2012[1] and resulting in three affinity profiles: high-affinity binders (HABs), mixed-affinity binders (MABs) and low-affinity binders (LABs) which affect tracer uptake and PET quantification. Patient genotyping is therefore necessary in clinical trials using these radiopharmaceuticals. This work aimed to review how this polymorphism has impacted the use of the second-generation TSPO radiopharmaceuticals1C-PBR28, 11C-DAA1106, 11C-DPA713, 18F-DPA714, 18F-PBR111, 18F-FEPPA and 18F-PBR06 in clinical studies. ***Materials and Methods:*** 200 clinical articles using these radiopharmaceuticals, published between 2012 and 2022, and representing 5929 subjects, were extracted from PubMed. Demographic data, pathology studied, radiopharmaceuticals, PET analysis and rs6971 polymorphism analysis were collected and analyzed. ***Results:*** The frequency of genotyping initially increased since 2012, before stabilizing for several years at around 90% of the studies. In the Caucasian population, the distribution of genotype profiles was consistent with what had been reported[2]: ~65% HABs, ~35% MABs and ~5% LABs. In order to pool HABs and MABs subgroups, several studies proposed a correction factor of the volume of distribution (VT) of MABs subjects, fairly consistent between 1.4 and 1.8 depending on the tracer, whatever the pathology studied and the radiopharmaceutical used. ***Conclusion:*** This analysis confirmed that the rs6971 polymorphism is a limiting factor in the analysis of PET images because it imposes a genotyping to identify LABs, MABs and HABs subjects to perform in each study. Moreover, there is always a hypothetical bias introduced in excluding MABs and LABs from the cohort, although overall no findings obtained with rs6971-insensitive tracer [11C]PK11195 has been contradicted when the same pathology was investigated with one of those 2nd generation tracer. No consensus exists to date to account for the effect of polymorphism on the PET signal, we therefore propose guidelines considering characteristics of the research protocol (kinetics of microglial activation in the pathology studied, need for therapeutic intervention, etc.), and regarding timing of genotyping relative to inclusion and PET, and LABs exclusion. The clinical impact of third-generation TSPO radiopharmaceuticals, insensitive to the polymorphism, should also be considered. ***References:*** [1]Owen DR, et al. J Cereb Blood Flow Metab. 2012 Jan;32(1):1-5.[2]Mizrahi R, et al. J Cereb Blood Flow Metab. 2012 Jun; 32(6):968-72.

EP-0546

^{18}F-FDG-PET/CT in the diagnosis of autoimmune limbic encephalitis: a case series

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Aim/Introduction: Autoimmune limbic encephalitis (ALE) is a rare condition characterized by autoimmune inflammatory lesions of the medial temporal lobe (MTL) associated with circulating antibodies against surface or intracellular neuronal antigens. Whole-body 18F-FDG-PET/CT is commonly performed to detect/exclude paraneoplastic origin of ALE, but current consensus criteria propose brain 18F-FDG-PET/CT as an alternative to MRI for the establishment of definite diagnosis of ALE [1]. We present a small series of ALE cases in which 18F-FDG-PET/CT, performed for investigating potentially paraneoplastic ALE, detected brain metabolic changes compatible with ALE. ***Materials and Methods:*** We retrospectively reviewed 18F-FDG-PET/CT scans performed in patients suspect of ALE between 8/2016 and 12/2023. We found 11 scans performed in 7 patients with definite diagnosis of ALE according to current consensus criteria. All had short-term memory deficits, behavioural disorders, slow-wave temporal EEG activity and no imaging evidence of malignancy. Serum and CSF antineuronal antibodies were detected in 5/7 patients (anti-LGI1, anti-LGI1/anti-CASPR2, anti-Hu/anti-CV2, anti-CV2, anti-GABABR), while 2/7 patients were seronegative. Baseline brain MRI showed bilateral (in 3) or unilateral (in 4) hyperintensity of the MTL on T2-weighted and FLAIR images. All patients underwent dedicated brain and whole-body 18F-FDG-PET/CT scans, repeated in 3 post-treatment. 18F-FDG temporal cortex uptake was visually and semi-quantitatively assessed. ***Results:*** Brain PET revealed altered 18F-FDG medial temporal lobe metabolism in all patients. Unilateral hypermetabolism in MTL was present in 5/7 patients (SUVmax 8.7-16.9), while unilateral

hypometabolism in MTL was detected in 2 patients. Of notice,18F-FDG-PET/CT showed an additional hypermetabolic (SUVmax 15.8) focus in the right parietal lobe, without MRI abnormality, in an anti-LGI1/anti-CASPR2-positive patient. Whole-body 18F-FDG-PET/CT ruled out underlying malignancy in 5/7 patients. In an anti-Hu/anti-CV2-positive patient, 18F-FDG-PET/CT revealed a hypermetabolic (SUVmax 12.0) lesion in the left pulmonary portal, histopathologically confirmed as primary SCLC. In an anti-GABABR-positive patient, 18F-FDG-PET/CT revealed hypermetabolic mediastinal lymphadenopathy (SUVmax 10.5) strongly suspected as metastatic disease. FDG temporal abnormalities returned to normal on all 4 follow-up PET scans performed in 3 patients post treatment. ***Conclusion:*** Our study suggests that 18F-FDG-PET/CT may be a valuable tool in the diagnostic work-up of ALE. Beyond detecting previously unrecognized malignancies underlying paraneoplastic ALE, it also, by detecting brain metabolic changes (commonly medial temporal 18F-FDG hypermetabolism), may substantiate the diagnosis of ALE even in the absence of MRI or biomarkers abnormalities, and further, assess ALE response to treatment. ***References:*** [1] Graus F, Titulaer MJ, Balu R, et al. Clinical approach to diagnosis of autoimmune encephalitis. Lancet Neurol. 2016; 15: 391-404.

EP-0547

Using Synthetic MRI for Improved Stroke Lesion Characterization and Metabolism Prediction By Hybrid PET/MR

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Aim/Introduction: Stroke is a common disease, with one in four people affected over their lifetime, and is the first leading cause of death in adults worldwide. Positron Emission Tomography (PET)/Magnetic Resonance Imaging (MRI) is a vital tool for assessing stroke and can provide more valuable information. Synthetic MRI (syMRI) is a rapid quantitative MRI technique which enables the simultaneous acquisition of relaxometry measures using multi-echo and multi-delay acquisition method. It allows for not only tailored contrast optimization to enhance stroke lesion delineation, but also provides quantitative data potentially predictive of PET value, which reflect metabolic activity in tissues. This study aims to explore the feasibility of applying synthetic MRI technology to improve stroke lesion characterization and to predict regional metabolic activity of the lesion area. ***Materials and Methods:*** Twenty stroke patients underwent T2-FLAIR, syMRI and PET scanning with a 3.0 T scanner (SIGNA PET/MR, GE Healthcare). We derived T1 values of lesions and surrounding tissues from syMRI scans. Two synthesized inversion recovery images, aimed at suppressing the lesion (TI=800ms) and surrounding tissue (TI=500ms), were merged to create a composite image that maintained anatomical clarity while enhancing lesion contrast. We compared these images with traditional T2-FLAIR for tissue contrast. We also used quantitative relaxation values to construct a predictive model for PET SUV, indicating metabolic activity within lesions. ***Results:*** Logistic regression analysis demonstrated a correlation between the synthesized images and PET image in stroke lesion (R2=0.729, p<0.01). This improved visualization aids more accurate clinical and research assessments. The predictive model based on T1, T2, and PD relaxation values reliably estimated regional metabolic activities, highlighting syMRI's potential in metabolic assessment of stroke lesions. ***Conclusion:*** This study demonstrates syMRI's enhanced imaging capabilities in stroke diagnosis through better lesion visualization and metabolic activity prediction. These advancements could improve diagnostic accuracy and treatment strategies, offering significant benefits in stroke management.

EP-0548

^{18}F FDG PET/CT, the game changer in management of seronegative autoimmune encephalitis patients: an experience from a tertiary care centre

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Aim/Introduction: Diagnostic criteria for diagnosis of auto immune encephalitis emphasised more on antibody testing, MRI and EEG changes. Ab testing is not accessible in many institutions and time consuming. Absence of Abs also does not rule out the diagnosis because of the entity called Seronegative Autoimmune encephalitis. MRI and EEG changes were also less specific , non-contributory in many cases. Many case series have highlighted the importance of ^{18}F FDG PET CT for early diagnosis of antibody positive auto immune encephalitis. But no specific study is available regarding the imaging spectrum of seronegative auto immune encephalitis. Hence we decided to retrospectively analyse the ^{18}F FDG PET CT imaging findings of patients with seronegative AE. ***Materials and Methods:*** We retrospectively reviewed 88 (24 females and 64 males, age range 13- 80 years) patients who underwent FDG PET/CT with clinical suspicion for AE and given report as probable AE based on PET/CT . All 88 patients tested negative for autoimmune encephalitis panel of antibodies. Each FDG-PET/CT study was evaluated in consensus by two nuclear medicine physicians with a mean experience of 5.5 years. The brain FDG-PET/CT images were spatial and intensity normalized, and a semi quantitative analysis comparing each patient's image to a database of normals was performed using syngovia software (Siemens, Germany). CSF pleocytosis and MRI were compared with ^{18}F FDG PETCT results. The data was analysed using appropriate statistical methods. ***Results:*** 88 patients underwent FDG-PET/CT imaging at median 7 weeks of symptoms (earliest being 2.5 weeks , late being 12 weeks). Most(55/88, 62%) patients demonstrated bilateral medial temporal lobes, basal ganglia hypermetabolism on PET/CT. Hypo metabolism in frontal and temporal cortices were observed in (27/88, 31%) patients on PET/CT. patients with hyper metabolism and who had an earlier scan responded well to the treatment. patients, who had a scan after 4 weeks of symptoms and with hypo metabolism responded poorly to the treatment. FDGPET/CT diagnosed more cases of auto immune encephalitis than MRI and CSF studies. ***Conclusion:*** Out of 88 patients, PET/CT and MRI concordance was found in only 42 patients. Hence FDG PET/CT was more useful than MRI and CSF studies in diagnosing sero negative auto-immune encepahlitis. Our study also suggests the imaging predictive markers for treatment response. In acute clinical setting, abnormal FDG PET CT being more common than MRI, may serve as an early imaging biomarker of seronegative Autoimmune encephalitis, thus helping in early treatment.

EP-0549

Association Of Ipsilateral Thalamic Hypometabolism On FDG PET-CT With Clinico-Electro-Radiological Features In Patients With Mesial Temporal Lobe Epilepsy.

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Aim/Introduction: Mesial temporal lobe epilepsy(MTLE) is one of the most common types of drug refractory focal epilepsy. The cortico-subcortical circuit of epilepsy is well known. Thalamic involvement has been emphasized because of its diffuse reciprocal interconnection with cortex physiologically. Recently, there has been special interest to address the relationship between thalamus and focal seizures. In this study, we investigated the association of ipsilateral thalamic hypometabolism on PET-CT with clinical(epilepsy duration & semiology), EEG and radiological(MRI) features in patients with MTLE. ***Materials and Methods:*** We retrospectively reviewed FDG PET-CT brain images of 61-patients who were diagnosed as mesial temporal lobe sclerosis(MTLS) on MRI. Out of 61-patients, 6-patients who had ipsilateral thalamic hypometabolism were included in this study. Both qualitative and semiquantitative analysis was done for PET-CT images. ROI was drawn over each thalamic region on coronal section of fused PET-CT images and SUVmax for the ipsilateral and contralateral side to the disease involvement was calculated. Ipsilateral to contralateral thalamic SUVmax ratio(I/C-ratio) was analyzed. SUVmax values in bilateral thalami were compared using the independent sample t-test. Correlation between I/C ratio with epilepsy duration(years from onset) was determined by means of spearman correlation coefficient. The association between EEG patterns, seizure semiology & MRI findings were also studied. ***Results:*** Demographic details of patients were as follows:3-females, 3-males; median age-20.5years(range 15-50). MRI revealed right MTLS in 4/6patients and left MTLS in 2/6 patients. 3/6 patients had secondary MTLS(2-right sided and 1-left sided). For all patients, SUVmax in the thalamus ipsilateral to the MTS(7.83±2.99) was significantly lower than the contralateral side(10.49±1.97)(p=0.049). There was a significant(p=0.049) strong, negative(rs=-0.81) correlation between I/C-ratio and duration of seizure. Impaired awareness and generalized tonic-clonic movements of all 4-limbs were observed in 4/6-patients(66.6%). Whereas, generalized tonic movements and tonic posturing of left upper limb was observed in one-patient each. EEG was not available for 2/6-patients. 3-patients had alpha range background(1-generalised;2-posterior dominant) and 1-patient showed delta & theta activity on EEG. EEG changes were concordant with PET-CT findings in 4-patients. MRI revealed ipsilateral thalamic atrophy in only 1/6 patients. ***Conclusion:*** The ipsilateral thalamic involvement is uncommon and eminent in patients with longstanding MTLE.Thalamic abnormality on FDG PET-CT precedes structural abnormality on MRI and correlates well with seizure duration & semiology. Semiquatitative analysis on FDG PET-CT is reliable and useful tool in assessment of metabolic alterations in thalamus. However, prospective study with large sample size is warranted to establish these facts precisely.

EP-0550

The role of F^{18}-fluro-ethyl-tyrosine PET/CT for detecting corticotropinomas in Cushing's disease

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Aim/Introduction: Cushing's disease is an endocrine disorder caused by adrenocorticotropic hormone (ACTH)-secreting pituitary adenomas. Magnetic resonance imaging is the current standard imaging method for diagnosing and localizing corticotropinomas, with a failure to detect adenomas in up to 40% of cases. Different molecular imaging methods are being studied for their complementary value. The aim of this study was to observe the value of F^{18}-FET PET/CT in Cushing's disease. ***Materials and Methods:*** Seven patients (five women) were referred from the endocrinology clinic with Cushing's disease for further imaging and possible localization of microadenomas. Their age ranged from 24 to 78 years (mean 50 years). Two patients had prior transsphenoidal surgery. Brain MRI was negative for pituitary macroadenomas in all patients. Standard protocol F^{18}-fluoro-ethyl-tyrosine brain PET/CT was performed 20 minutes after intravenous injection of 200 MBq of F^{18}-FET. ***Results:*** No focal pathological uptake of F^{18}-FET was found in the pituitary in this patient group. Diffuse low-intensity uptake of F^{18}-FET was found in the pituitary in four patients, within normal biodistribution of F^{18}-FET and with a pituitary-to-brain ratio SUVmax < 1,5. ***Conclusion:*** No focal amino acid metabolism pathology was found in the pituitary indicative of corticotropinomas in our small patient group. Variable cell biology of the pituitary warrants further research in different molecular pathways and the potential use of alternative radiopharmaceuticals for the detection of microadenomas in Cushing's disease. ***References:*** Bauman MMJ, Graves JP, Harrison DJ, Hassett LC, Bancos I, Johnson DR, et al. The utility of PET for detecting corticotropinomas in Cushing disease: a scoping review. Neurosurg Rev. 2023;46:160.

EP-0551

Investigation of vermal [18F]PI-2620 signal and its sex-related differences in dynamic tau-PET imaging

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Aim/Introduction: The evaluation of tau PET imaging data can be affected by off-target binding. First-generation tau PET tracers exhibit off-target binding to MAO-B, neuromelanin and blood products. Second-generation tracers, including [18F] PI-2620, demonstrate more specific binding properties due to their low binding activity for monoamine oxidases. However, the recurring tracer signal in the cerebellar vermis and paravermal region in [18F]PI-2620 scans and its association with tau burden has not yet been investigated. ***Materials and Methods:*** We included dynamic [18F]PI-2620 PET scans from 329 cases with clinically diagnosed Alzheimer's disease (n=119), progressive supranuclear palsy (n=115), corticobasal syndrome (n=46), frontotemporal dementia (n=41), and controls (n=18) in our study. Standardized uptake values (SUV) of the vermis and paravermal region were calculated using the inferior cerebellum as reference region (SUVRVER/CBL) and compared among cohorts. Correlation analyses were conducted between vermis signal and age, gender as well as p-Tau levels in cerebrospinal fluid (CSF). For histopathological evaluation, we performed combined autoradiography and immunohistochemistry experiments of post-mortem brain tissue of deceased patients

(n=9) with different neurodegenerative diseases. ***Results:*** Correlation analysis revealed a significant association between vermal tracer uptake and sex. The mean SUVRVER/CBL in male patients (1.33±0.37, n=176) is elevated compared to female patients (1.14±0.25, n=153), p < 0.0001. Thus, male patients exhibit a higher and more frequent vermal [18F]PI-2620 uptake. Accordingly, there is a significant correlation between SUVRVER/CBL and haemoglobin value in blood sampling (n=80, p=0.01). In histopathological experiments, vermal white matter containing high tau burden in immunohistochemistry evinced elevated [18F] PI-2620 signal in autoradiography. Interestingly, leptomeningeal pigmented cells were colocalized with strong signal spots in autoradiography. No significant association was found between vermal [18F]PI-2620 uptake and age or p-Tau levels in CSF. ***Conclusion:*** Our results suggest that vermal tau accumulation and leptomeningeal pigmented cells contribute to vermal [18F]PI-2620 uptake. Further investigation will include sex-specific signal sources as well as kinetic parameters and microautoradiography to decipher the signal origin at cellular level.

EP-0552

Transcriptional Signatures of Cerebellar Astrocytes Underpin the Aberrant Metabolism in Focal to Bilateral tonic-clonic Seizures

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Aim/Introduction: Focal to bilateral tonic-clonic seizures (FBTCS) is one of the severest forms of epilepsy that is associated with a higher risk of epilepsy-related injury, sudden unexpected death in epilepsy, and unfavorable prognosis after epilepsy surgery. This study aims to establish a link between metabolic phenotypes and transcriptional signatures in patients with temporal lobe epilepsy (TLE), aiming to enhance our comprehension of the mechanisms underlying potential epileptic discharge propagation and biological changes in TLE-FBTCS. ***Materials and Methods:*** The study included three cohorts. The 2-[18F]-fluoro-2-deoxy-D-glucose ([18F]FDG) positron emission tomography (PET) cohort comprised 128 TLE patients treated at Xiangya Hospital, followed for at least one year after surgery. The transcriptome dataset consisted of hippocampal dentate gyrus tissue samples from six TLE patients who underwent standard anterior temporal lobectomy at the Department of Neurosurgery in Xiangya Hospital and a publically available transcriptomic dataset. Metabolic factors and corresponding loading coefficients for each participant were evaluated using non-negative matrix factorization applied to [18F]FDG PET images. The association between metabolic factors and TLE-related gene expression was modeled using partial least squares regression (PLS), and cell-type enrichment of PLS-derived genes was performed using Cell-type Specific Expression Analysis. ***Results:*** This study included 85 TLE-FBTCS patients, 43 TLE patients with focal seizures (FS), and 80 healthy controls. TLE-FBTCS patients showed overloading of metabolic factors characterized by hypometabolism in the ipsilateral hippocampus and temporal lobe, and hypermetabolism in the bilateral cerebellum and thalamus. Metabolic factors were significantly correlated with the linear combination of TLE-related gene expression (R272=0.559, Ppermutation<0.0001; R272=0.883, Ppermutation<0.0001), and cerebellum weighted most in the PLS component. PLS-derived genes were significantly enriched in cerebellar astrocytes (PFDR<0.01). ***Conclusion:*** These findings suggest that cerebellar astrocytes underpin the metabolic disruptions in FBTCS, shedding new light on the cellular mechanism of seizure generalization, and potential target of therapeutic strategies for patients with TLE.

EP-0553

Distinct Neuroimaging Patterns of Autoimmune Encephalitis Revealed by Combined FDG and TSPO PET/MR Imaging

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Aim/Introduction: To explore the neuroimaging characteristics of autoimmune encephalitis (AE) based on 18F-fludeoxyglucose (FDG) and 18F-PBR06 (the translocator protein 18 kDa translocator protein [TSPO] radioligand) positron emission tomography/magnetic resonance (PET/MR). ***Materials and Methods:*** The study was approved by the Ethics Committee of our institute (KY2021-152-B). Forty AE patients (48.48±18.50y), 11 FDG healthy controls (53.91±4.25y) and 9 TSPO healthy controls (42.44±21.48y) were included in the study. All subjects in AE group underwent brain 18F-FDG and 18F-PBR06 PET/MR scan, separately. Using MATLAB and SPM12 software, the mean standardized uptake value ratio (SUVR) of FDG and PBR06 between AE patients and healthy control groups was compared to explore abnormal uptake brain regions. Specifically, cut-offs values were set at ±2 standard deviations (SD) for FDG and +2 SD for PBR06. To mitigate the potential interference of skull uptake in voxel-based analysis, the skull was removed from 18F-PBR06 PET images based on T1-weighted images. Two-sample t-tests were used, statistical significance was determined at P<0.001 with an additional cluster-level family-wise error (FWE) correction set at P<0.05. ***Results:*** Among the AE patients, 38 exhibited both increased and decreased FDG uptake in distinct brain regions, while the remaining two displayed either solely increased or decreased uptake. Notably, 82.5% (33/40) of AE patients exhibited increased FDG uptake in the lenticular nucleus, while 55% (22/40) exhibited decreased FDG uptake in the right angular. Using ^{18}F-PBR06 PET, 75% (30/40) of patients was detected in AE, with the left superior temporal gyrus showing the highest positive rate (37.5%, 15/40). Statistical analysis highlighted an increase in FDG uptake in the cerebellum, hippocampus, and parahippocampus, accompanied by a decrease in uptake in the parietal and occipital lobes. While no significant increase in TSPO uptake was observed, decreased uptake was evident in the right posterior central gyrus, superior marginal gyrus, and middle cingulate gyrus. ***Conclusion:*** Our findings indicate that abnormal FDG and TSPO uptake in distinct brain regions is a characteristic neuroimaging feature of AE. The findings provide valuable insights into the underlying neuropathological processes of AE and may aid in the diagnosis and management of this complex neurological disorder.

EP-0554

[18F]FDG-PET IN REFRACTORY EPILEPSY: EPILEPTIC FOCI LOCALIZATION AND COMPARISON WITH MAGNETIC RESONANCE IMAGING.

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Aim/Introduction: Epilepsy is a chronic multifactorial disease characterized by epileptic seizures and is one of the most

disabling neurological disorders. It can affect all age groups and etiologies are multiple. Standard complementary studies are: electroencephalography (EEG) and magnetic resonance imaging (MRI). However, in patients with refractory epilepsy, 2-[18F] fluoro-2-deoxy-D-glucose positron emission tomography ([18F] FDG-PET) has become a well stablished component of the non-invasive lesion localization (1,2). In this study, we evaluate the [18F] FDG-PET metabolic findings in patients with refractory epilepsy and compare its usefulness with MRI. ***Materials and Methods:*** Unicentric cross-sectional study, which includes 16 patients with epilepsy between June 2021 and December 2023. Every patient underwent a [18F]FDG-PET using a digital PET/CT and a 3T MRI. Visual and semiquantitative PET imaging evaluation was performed. [18F]FDG-PET and MRI results were compared according to the epileptic foci localization. ***Results:*** Among the 16 patients, 9 were female, with an age average of 33 years old (9-58). [18F]FDG-PET was pathologic in 10/16 of the patients (62.5%); MRI in 4/16 (25%). [18F]FDG-PET showed hypometabolic foci in: temporal lobe (5), insular lobe (4), hippocampus (3) and frontal lobe (3). ***Conclusion:*** [18F]FDG-PET showed a greater detection of hypometabolic foci compared to the morphologic lesions described by the MRI. The most frequent epileptic foci localization by [18F]FDG-PET was the temporal lobe. ***References:*** 1. Traub-Weidinger, T., Arbizu, J., Barthel, H. et al. EANM practice guidelines for an appropriate use of PET and SPECT for patients with epilepsy. Eur J Nucl Med Mol Imaging (2024). https://doi.org/10.1007/s00259-024-06656-3. 2. von Oertzen, T.J., Gröppel, G., Katletz, S. et al. SPECT and PET in nonlesional epilepsy. Clin Epileptol 36, 104-110 (2023). https://doi.org/10.1007/s10309-023-00577-1.

EP-0555

The utility of FDG-PET/CT in meeting Graus criteria for limbic encephalitis

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Aim/Introduction: The diagnosis of autoimmune encephalitis (AE) requires the use of paraclinical exams, and among these, magnetic resonance imaging (MRI) is the primary neuroimaging tool according to the 2016 criteria proposed by Graus et al.However, a considerable number of AE cases lack MRI abnormalities. In such instances, ^{18}F-fluorodeoxyglucose positron emission tomography (FDG-PET/CT) can provide valuable assistance. Indeed, previous reports showed that brain FDG-PET/CT can reveal metabolic abnormalities even when the results of all other ancillary tests (MRI, cerebrospinal fluid (CSF), or electroencephalogram) are normal. This study explores the diagnostic efficacy of brain FDG-PET/CT in AE patients and its correlation with clinical improvement. ***Materials and Methods:*** This retrospective, observational study conducted at a single center included all patients meeting the Graus criteria for definite limbic encephalitis who underwent brain FDG-PET. Clinical and paraclinical data were collected from medical records. ***Results:*** Out of 39 patients suspected of autoimmune or paraneoplastic encephalitis (2012-2022), 12 with definite limbic encephalitis were included. MRI criteria for AE were not met in 6/12 patients (50%), In these patients the fulfilment of the Graus criteria relied on the presence of neural antibodies (n=3/6) and/or brain FDG-PET/CT abnormalities (n=6/6). Notably, FDG-PET/CT was abnormal in all but one patient, who underwent FDG-PET/CT post-immunotherapy. FDG-PET detected abnormalities in 7 patients without CSF pleocytosis and all seronegative cases (n=8/12). During the acute phase, FDG-PET/CT revealed bilateral (n=4/12) or unilateral (n=3/12) mesial temporal lobes (MTL) hypermetabolism, whereas in the chronic phase, bilateral (n=6/12) or unilateral (n=1/12) mesial temporal lobes hypometabolism was found. Follow-up FDG-PET/CT in 4 patients showed an evolution from hypermetabolism to normal or reduced metabolism in the same regions, correlating with clinical improvement. ***Conclusion:*** Brain FDG-PET/CT proved more sensitive than MRI for confirming limbic AE diagnosis, especially in seronegative patients. Furthermore, a longitudinal correlation between regression of FDG-PET/CT hypermetabolism and clinical improvement was observed in individual patients. These findings suggest that FDG-PET/CT is a valuable tool for diagnosing and managing autoimmune encephalitis and should be included in the main diagnostic criteria for limbic AE patients.

EP-0556

CANVAS syndrome is associated with cerebellar hypometabolism in ^{18}F-FDG PET imaging.

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Aim/Introduction: CANVAS caused by RFC1 biallelic expansions is a recently described entity, in which diagnosis is usually challenging. The main clinical characteristics include cerebellar ataxia, neuropathy, vestibular impairment, sensory impairment, areflexia, autonomic dysfunction, and cough. However, other different phenotypes have been described, including motor neuron disorders, hyperkinetic movement disorders, sleep disorders, or cranial neuropathies. Some studies have reported cerebellar and basal ganglia atrophy in structural MRI, but to our knowledge, there are not studies investigating the pattern of brain metabolism. ***Materials and Methods:*** Cross-sectional study including 11 patients with a genetically confirmed diagnosis of RFC1-related disorder. Patients underwent comprehensive clinical examination and ^{18}F-FDG PET-CT imaging. Voxel-based brain mapping analysis was conducted with SPM12. Patients were compared with a healthy control group of 40 subjects. ***Results:*** The mean age was 68.55±9.55, 4 (36.4%) were women. All patients have clinical symptoms at the moment of assessment. A lower metabolism in the bilateral cerebellum was observed in patients with RFC1-related disorder compared with healthy controls. No regions of higher metabolism were detected. ***Conclusion:*** Our study found a pattern of bilateral cerebellar hypometabolism in patients with RFC1 biallelic expansion. This suggests that ^{18}F-FDG PET could be a novel biomarker for this disorder. Future studies should compare the usefulness of ^{18}F-FDG PET imaging in the differential diagnosis with other disorders.

EP-35

e-Poster Area

B: Imaging Clinical Studies -> B6 Endocrinological Imaging Clinical Study -> B61 Endocrinology (including Thyroid Benign)

EP-0557

Quantitative single-photon emission computed tomography for dose calculation of radioiodine therapy in hyperthyroidism

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Aim/Introduction: Treatment of hyperthyroidism with radioiodine (131I) therapy in Graves' disease (GD) and toxic multinodular goiter (TMNG) preferably avoids early hypothyroidism and still effectively cures hyperthyroidism. Currently, patient-specific 131I dose is calculated based on iodine uptake (123I or 131I) and thyroid volume measured in planar scintigraphy (PS). However, especially planar volume measurements lack accuracy and have large inter and intra observer variation. 131I dose calculation using quantitative SPECT/CT may be more accurate and potentially improve clinical outcome. This study aims to determine accuracy of quantitative SPECT/CT for volume and uptake measurements and compares 131I dose for radioiodine therapy as calculated based on PS and quantitative SPECT/CT. Furthermore, the administered 131I dose concentration is correlated to clinical outcome. ***Materials and Methods:*** Quantitative SPECT/CT was validated in a phantom study. For patients with GD or TMNG, planar 123I uptake and volume measurements were retrospectively compared to 123I quantitative SPECT/CT. Furthermore, the administered 131I dose concentration (MBq/ml) was determined using quantitative SPECT/CT and was correlated to thyroid function one year after therapy. ***Results:*** In patients with GD (n=31), the uptake in quantitative SPECT/CT was 65% (IQR 53-78) vs. 52% (IQR 44-60) in PS ($p<0.001$). The thyroid volume was 22 mL (IQR 17-31) vs. 26 mL (IQR 21-42), respectively ($p<0.001$). Subsequently, when quantitative SPECT/CT was used to calculated the required 131I dose, this would have reduced the dose by 38% ($p<0.001$). One year after therapy, 29% of patients developed euthyroidism, 29% had persistent hyperthyroidism and 42% developed hypothyroidism. Corresponding dose concentrations were 5.6 MBq/mL (IQR 4.4-8.2), 6.1 MBq/mL (IQR 4.4-8.1) and 7.8 MBq/mL (IQR 6.1-9.1) (nonsignificant (ns.)). In patients with TMNG (n=34), the uptake in quantitative SPECT/CT was 37% (IQR 31-48) vs. 26% (IQR 20-37) in PS ($p<0.001$). The thyroid volume was 38 mL (IQR 26-74) vs. 42 mL (IQR 26-79), respectively (ns.). Subsequently, when quantitative SPECT/CT was used to calculated the required 131I dose, this would have reduced the dose by 23% (ns.). One year after therapy, 59% of patients developed euthyroidism, 12% had persistent hyperthyroidism and 29% developed hypothyroidism. Corresponding dose concentrations were 8.3 MBq/mL (IQR 5.6-9.8), 6.7 MBq/mL (IQR 4.0-9.3), and 10.4 MBq/mL (IQR 10.2-11.7) ($p<0.05$). ***Conclusion:*** Quantitative SPECT/CT allows for more accurate 131I dose calculations based on both more accurate thyroid volume and 123I uptake measurements, compared to PS. Quantitative SPECT/CT might improve clinical outcome after radioiodine therapy in patients with GD or TMNG.

EP-0558

Diagnostic value of 68Ga-Pentixafor PET/MR in Functional nodules of Primary Aldosteronism

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Aim/Introduction: To investigate the clinical value of 68Ga-Pentixafor PET/MR in the diagnosis of primary aldosteronism (PA) of functional adrenal nodules, especially those with diameter < 10mm, and compare it with the single PET model. ***Materials and Methods:*** We prospectively assessed 39 patients diagnosed with PA and 13 patients with non-functional adrenal adenoma (NFA). All patients underwent 68Ga-pentixafor PET/MR before adrenalectomy. Receiver-operating characteristic (ROC) curves were constructed to determine the threshold of semi-quantitative parameters and the diagnostic accuracy of 68Ga-pentixafor PET/MR for the diagnosis of functional nodules. ***Results:*** The subtypes of 39 PA patients included 30 aldosterone-producing nodules, 5 cases of suspected unilateral adrenal hyperplasia, and 4 cases of idiopathic aldosterone hyperplasia. The cut-off value for diagnosing functional nodules by ROC curve was SUVmax >7.87. In further subgroup analysis, the cut-off value of nodules less than 10mm in diameter was less than the total (SUVmax>6.49), while the cut-off value of nodules greater than 10mm was the same as the total. Compared with a single PET model, the sensitivity of PET/MR increased from 72.7% to 90.5%, and the area under the ROC curve increased from 0.865 to 0.937. In subgroups, PET/MR mainly improved the sensitivity of PET with a diameter less than 10mm, from 68.8% to 87.5%, and the area under the ROC curve increased from 0.760 to 0.854. ***Conclusion:*** 68Ga-pentixafor PET/MR demonstrated promising diagnostic accuracy in functional nodules of PA patients, especially improved the sensitivity of PET for adrenal nodules with diameters less than 10mm.

EP-0559

Evaluating 68Ga-DOTANOC PET/CT for TIO Culprit Lesion Detection and Comparing with CT

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Aim/Introduction: Assessing the Clinical Efficacy of 68Ga-DOTANOC PET/CT in Identifying the Underlying Culprit Lesion in Tumor-Induced Osteomalacia (TIO) and Contrasting its Performance Against Computed Tomography. ***Materials and Methods:*** Fifty-eight patients suspected of TIO underwent 68Ga-DOTANOC PET/CT scans, with their clinical data documented. Experienced nuclear medicine physicians interpreted the PET/CT images. The detection rates of lesions using 68Ga-DOTANOC PET/CT and CT were compared, and the correlation between SUVmax and TLG values with lesion size on CT was assessed. ***Results:*** The study comprised 58 patients, with 48 males and 10 females. Their mean age was 36.86 ± 13.19 years, spanning from 14 to 68 years old. Among the 58 patients enrolled in the study, culprit lesions were identified in 36 patients, yielding a lesion detection rate of 62% (36/58). Among those with detected lesions, four patients underwent follow-up scans to monitor the progression or treatment response of their TIO. CT scans were individually examined for all patients, revealing a lesion detection rate of 32.7% (19/58). In the 17 cases where CT did not identify a culprit lesion, 68Ga-DOTANOC PET/CT provided an additional diagnostic benefit of 47.2% (17/36) over CT in detecting these lesions. The average size of the identified culprit lesions on CT was 1.5 ± 0.1 cm, ranging from 0.5 to 4.4 cm. ***Conclusion:*** 68Ga-DOTANOC PET/CT exhibited heightened sensitivity in identifying culorit lesion in TIO compared to CT. This advanced imaging technique offered valuable insights into lesion detection and associated metabolic activity, facilitating treatment planning and ongoing monitoring of the condition.

EP-0560

Effects of Mirabegron and Quinolone on the Activation of Brown Adipose Tissue Identified by [18F]FDG-PET/CT in Humans (MIRAQL-BAT STUDY)

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Aim/Introduction: Brown adipose tissue (BAT) has regulatory functions on energy (thermogenesis), glucose and lipid homeostasis. BAT activation can be detected by [18F] fluorodeoxyglucose positron emission tomography/computed tomography ([18F]FDG-PET/CT). Drugs such as β3-adrenergic agonists and quinolones are candidates for activating BAT for therapeutic purposes. We aimed to evaluate the effects of mirabegron (β3-adrenergic agonist), ciprofloxacin (quinolonone), or the combination of both, on the activation of BAT, glucose and lipid homeostasis. We present here the preliminary results of this ongoing study. ***Materials and Methods:*** Prospective, double-blind, randomized, crossover study. Twenty participants [18-40 year-old women, BMI 27-35 kg/m2, insulin resistance (HOMA-IR >2,7)]. Two random-order interventions: mirabregron 100 mg/day plus placebo (4 weeks) (M intervention); mirabregron 200 mg/day plus placebo (2 weeks), followed by mirabregron 200 mg/day plus ciprofloxacin 1000 mg/day (2 weeks) (MQ intervention). Ten of the participants were also randomized to a third intervention: placebo (2 weeks), followed by ciprofloxacin 1000 mg/day plus placebo (2 weeks). Washout period between interventions: 4 weeks. Outcomes: BAT activation after each intervention [visually identifiable in [18F]FDG-PET/CT (room temperature: 25 oC) compared to background activity; BAT SUVmax]; changes in weight, circumferences of waist, hip, neck; changes in glucose, insulin, hemoglobina A1c, total cholesterol and fractions and triglycerides. ***Results:*** Thirteen participants were included so far (median age 31 years, range 19-38 years; median BMI 32.9 kg/m2, range 29.3-35.0 kg/m2). Circumferences (cm) of neck, waist and hip were [median (range)] 36.0 (33.5-42.0), 95.0 (87.0-102.0) and 120.0 (109-126), respectively. Fasting glucose (mg/dl), insulin (uUI/ml) and HOMA-IR were [median (range)] 94.0 (83-106), 24.5 (16.7-36.9) and 6.4 (3.7-8.6), respectively. Anthropometric and metabolic parameters did not change significantly after interventions. BAT was not activated by ciprofoxacin alone (n=10). Ten participants completed both M and MQ. BAT SUVmax ranged from 4.78 to 23.5 (median 12.1) across interventions. BAT activation was observed after neither of the interventions in four participants, only after MQ in one, only after M in two, and after both M and MQ in three. Compared to M, one participant had higher SUVmax after MQ (22.7 vs 12.1) and two had lower SUVmax after MQ (15.1 vs 23.5; 4.78 vs 6.7). ***Conclusion:*** Mirabegron-stimulated BAT activation at room temperature is viable in a tropical country. BAT is not activated by ciprofloxacin alone, but may be activated by mirabegron, either alone or in combination with ciprofloxacin. However, mirabregron effect lacks consistency across interventions and the effect of drug combination is not clear yet.

EP-0561

Contribution of ^{18}F-Fluorocholine PET/MRI in the post-operative follow-up of pituitary adenomas: head-to-head comparison with ^{11}C-Methionine.

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Aim/Introduction: The detection of residual or recurrent pituitary adenoma (RPA) by MRI is hindered by the tissue remodelling that follows surgery or radiotherapy. 11C-Methionine (MET) PET has shown high diagnostic accuracy and sensitivity in detecting RPA, but its use remains restricted to centers with an onsite cyclotron. This study assessed the clinical usefulness of ^{18}F-Fluorocholine (FCH) PET/MRI compared to MET PET/MRI for accurate localization of RPA and its differentiation from the pituitary gland remnant (PGR) after trans-sphenoidal adenomectomy. ***Materials and Methods:*** This is a prospective study on 24 patients addressed for post-surgical evaluation of pituitary adenoma. The patients underwent a standard MET PET/MRI acquisition and subsequently a 20 min dynamic FCH PET/MRI acquisition followed by an additional FCH PET/CT acquisition performed at 40-55min post-FCH injection. For MET and FCH, the uptake of the RPA and PGR were compared visually and quantitatively by means of maximum standardized uptake value (SUVmax). Moreover, the FCH time activity curves for both the RPA and PGR were analyzed. ***Results:*** 13 of the 24 patients included had a non-functional adenoma. For the RPA, the FCH uptake was similar to the MET uptake, with a mean SUVmax of 6.15 for early static (3-20 min PI) FCH images and 5.12 for late static FCH images compared to 5.45 for MET (p=NS). Visually, all RPA were detected on FCH images. Contrary to RPA, PGR showed a decreasing kinetic of FCH uptake over time with a mean SUVmax of 5.73 for early FCH and 3.73 for late FCH (p<0.0001). ***Conclusion:*** FCH PET/MRI localized residual and recurrent pituitary adenoma similarly to MET PET/MRI. Moreover, a dual-phase FCH PET acquisition allows for better discrimination of the PRG from RPA.

EP-0563

68Ga-DOTANOC PET/CT in patients with Tumour Induced Osteomalacia - A retrospective single center experience.

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Aim/Introduction: Tumor-induced osteomalacia (TIO), is a paraneoplastic syndrome caused by small mesenchymal tumors. Detecting these occult mesenchymal tumors is of utmost importance, as they are completely curable after resection. This occult source can be imaged with SSTR positron-emission tomography-computed tomography (PET/CT). We aimed to study the role of 68Ga-DOTANOC PET/CT in the localization of culprit lesion. ***Materials and Methods:*** Records of consecutive patients with clinically and biochemically suspected TIO syndrome who underwent 68Ga-DOTANOC PET/CT at our tertiary care institution, between January 2019 and Febrauary 2024 were retrospectively reviewed. All patients were injected 3-4mCi 68Ga DOTANOC intravenously and underwent whole-body PET/CT 30-40 minutes post-injection. Scanned images were interpreted by two nuclear physicians independently. 68Ga DOTANOC PET/CT findings were corroborated with clinical details. Histopathology details were reviewed for the patients who underwent surgery. Findings of biochemical and conventional imaging were also utilized for correlation. ***Results:*** 47 patients with biochemically proven hypophosphatemia and elevated Fibroblast growth factor-23 (FGF-23) were included in the final analysis. 68Ga-DOTANOC

PET/CT was positive for a lesion in 29/47 patients (61.7%). 68Ga DOTANOC identified the primary lesion in 11/29 patients (37.9 %) in facial bones, 8/ 29 (27.5%) were localized to the upper and lower extremities, 8/29 (27.5 %) to the spine and pelvis, and 2/29 (6.8 %) to the soft tissue. Clinical and biochemical follow-up of the operated patients showed post-operative normalization of phosphate and FGF 23 levels. ***Conclusion:*** 68Ga-DOTANOC PET/CT proved to be a valuable modality in the workup of patients with suspected TIO by revealing the primary tumor in almost 60% of the patients with TIO.

EP-36

e-Poster Area

B: Imaging Clinical Studies -> B7 Musculoskeletal, Infection and Inflammation Imaging Study -> B71 Bone Infection and Inflammation

EP-0564

Is Tc99m-leukocytes a sufficient modality for detection of osteomyelitis in Charcot Neuroarthropathy?

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Aim/Introduction: We describe the contribution of bone marrow scan (BMS) in the investigation and diagnosis of osteomyelitis in Charcot Neuroarthropathy (CN). CN is a rare condition, but a really destructive disease of the ankle joint. Many diabetic patients suffer from foot disorders such us ulcers, neuroarthropathy, and osteomyelitis. X-Rays fail to show bone inflammation unless there is at least 30-50% destruction of the corresponding bone. MRI has difficulties in differential diagnosis osteomyelitis from CN. 3 Phase Bone Scan is positive in most of these situations, especially in bone inflammation, fracture and neuroarthropathy. Leukocytes do accumulate in rapidly evolving Charcot (aseptic inflammation, fracture, bone reconstruction processes) even in absence of infection (septic osteomyelitis). In such case, the combination of bone scan and Tc99m-Leukocytes is not enough. In presence of haematopoietically active bone marrow, the specificity of labeled leukocytes decreases. For the confirmation of septic osteomyelitis in CN, bone marrow scan (BMS) is the cornerstone modality, when in doubt. ***Materials and Methods:*** Four patients with radiographically confirmed CN and positive findings in hindfoot in both bone scan and Tc99m-leukocytes, underwent bone marrow scan. A leukocytes/ BMS concordant distribution ruled out osteomyelitis and indicated an active bone marrow due to rapidly evolving Charcot. A positive labeled leukocyte scan without corresponding findings in BMS (unconcordant pattern) indicated septic osteomyelitis. ***Results:*** A leukocyte/ BMS concordant pattern was present in one of four patients. If we had stopped after the bone scan/ leukocyte combined study, we would have concluded to a wrong diagnosis. In this situation bone marrow scan helped us to exclude osteomyelitis and the patient avoided to take unnecessary antibiotics. ***Conclusion:*** We conclude that a bone marrow scan is a very useful study to exclude septic osteomyelitis, in rapidly evolving Charcot neuropathy where 3 Phase Bone Scan and Tc-99m-leukocytes are both positive. We have to keep it in mind when we evaluate diabetic feet.

B: Imaging Clinical Studies -> B7 Musculoskeletal, Infection and Inflammation Imaging Study -> B72 Vasculitis and Endocarditis

EP-0565

Various sites and patterns of granulomatosis with polyangiitis involvement detected by the versatile imaging tool F^{18} FDG PET/CT

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Aim/Introduction: Granulomatosis with polyangiitis, previously known as Wegener's granulomatosis, is a rare multi-system autoimmune disorder of unknown etiology and form of vasculitis affecting a host of different organs in the body. Literature review suggests F^{18} FDG PET/CT can help in assessing the disease burden, finding out the various sites of involvement by the disease, identifying appropriate sites for targeted biopsy and monitoring the response to systemic therapy. This study aimed to identify the various patterns of disease involvement that can be detected using F^{18} FDG PET/CT. ***Materials and Methods:*** This retrospective observational study included all patients presenting with histopathologically diagnosed or clinically and biochemically suspected granulomatosis with polyangiitis who underwent a whole-body F^{18} FDG PET/CT between January 2015 and April 2024 at a tertiary care centre. The clinical and imaging findings were analyzed to identify the various patterns of disease involvement. ***Results:*** Thirty-five patients (20 females and 15 males) were included in this study, with a mean age of 47.7 years (SD ±16.7). The most common presenting symptoms were nasal stuffiness with epistaxis and fever, both seen in 8/35 patients (22.8% each), closely followed by shortness of breath which was seen in 7/35 patients (20%). One patient presented with a clinical history of recurrent cerebrovascular accident, who, on evaluation, was found to have granulomatosis with polyangiitis. In the F^{18} FDG PET/CT, single-organ involvement was seen in 9/35 patients (25.7%),with lungs (6/9 patients) being the commonest site, followed by paranasal sinuses (3/9 patients). Two or more organs were involved in the rest of the study population. Overall, lung involvement was the most common finding seen in 28 patients (80%), followed by paranasal sinus involvement in 16 patients (45.7%), lymph nodal involvement in 9 patients (25.7%),with renal lesions in 4 participants (11.4%). Patterned FDG uptake in the dilated blood vessels was present in 14.3% of the study population. Classical presentation with involvement of the paranasal sinuses and pulmonary and renal lesions were present in only 2 participants. Involvement of any one or two of the above findings coupled with FDG uptake in the nasal septum, blood vessels, locoregional lymphadenopathy and laryngeal cartilages should alert the physician towards the diagnosis of granulomatosis with polyangiitis. ***Conclusion:*** F^{18}- FDG-PET/CT helps to detect the various organ systems involved by granulomatosis with polyangiitis with different patterns of involvement, thereby estimating the true disease burden by identifying multiple occult sites of disease involvement.

EP-0566

Infective Endocarditis Associated with a Percutaneous Mitral Valve Repair

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Aim/Introduction: The incidence of infective endocarditis (IE) associated with prosthetic valves ranges from 1 to 6%, and for bioprosthetic aortic valve transcatheter implantation (TAVI), it ranges from 0.5-3.1%. This study aims to review and analyze all published cases of IE associated with an edge-to-edge mitral repair (MitraClip). ***Materials and Methods:*** We conducted a comprehensive literature search on MEDLINE and Google Scholar. The search keywords employed were "MitraClip" and "Endocarditis." Additionally, a manual search of reference lists was performed. ***Results:*** We identified a total of 20 cases (13 males) of endocarditis associated with the MitraClip procedure. The mean age was 72 years (range 51-88), and patients tended to have multiple complex medical comorbidities. The average time from implantation to IE diagnosis was 10 months (range 24 hours to 4 years). In all cases, transthoracic or transesophageal echocardiography confirmed IE. The most frequently isolated pathogens were Staphylococcus aureus (10 cases, including 4 methicillin-resistant) and Enterococcus faecalis (3 cases). ***Conclusion:*** The use of the MitraClip device is on the rise for managing severe mitral regurgitation in patients with high surgical risk. Although the incidence of IE associated with MitraClip is relatively low compared to other valve procedures, given the clinical profile of these patients, it represents a potentially life-threatening complication requiring complex and multidisciplinary management.

EP-37

e-Poster Area

B: Imaging Clinical Studies -> B7 Musculoskeletal, Infection and Inflammation Imaging Study -> B73 Other Infections and Inflammatory Diseases

EP-0567

"SPECIFIC" Trial of ^{68}Ga-triacetylfusarinine C (TAFC) Siderophore PET/CT for Detection of Invasive Aspergillus Infection: First-In-Human Imaging Result

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Aim/Introduction: Invasive Aspergillus infection (IAI) is a common infection in immunocompromised patients. Prompt diagnosis is paramount given high morbidity and mortality. Whilst 18F-fluorodeoxyglucose (FDG) PET/CT is useful in diagnosis, it remains non-specific and invasive procedures such as bronchoalveolar lavage are generally required to confirm the diagnosis. Siderophore-radiolabelled PET/CT may facilitate rapid and non-invasive diagnosis of IAI. Siderophores are natural scavengers of iron produced by pathogens, and specific for certain pathogens. Aspergillus fumigatus secretes two siderophores, fusarinine C and TAFC, which are not taken up by human cellular systems. TAFC is an attractive candidate for labelling due to its short half life and rapid renal clearance. Preclinical studies have demonstrated the diagnostic potential of 68Ga-TAFC PET/CT with specific visualisation of Aspergillus fumigatus infection in mouse models[1]. This study aims to evaluate whether these preclinical findings can be confirmed in humans with proven or probable IAI. ***Materials and Methods:*** We report results of the first patient enrolled in a 10 patient pilot imaging study of patients with probable or proven IAI. Patients satisfying inclusion and exclusion criteria are recruited to undergo 68Ga-TAFC-PET/CT within two weeks of IAI diagnosis. Whole body PET/CT was performed at 15, 62 and 209 minutes following intravenous injection of 139 MBq 68Ga-TAFC. 68Ga labelling was optimised to yield 68Ga-TAFC quantitatively at 50 C (pH 4.0) in 7 minutes. Findings pertinent to IAI and physiologic uptake were qualitatively and quantitatively analysed. ***Results:*** The first patient had probable invasive pulmonary aspergillosis in the setting of new diagnosis of leukemia, with positive galactomannan antigen and Aspergillus fumigatus PCR on bronchoalveolar lavage fluid. 68Ga-TAFC-PET/CT was performed 10 days after empiric antifungal treatment and 4 days after microbiological confirmation of invasive infection, which was clinically effective with resolution of fevers by 72 hrs. PET/CT demonstrated blood pool activity (SUVmax 15/60/209 mins: 4.1/2.7/1.9) with minimal liver, spleen and gastrointestinal tract uptake (SUVmax 2.7), early renal excretion, and no marrow or other organ uptake. Low grade focal uptake was visualised in multiple pulmonary lesions, similar to blood pool activity, with synchronous washout over time. No adverse effects were encountered. ***Conclusion:*** Very low background physiologic biodistribution was seen in the first participant in this first-in-human study. Focal low grade pulmonary uptake was visualised, presumably representing specific activity, and likely attenuated reflecting successful response to antifungal treatment. Trial recruitment continues. ***References:*** [1] Journal of Fungi 2021; doi: 10.3390/jof7070558.

EP-0568

Increased gastrointestinal FAPI uptake in systemic sclerosis patients with gastrointestinal symptoms

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Aim/Introduction: Systemic sclerosis is a complex disease process with multisystem involvement, with the gastrointestinal (GI) tract involved in up to 90% of patients. Gallium-68 labeled fibroblast activation protein inhibitor (FAPI) is an emerging imaging biomarker of fibroblast activation, which is implicated in the pathogenesis of systemic sclerosis. We report the detection of FAPI uptake in the GI tract of systemic sclerosis patients with GI symptoms. ***Materials and Methods:*** We retrospectively analyzed FAPI PET/CT imaging performed for patients with confirmed diagnosis of systemic sclerosis. GI symptoms were scored according to the UCLA GIT 2.0 questionnaire. Bowel segmentation was performed using MIM 6.9.9 software. The SUVmax and SUVmean of the affected segments were analyzed. ***Results:*** Preliminary results showed that 50% (3/6) of patients with GI symptoms demonstrated increased FAPI bowel uptake. ***Conclusion:*** To our knowledge, this is the first study describing FAPI bowel uptake in systemic sclerosis patients, with associated

GI symptoms. Our findings suggest that FAPI PET/CT imaging may have potential as a non-invasive tool in detection and monitoring of GI disease activity in systemic sclerosis patients. ***References:*** Shreiner AB, Murray C, Denton C, Khanna D. Gastrointestinal Manifestations of Systemic Sclerosis. J Scleroderma Relat Disord. 2016;1(3):247-256. doi: 10.5301/jsrd.5000214. Epub 2016 Oct 18. PMID: 28133631; PMCID: PMC5267349. van Leeuwen NM, Boonstra M, Fretheim H, Brunborg C, Midtvedt Ø, Garen T, Molberg Ø, Huizinga TWJ, de Vries-Bouwstra JK, Hoffman-Vold AM. Gastrointestinal symptom severity and progression in systemic sclerosis. Rheumatology (Oxford). 2022 Oct 6;61(10):4024-4034. doi: 10.1093/rheumatology/keac118. PMID: 35238377; PMCID: PMC9789747.

EP-0569

^{18}F-FDG PET/CT in Pyrexia of unknown origin: Guiding the differentials and site of biopsy.

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Aim/Introduction: This study aims to assess the significance of F^{18}-FDG PET/CT in directing clinicians towards the site of biopsy and to evaluate the agreement between our preliminary differential diagnosis and the final histopathological findings. ***Materials and Methods:*** We retrospectively assessed 207 patients of pyrexia of unknown origin (PUO) referred to our centre for F^{18}-FDG PET/CT. Evaluation was based on our imaging reports and final biopsy results. Imaging findings were categorised into first, second and third differentials, with consensus reached by two experienced nuclear physicians with 5-20 years of experience. ***Results:*** Out of 207 patients, site of biopsy was advised for 104 patients to guide clinicians to establish a quick diagnosis. From those 104 patients, 36 patients had a conclusive diagnosis after biopsy results. As per our first differential diagnosis 5 out of 8 patients, 9 out of 14 patients, 2 out of 5 patients and 4 out of 9 patients came out to be tuberculosis, lymphoma, malignancy and other infections respectively, in accordance with the biopsy report. The other 103 patients had already underwent biopsy, according to the first differential given on PET/CT, 9/22(40.9%), 18/30(60%), 10/28(35.7%), 8/18(44.4%) and 5/5(100%) patients came out to be tuberculosis, lymphoma, other infections, malignancies and vasculitis, respectively and had concordance with the histopathological examination. ***Conclusion:*** Early utilisation of F^{18}-FDG PET/CT in the diagnostic process significantly enhances the management of pyrexia of unknown origin (PUO) patients. By offering initial diagnosis and directing clinicians to the most feasible biopsy site, it facilitates expedited and improved patient care.

EP-0570

Positron Emission Tomography/Computer Tomography in the Diagnosis of Inflammation of Unknown Origin: A Systematic Review and Meta-Analysis

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Aim/Introduction: Inflammation of unknown origin (IUO) is persistent or recurrent inflammation with no identifiable cause despite extensive examination and investigation (1). Positron Emission Tomography (PET)/Computer Tomography (CT) has gained recent attention in its potential to differentiate the underlying diseases of IUO. Our aim was to conduct the first systematic review to assess the diagnostic accuracy of PET/CT in IUO specifically. ***Materials and Methods:*** A systematic review was conducted via comprehensive search of electronic databases (Cochrane, Embase, MEDLINE and PubMed) from the earliest data available to January 2024 following the Cochrane Handbook for Systematic Reviews of Diagnostic Test Accuracy and the Preferred Reporting Items for Systematic Reviews and Meta-Analyses of Diagnostic Test Accuracy Studies (PRISMA-DTA). Studies were screened following the defined inclusion criteria and data was extracted by two pairs of independent reviewers. A meta-analysis was performed using the Review Manager 5.4.1 (RevMan) and STATA 18 using the random effect bivariate model. Studies were also assessed qualitatively for the outcomes not included in the meta-analysis. ***Results:*** 16 studies were included in the systematic review meeting the eligibility criteria. 6 of these reported the required diagnostic outcomes for IUO specifically and were included in the meta-analysis with a total patient sample size of 789. The sensitivity and specificity of PET/CT in diagnosing IUO was 88% (95% CI = 74-95%) and 80% (95% CI = 50-94%), respectively. The resulting diagnostic odds ratio was 28.51 (95% CI = 8.79-92.46). The positive likelihood ratio and negative likelihood ratio was 4.37 (95% CI = 1.55 - 12.35) and 0.15 (95% CI = 0.02 - 0.29. An exploratory subgroup analysis suggested that PET/CT sensitivity and specificity improved when C-reactive protein (CRP) levels were above 53 mg/L. Non-infectious inflammatory diseases were the most frequent cause of IUO, with vasculitis and polymyalgia rheumatica the most frequently diagnosed diseases across the included studies. ***Conclusion:*** Our study showed that PET/CT has good diagnostic performance in the diagnosis of IUO. This review could aid in establishing evidence based IUO diagnostic pathways and guiding indications for PET/CT scans. Consideration of undertaking a PET/CT scan earlier in the diagnostic pathway of patients with IUO could result in better patient care and outcomes. ***References:*** 1) Boulu X, et al. value of positron Emission tomography coupled with computed Tomography for the diagnosis of inflammatory syndrome of unknown origin in an internal medicine department. Mayo Clin Proc Innov Qual Outcomes. 2023 May 4;7(3):178-186.

EP-0571

Unexpected non-neoplastic focal high-uptake in liver on [^{68}Ga]Ga-DOTA-FAPI-04 PET

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Aim/Introduction: [68Ga]Ga-DOTA-FAPI-04 positron emission tomography (PET) is an emerging imaging modality in oncological imaging. This study aims to investigate the occurrence of unexpected high uptake in non-neoplastic liver lesions during the detection of malignant neoplastic lesions using [68Ga]Ga-DOTA-FAPI-04 PET. ***Materials and Methods:*** We retrospectively reviewed [68Ga]Ga-DOTA-FAPI-04 PET/magnetic resonance imaging (MRI) or PET/computed tomography (CT) scans from 1,000 patients conducted at our PET center between January 2021 and January 2024. Foci of elevated [68Ga]Ga-DOTA-FAPI-04 uptake in the liver were identified and further evaluated using CT, MRI, and biochemical analysis to determine their nature. We recorded and analyzed the locations, shapes, maximum standard uptake values (SUVmax), liver-to-muscle uptake ratios (LMR), and liver-to-background blood uptake ratios (LBR) of the benign lesions. ***Results:*** Among 1,000 patients, 41 demonstrated unexpected focal high uptake of [68Ga]Ga-DOTA-FAPI-04 in the liver, diagnosed as focal liver fibrosis due to regional cholestasis

(11/41, 26.8%), treatment-related changes (17/41, 41.5%), and underlying chronic liver disease (13/41, 31.7%). The uptake linked to cholestasis generally appeared in a wedge-shaped pattern accompanied by bile duct dilation, with SUVmax of 6.67 ± 2.63, LMR of 3.71 ± 2.54, and LBR of 3.89 ± 1.92. Treatment-related uptake often occurred adjacent to tumors, manifesting in striated or patchy patterns, and presented an SUVmax of 6.14 ± 4.76, LMR of 2.54 ± 2.16, and LBR of 3.27 ± 2.20. Uptake from underlying liver disease, predominantly diffuse, showed an SUVmax of 6.79 ± 3.74, LMR of 3.15 ± 1.77, and LBR of 3.39 ± 1.92. No statistically significant differences were observed in SUVmax, LMR, and LBR across the different causes of uptake (all P > 0.05). Imaging typically indicated normal density on computed tomography, mild hyperintensity on T1-weighted and diffusion-weighted imaging, with areas showing contrast enhancement. ***Conclusion:*** Unexpected non-neoplastic high uptake of [68Ga]Ga-DOTA-FAPI-04 in the liver can indicate focal liver fibrosis with various etiologies, requiring differentiation from tumors and other benign conditions. [68Ga]Ga-DOTA-FAPI-04 PET imaging effectively assesses the functional and pathological status of the liver, aiding in the development of personalized treatment plans for patients with malignant tumors.

EP-0572

The role of [18]F-FDG PET/CT in patients with Nocardiosis

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Aim/Introduction: Nocardiosis is a rare and a opportunistic infection caused by aerobic gram-positive bacteria. Skin and lungs are usually the main sites of localized lessions. The aim of this paper is to evaluate the role of ^{18}F-FDG PET/CT in the differential diagnosis of pulmonary nodules. We present the results of two patients. ***Materials and Methods:*** We reviewed records of two patients referred to our Nuclear Medicine Department with diagnosis of Nocardia infection: 41 years old woman with pulmonary nodules (no other importants diseases) and 71 years old male with trated lung cancer, abdominal abscess (nocardia culture positive) and pulmonary nodules (cytology negative). Whole body ^{18}F-FDG PET/CT and visual evaluation was performed and they had a follow up of two years. ***Results:*** Both cases presented moderate ^{18}F-FDG uptake in lung lessions, as well as in the intra-abdominal abscess describe in the male studies. During the follow up the patients underwent other whole body ^{18}F-FDG PET/CT study. Our first case show a rare opportunistic infection in no inmunocompromised patient, who underwent poor outcome during de follow up, with inadecuate antibiotic response. Control PET/CT study showed a slight increase in metabolism in the pulmonary nodules. In addition, PET/CT guided the biopsy (histopathological analysis did not show malignancy). The second patient, the male, did not show significant changes in the lesions described in the previous study, which supports an infectious origin (less likely recurrence of lung cancer given stability without treatment). ***Conclusion:*** Nocardiosis is a rare infection that we have Know, mainly in immunocompromise patients. In addition, ^{18}F-FDG PET/CT at baseline add information about disease extent and underlying malignancies, as well as follow up FDG-PET/CT could evidenciate the therapy response. However, bigger scale studies are needed to prove the optimal timeframes between both PET/TC studies.

EP-38

e-Poster Area

B: Imaging Clinical Studies -> B8 Nephro-Urological Imaging Study -> B81 Nephro-Urology

EP-0573

Mean Parenchymal Transit Time measurement on Tc-99m EC Diuretic renography can help differentiate obstructed from non-obstructed kidneys

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Aim/Introduction: Diuretic renography is used to rule out pelviureteric junction obstruction (PUJO) in antenatally-detected hydronephrotic kidneys. In addition to Normalized Residual Activity at 20 minutes (NORA20) and Output Efficiency at 20 minutes (OE20), Mean parenchymal transit time (MPTT) measured through deconvolution analysis is a continuous quantitative parameter that can be used for follow up and for deciding intervention. The objectives of the study were to compare MPTT values obtained with Tc-99m EC diuretic renography in obstructed and non-obstructed hydronephrotic kidneys in children with suspected PUJO and to find the association with other transit time parameters. ***Materials and Methods:*** In a cross-sectional analytical design, this study analyzed data of Tc-99m EC diuretic renography performed in children under the age of 18 years and suspected to have PUJO. The renography data was transferred to MATLAB and values of NORA20, OE20, and MPTT were obtained using separate algorithms. The contralateral non-hydronephrotic kidney was considered normal for study purposes. Obstructed kidneys were identified based on the diuretic renography images and curve pattern by an experienced nuclear medicine physician. The MPTT values were compared between normal, hydronephrotic non-obstructed, and obstructed kidneys. In addition, association between values NORA20, OE20 and MPTT was studied. ***Results:*** In the interim analysis of data from 75 patients (143 renal units), the median MPTT in non-hydronephrotic (n=58), hydronephrotic non-obstructed kidneys (n=58), and obstructed kidneys (n=27) were found to be 3.18 minutes (IQR: 2.87, 3.57), 4.63 (IQR: 3.47, 6.06), and 10.15 (IQR: 8.78, 11.90) respectively. A significant difference was observed between the 3 groups ($p < 0.01$). The median values of NORA20 for hydronephrotic non-obstructed and obstructed kidneys were 0.66 (IQR: 0.39, 1.04) and 2.43 (IQR: 1.79, 3.08), while the values of OE20 were 83.04 (IQR: 69.86, 90.50) and 44.33 (IQR: 34.97, 55.25), respectively. There was a strong positive correlation between MPTT and NORA20 in obstructed kidneys (correlation coefficient: 0.76, $p=0.18$) but weak in the other two subgroups. There was a strong negative correlation between MPTT and OE20 in obstructed kidneys (correlation coefficient: -0.79, $p<0.05$) but weak in the other two subgroups. ***Conclusion:*** MPTT values obtained on Tc-99m EC diuretic renography showed a significant difference between the hydronephrotic non-obstructed and hydronephrotic obstructed kidneys, implying that MPTT can distinguish obstructed from non-obstructed kidneys. The values correlated with NORA20 and OE20 values.

EP-0574

Impact of kidney allograft infarction on renal transplant outcomes

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Aim/Introduction: Renal transplantation is the best choice of treatment for patients with end-stage renal disease as it is associated with the best survival rates and improved quality of life. However, various complications may occur in the post-operative period or during follow-up, resulting in graft dysfunction or in severe cases graft loss. Segmental infarction is one of the complications that may occur in the post-operative period. The aim of this study was to compare differences in time to allograft failure and 5-year post-transplant estimated glomerular filtration rate (eGRF) between patients either with or without allograft infarction immediately after transplant. ***Materials and Methods:*** An observational and retrospective study was carried out, which included adults that underwent renography with [99mTc]Tc-MAG3 or [99mTc]Tc-DTPA for assessment of perfusion and function of the kidney allograft in the early post-operative period in our institution between 2014 and 2017. Segmental infarction was reported when a persistent photopenic image in the allograft was seen in all phases of the dynamic study. Graft failure was defined as the need for renal replacement therapy or transplantectomy. eGFR was calculated using the MDRD equation. The hypothesis of differences in the time to allograft failure between both groups of patients was tested through Kaplan-Meier analysis and the Log-Rank test. For patients in whom allograft failure did not occur during the follow-up, the association between the diagnosis of infarction and the eGFR at 5 years post-transplant was tested with two sample t-test. ***Results:*** 50 patients were included and 29 were male (58%). Median age was 49.6 ± 11.7 years. 20 patients (40%) had one or more images suggestive of segmental infarction. In 10 patients (20%) allograft failure occurred during the follow-up, of which 3 needed to undergo renal replacement therapy and 7 transplantectomy. There was no statistically significant association between the occurrence of infarction and allograft failure (p=0.38) using Kaplan-Meier analysis and the Log-Rank test. In patients in whom allograft failure did not occur during the follow-up, we found a statistically significant association between the occurrence of infarction and a lower eGFR (t=2.97; p=0.005). ***Conclusion:*** This study suggests that the occurrence of kidney allograft infarction is not associated with higher rates of graft failure but it is related to a lower GFR in renal transplant recipients.

EP-39

e-Poster Area

B: Imaging Clinical Studies -> B9 Paediatric Imaging Study -> B91 Paediatric Study

EP-0575

Total variation filter in dose reduction by improving image quality in Pediatric Scintigraphy

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Aim/Introduction: Currently, more than 300 million diagnostic pediatric examinations involving radiation are performed globally. In Pediatric Renal Scintigraphy (PRS), finding a balance between image clarity and minimal radiation exposure is critical for accurate diagnoses and patient safety. However, as the image noise inherent in low radiation can impair diagnostic accuracy, it is necessary to improve image quality without increasing the radiation dose. ***Materials and Methods:*** This work proposes a method based on the minimization of Total Variation (TV) of the data to mantaining the image quality standards in PRS examinations with lower radiation dose for the children. The public Database of dynamic renal Scintigraphy was used, specifically the drsbru dataset, which includes 100 99mTc-MAG3 dynamic renal studies carried out on children aged between 0 and 17 years. These studies cover cases of unilateral or bilateral uropathy, and were acquired in posterior projection, with a resolution of 128x128 pixels and captured in 10-second frames during a 20-minute acquisition. Before implementing the Total Variation minimization filter, a dose reduction of the sum of the 100 slices was simulated, so 75%, 50% and 25% of the slices were considered. Despite the reductions, we consistently used the combined image of all the slices for analysis. Subsequently, the TV filter was applied to the cases corresponding to the lowest dose simulations. Image quality was assessed by measuring the signal-to-noise ratio (SNR) and multiscale structural similarity (MS-SSIM), before and after applying the filter. ***Results:*** In this preliminary study, four cases within 0 and 1 year age range were selected. The SNR values in the kidneys exhibited a notable increase, with an average variation of 21% with 75% of the original dose, and 12% with 50% of the original dose post-filtering. The MS-SSIM in 50% of the slices after filtering with the TV filter had very high values of 0.984 on average (a variation of 1.59% on average). ***Conclusion:*** The increase in SNR values after filtering showed that it is possible to use lower doses (-50%) without compromising image quality, and the application of the filter in this dose reduction takes, on average, around 0.11 seconds. The low variation of MS-SSIM allows us to conclude that there is no deterioration in the definition of small structures in the image, i.e, the application of the TV filter can smooth out the noisiest areas of the PRS image, preserving the contours and details of the structure.

EP-0576

Prognostic power of prenatal pelvic anteroposterior diameter APD and residual functional area RFA to predict functional impairment and excretory alterations at renal sequential scintigraphy.

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Aim/Introduction: The comparison between the functional and morphological alterations during prenatal sonography and the scintigraphic results after birth. ***Materials and Methods:*** 42 children with prenatal diagnosis of hydronephrosis (IDN) and hydroureteralnephrosis (IDUN) at 36weeks of gestational age, were evaluated with diuretic scintigraphy within 8 months from birth (mean 5 months). The kidney were classified considering the pelvis anteroposterior diameter APD on SIEOG classification as mild, moderate and severe in IDN and as specific cohort in IDUN. Effective renal plasma flow ERPF and the %excretion 20minutes after furosemide administration E% were considered for comparison with prenatal parameters. Functional residual area (FRA) is defined as the whole-kidney area minus the pelvic

area, evaluated on longitudinal view, and expressed as %. ***Results:*** In severe (14/20; 70%) IDN and IDUN (22/22) the median monolateral ERPF of pathologic kidney was lower 255 (range 190-290) ml/min/1,73 m2BSA) vs 299 found in mild (1/20; 0.5%) and in moderate (5/20; 25%) IDN (range 275-315) (p=0.038). Even if not significant (p=0.86) we found that the tracer excretion was insufficient (E% <40%) in 10 kidney with severe IDN (10/14;71%) and only in one with mild IDN (1/5; 20%) and 8 with IDUN (8/22; 36%). Ballon shaped pelvis (BP) was found in 29/42(69%) cases and associated to a poor excretion E%<40% in 16/29(55%) and only in 3/13(23%) in not-BP (p=0.093). Mean ERPF is reduced in BP, 237 ml/min/1,73 m2BSA (range 180-278), while it's 292 ml/min/1,73 m2BSA (range 251-308) in not-BP. A correlation between FRA and ERPF in all 56 pathologic kidneys showed two clusters: 5/56 (9%) with FRA <70% which had a mean ERPF of 70 ml/min/1.73m2BSA and displasia feature (uretral valves or major vescico-ureteral reflux) and 51/56 (91%) with meanERPF 286 ml/min/1.73m2BSA (range 245-312) always related to IDN or IDUN without displasia. Mild and moderate IDN have 78% and 42% probability of spontaneous resolution, 5% and 10% of urinary tract infection UTI, 0% and 8% surgical treatment, respectively. Only 25% needed further investigations. Severe IDN and IDUN have 5% and 24% probability of spontaneous resolution, 30% and 33% of UTI. 75% of IDN needed further examinations and 55% was operated for pelvic-ureteral stenosis. 24% of IDUN had spontaneous resolution and 24% was operated. ***Conclusion:*** For kidney with FRA >70% during prenatal echography we could expect a normal or only slightly reduced renal function. The proposed FRA cut-off, if confirmed as prognostic tool, could help for accurate risk assessment.

EP-0577

Comparison between diuresis renography protocols F0 and F+15 in the evaluation of hydronephrosis in children under 2 years old: a propensity score-matched analysis

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Aim/Introduction: Hydronephrosis is the most common abnormality of the urinary tract diagnosed in children. Diuresis renography provides information on relative renal function and drainage pattern of the excretory system, allowing identification of cases at risk for function loss that benefit from early intervention. Various furosemide administration protocols can be used. The F0 protocol decreases the exam duration compared to the F+15 protocol, but it results in a loss of information about the elimination of the radiopharmaceutical in basal conditions. Additionally, in children with immature kidneys, cortical clearance of the radiopharmaceutical is not useful to exclude obstruction. Few studies have compared the F0 and F+15 protocols, and none included only children under 2 years of age. The aim of this study was to compare positivity rates for obstruction between furosemide protocols F0 and F+15 of renography in children under 2 years old. ***Materials and Methods:*** An observational and retrospective study was conducted, including children under 2 years old with unilateral hydronephrosis who underwent either F0 or F+15 protocol of diuresis renography with [99mTc] Tc-MAG3 (both with late post-void imaging), in our institution between 2018 and 2024. Each renography was classified as having obstructive stasis or normal/non-obstructive stasis based on the most likely diagnosis assigned in the medical report. We also recorded the values of the relative renal function and time to peak of each renography, the anteroposterior diameter of the renal pelvis given by ultrassound and the reporting physician. The hypothesis of differences in positivity rates for obstruction between F0 and F+15 protocols was tested after adjusting for potential confounding factors by sequentially applying propensity score analysis, full matching and weighted logistic regression with g-computation on the matched data. ***Results:*** 52 children were included and 43 were male (83%). The median age was 7.3 ± 6.4 months. 30 children (58%) underwent renography with the F+15 protocol and 22 (42%) with the F0 protocol. Obstruction occurred in 6 children (20%) who underwent renography with the F+15 protocol and in 7 (32%) who underwent renography with the F0 protocol. There was no statistically significant association between the diuretic protocol type and the result of the renogram (odds ratio: 0.618; p-value: 0.455), after adjusting for relative renal function, anteroposterior diameter of the renal pelvis and reporting physician. ***Conclusion:*** This study suggests that F0 and F+15 protocols have similar accuracy for detection of upper urinary tract obstruction in children under 2 years old.

EP-40

e-Poster Area

C: Therapy Clinical Study -> C1 Oncological Therapy Clinical Study -> C11 Neuroendocrine Therapy

EP-0578

Impact of Renal Function on Texture Analyses of Kidney Uptake duringPeptide Receptor Radionuclide Therapy with^{177}Lu-DOTATATE

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Aim/Introduction: The kidney is a critical target organ for peptide receptor radionuclide therapy (PRRT) with 177Lu-DOTATATE for neuroendocrine tumor patients. The damage effects may differ between patients due to renal function. Although the effects have been mainly studied by radiation exposure dose, the accumulation features by texture analyses have not been reported. This study investigated whether renal accumulation features during PRRT are altered by renal function using LIFEx feature analysis software (ver 7.5.7). ***Materials and Methods:*** Patients underwent dosimetry with four imaging sessions at 4hr, 24hr, 72hr, and 120hr after 1st PRRT. Volumes of interest (VOI) of bilateral kidneys were manually delineated, and the VOI for analysis was set with a threshold of 40% of the upper limit. Kidneys near the tumor, in which the VOI setting was difficult to delineate, were omitted from the present study. Using the LIFEx texture analysis program, we extracted texture and specific features from the images. Then, we calculated the statistical significance of differences between parameters of patients with eGFR less than or more than 60 ml/min by an Analysis of Variance (ANOVA). All pairs were compared using Tukey-Kramer HSD tests. A linear relationship was analyzed between two variables. P<0.05 were considered as significant. ***Results:*** Twenty-one patients received dosimetry, and 34 kidneys were analyzed. For all kidneys, all texture features had no

differences, but other specific features had significant differences by ANOVA: VOIIntensity-based_AreaUnderCurve, Intensity-based_EnergyIBSI, Intensity-based_RootMeanSquareIntensity, Intensity-based_TotalLesionSomatostatinReceptorExpression, and Local_Intensity_Histogram_GlobalIntensityPeak. All five features were significantly different between the four scans for kidneys with eGFR of more than 60 but not with eGFR of less than 60. Tukey-Kramer HSD tests showed values decrease steadily and significantly. Absorbed and biologically effective doses for kidneys tended to increase depending on lower renal function. ***Conclusion:*** This study found no texture feature change between the four imaging sessions in the kidneys. As for the intensity features, they decreased depending on time, but it depended on renal function. A correlation between renal function and radiation dose was also observed. It is important to recognize that renal exposure dose may increase when renal function is decreased.

EP-0579

Evaluation of the efficacy of the Lu-177 DOTATATE Treatment in Inoperable/Metastatic Paraganglioma and Malignant Pheochromocytoma

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Aim/Introduction: Our aim is to assess the efficacy of Lu-177 DOTATATE peptide receptor radionuclide therapy (PRRT) in inoperable or metastatic paraganglioma and malignant pheochromocytoma patients who have limited systemic treatment options. ***Materials and Methods:*** We retrospectively analyzed 26 patients (14 paraganglioma, 12 pheochromocytoma) treated with at least two courses of Lu-177 DOTATATE between 2010 and 2024.Eligibility criteria included increased somatostatin receptor (SSTR) expression (Krenning score ≥2) on Ga-68 DOTATATE PET imaging.Patients received an average of six treatments (range 2-13) with an average Lu-177 DOTATATE dose of 6.1 GBq (range 4.0-7.6 GBq) at 8-16 week intervals.Response was evaluated 3-6 months post-treatment using Ga-68 DOTATATE PET and RECIST 1.1 criteria.Patients were divided into two groups based on whether they received 2-4 courses (n=13) or ≥5 courses (n=13) of treatment.Kaplan-Meier analysis was performed for progression-free survival (PFS) and overall survival (OS).The relationship between histopathology, patient demographic characteristics, or the number of PRRT courses and PFS was evaluated using Chi-square test.Continuous variables between the two groups were compared using the Mann-Whitney U-test, and categorical variables were compared using Fischer's exact T-test.All statistical analyses were performed using SPSS v.29, and $p<0.05$ was considered statistically significant. ***Results:*** Nine patients were stable and four had progressive disease in 2-4 courses group, one patient showed partial response, eight had stable disease, and four progressed in ≥5 courses group. Adverse events included myelodysplastic syndrome (1 patient, 13 courses) and Grade 3 thrombocytopenia (2 patients, 8 and 5 courses).Median PFS was 29 months (15 for 2-4 courses, 42 for ≥5). Median OS was 85 months.Significant associations were found between the primary tumor type and gender ($p=0.045$) and mean SUVmax value ($p=0.031$).Furthermore, a statistically significant relationship was found between the number of PRRT courses and total lesion count ($p=0.003$), while no significant differences were found among other variables. ***Conclusion:*** Our study revealed a 66% stable disease rate and 69% disease control rate, comparable to literature, but higher progression (31%) and low objective response (4%).Study limitations include imaging-only response assessment, small sample size, no biochemical response evaluation, and heterogeneous treatments pre/post-PRRT.PRRT appears safe and beneficial for these conditions, improving PFS. However, a personalized, multidisciplinary approach is essential. Larger, homogeneous prospective studies are required to further explore PRRT's survival impact. ***References:*** Satapathy S, Mittal BR, Bhansali A. 'Peptide receptor radionuclide therapy in the management of advanced pheochromocytoma and paraganglioma:A systematic review and meta-analysis'. Clin Endocrinol (Oxf). 2019 Dec;91(6):718-727. doi: 10.1111/cen.14106. Epub 2019 Oct 13.

EP-0580

Predictive parameters of response to [177Lu]Lu-DOTA-TATE in well-differentiated neuroendocrine neoplasms

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Aim/Introduction: To evaluate the response to peptide receptor radionuclide therapy (PRRT) with [177Lu]Lu-DOTA-TATE in patients with well-differentiated neuroendocrine neoplasms (wNEN) and somatostatin receptors (STTR) overexpression based on tumor characteristics (anatomopathological, morphological and functional) and previous treatments received. ***Materials and Methods:*** Retrospective analysis of patients diagnosed with wNNE treated with [177Lu]Lu-DOTA-TATE in our centre between March/2017-July/2023. The Response Assessment (RA) to PRRT was evaluated based on the degree of tumor differentiation (G), treatment line (L) and functional parameters [Total Tumour Volume (TTV), Total Tumour Activity (TTA), Liver Tumour Volume (LTV), Liver Tumour Activity (LTA), SUVmax] calculated on the PET/CT [68Ga]Ga-DOTA-TOC (PET-SSA) pre-PRRT. Statistical analysis was performed to evaluate whether these data had an impact on progression-free survival (PFS) and overall survival (OS). ***Results:*** Seventy patients were treated (31 women, mean 59.4 years). 14p did not complete PRRT due to progression/toxicity/other. Overexpression of STTR pre-PRRT was observed using [m99Tc]Tc-EDDA/HYNIC-TOC (24p/70p) and/or PET-SSA (36p/70p). In 10p there was no access to pre-PRRT imaging. 33p/36p with PET-SSA had liver involvement. In these, the TTV/TTA/LTV/LTA/SUVmax parameters did not significantly influence RA in the Wilcoxon test, nor were significantly modified according to G. However, a high TTV/LTV meant worse PFS/OS ($p<0.05$). RA did not vary significantly depending on G or L, although a positive trend towards greater PFS/OS was identified in wNEN-G1; and PRRT in ≤2L led to better PFS/OS ($p<0.05$). ***Conclusion:*** In our cohort, better survival after PRRT was observed in patients with ≤2L, as well as with lower TTV/LTV. Trends towards a better post-treatment outcome were observed in wNEN-G1 when comparing to wNEN-G2.

Our results suggest that using PRRT in earlier stages leads to better results. TTV and LTV calculated on the PET-SSA pre-PRRT could be biomarkers of response to [177Lu]Lu-DOTA-TATE.

EP-0581

Prognostic value of the volumetric parameters measured by SSTR PET/CT in patients with neuroendocrine tumors treated with long-acting somatostatin analogues as a first line therapy

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Aim/Introduction: Somatostatin analogues (SSA) are the first treatment option (especially for disease control) for disseminated neuroendocrine tumors (NETs) with good expression of the somatostatin receptors. Despite significant progress in NET personalized management, searching for novel predictive and prognostic factors of response to systemic therapy in NET is crucial for more effective patient management including more accurate follow-up leading to better final outcomes. The aim of this study was to evaluate the predictive role of volumetric and standardized uptake values (SUVs) obtained from pre-treatment [68Ga]Ga-DOTA-SSA in the prediction of the response to SSA therapy in patients with NET. ***Materials and Methods:*** 42 patients (21 females, 21 males; age range: 46-84 years) with histologically proven metastatic NET (15 pancreas, 15 small intestine, 4 lung, 7 unknown, 1 cecum; WHO G1 13, G2 28, 1 unknown; median Ki-67 index 5%, range 1-16) receiving long-acting SSA as first-line treatment were included in the study All of them underwent [68Ga]Ga-DOTA-TATE PET/CT before receiving first dose of SSA. For each [68Ga]Ga-DOTA-TATE avid lesion, SUVmax and SUVmean were measured as well as TBR (SUVmean of tumours/metastases divided by SUVmean of normal spleen) was calculated. In addition, two volumetric parameters were counted: tumor somatostatin receptor expression volume (STV) and total lesion somatostatin receptor expression (TLD). Finally, the sum of STV (total STV, TSTV) and TLD (total TLD, TTLD) was calculated for each patient and used in the analysis. ***Results:*** At the time of analysis, 14 patients had stable disease (33.3%) and 28 patients had progressive disease (66.7%); among whom 12 died. Median progression-free survival (PFS) and overall survival (OS) were 26.5 and 46.5 months, respectively. The median SUVmax, SUVmean and TBR ratio were 38.5 (range 12.9-99.1), 21.4 (range 10.4-51.9) and 0.93 (range 0.38-3.29), respectively. The median TSTV was 41.4 cm3 (range 1.0-1446.7) and the median TTLD was and the median TTLD was 650.7 (range 10.6-16156.8). In the univariate analysis, the TBR ratio (HR=1.96, 95% CI 1.058-3.62, p=0.03) was the only parameter significantly associated with PFS. In patients with small bowel NETs, TSTV (HR=1.00, p=0.023) and TTLD (HR=1.00, p=0.026) were significantly associated with PFS in univariate analyses. No significant correlation was found between the measured volumetric parameters and OS. ***Conclusion:*** Volumetric parameters of pre-treatment 68[Ga]Ga-DOTA-TATE PET/CT may be potentially useful in prediction of the response to SSA therapy in patients with NET: higher TTLD was associated with worse outcome in patients treated with SSA in monotherapy.

EP-0582

External Exposure Dose to Carers and the Public During ^{177}Lu-PRRT for Neuroblastoma

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Aim/Introduction: To estimate the radiation dose to carers and the public from 177Lupeptide receptor radionuclide therapy (PRRT) for pediatric neuroblastoma patients and determine the duration of contact restrictions, aiming to provide a crucial reference for relevant radiation protection measures. ***Materials and Methods:*** A retrospective study was conducted to collect data from 18 pediatric neuroblastoma patients, aged (6.72±2.72) years, who received 177LuDOTATATE treatment at the Nuclear Medicine Department from June 2023 to July 2023. After administration, the dose rate (DR) around the patients was measured using a nuclear radiation monitoring dosimeter at 0, 0.1, 0.5, 1, and 2 meters from the patients at 1, 4, 24, 48, and 96 hours. And then, we delineated the wholebody ROI. Subsequently, curve regression fitting was performed using a biexponential function model. By incorporating hypothesized social contact durations, we estimated the cumulative radiation doses received by family members and the public through contact with patients. ***Results:*** The 177Lu-DOTATATE administration dose was (4353.42±1451.51) MBq. All patients were discharged 24 hours after 177Lu-DOTATATE administration. At discharge, patients had excreted (76.70±3.99)% of the administered activity, and DR at 0.1, 1, and 2 meters from the patients were (32.74±6.98), (4.07±1.45), and (1.22±0.51) μSv/h, respectively. After discharge, the radiation doses to carers from children aged 25 years and 513 years were (2.47±1.80) mSv and (0.88±0.47) mSv, respectively. The contact restriction period for sleeping with family members was 2 days, and 1 day for contact with other children. On the day of discharge, patients should limit their time on public transportation within 4 hours and do not need to restrict private transportation. ***Conclusion:*** To ensure that the total effective dose equivalent (TEDE) remains within the safety limits stipulated by current regulations, it is necessary to implement contact restrictions for patients' family members and the general public. After implementing preventive measures, 177LuDOTATATE emerges as a safe radionuclide therapeutic option.

EP-0583

^{177}Lu-Octreotide SPECT/CT Dosimetry in Predicting PRRT Efficacy and Adverse Reactions in Children with High-Risk Neuroblastoma

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Aim/Introduction: To establish dosimetry predictors for therapeutic response and adverse effects following 177Lu-labeled Peptide Receptor Radionuclide Therapy (PRRT) in pediatric patients with high-risk neuroblastoma, utilizing 177Lu-Octreotide SPECT/CT imaging. ***Materials and Methods:*** A prospective study enrolled pediatric patients with high-risk neuroblastoma scheduled for 177Lu-PRRT. Post-treatment, multi-timepoint whole-body imaging and 24-hour chest-abdomen SPECT/CT scans were performed. Hermes 3.0 software was utilized to measure the cumulative absorbed dose (CAD) in target lesions (up to 5 "hot" lesions) and critical organs. Therapeutic response was evaluated based on pre- and post-treatment 18F-SSTR PET imaging, while

adverse effects in critical organs were assessed using CTCAE 5.0 criteria. Logistic regression was applied to assess the correlation between dosimetry parameters, hematological indices, osseous tumor volume (OTV), and both therapeutic response and adverse effects. The predictive performance was evaluated using the area under the curve (AUC). ***Results:*** 25 patients received 1-2 cycles of 177Lu-PRRT, achieving a cumulative absorbed dose (CAD) of 2.79Gy in target lesions and ranging from 1.88 to 9.70Gy in critical organs. Therapeutic response was evaluated in 99 target lesions from 22 patients, revealing disease control rates of 54.54% for patients and 83.83% for lesions. The only adverse effect observed was myelosuppression. CAD in target lesions correlated with therapeutic response, and both CAD1cycle and CAD2cycles showed predictive value for treatment response (AUC=0.845 and 0.800, respectively). No association was found between bone marrow CAD and myelosuppression. Pre-treatment osseous tumor volume (OTV) and hemoglobin were identified as independent risk factors for grade 3-4 thrombocytopenia and anemia, with predictive accuracies of 0.793 and 0.813, respectively. ***Conclusion:*** Dosimetry measurements of CAD in target lesions post-177Lu-PRRT, combined with pre-treatment OTV and hemoglobin levels, effectively predict therapeutic response and adverse effects in pediatric patients with high-risk neuroblastoma receiving PRRT.

EP-0584

Safety and Dosimetry of [^{177}Lu]Lu-DOTA-TATE in Adolescent Patients With Somatostatin Receptor-Positive Gastroenteropancreatic Neuroendocrine Tumors or Pheochromocytomas and Paragangliomas

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Aim/Introduction: Adolescent patients with gastroenteropancreatic neuroendocrine tumors (GEP-NET) or pheochromocytomas/paragangliomas (PPGL) diagnosed with advanced disease have limited treatment options. The ongoing phase 2 NETTER-P study (NCT04711135) evaluates the safety and dosimetry of the radioligand therapy, [177Lu]Lu-DOTA-TATE (177Lu-DOTATATE), in adolescent patients with somatostatin receptor-positive (SSTR+) GEP-NET or PPGL. ***Materials and Methods:*** Enrolled patients were aged 12-17 years, with advanced, inoperable, SSTR+, GEP-NET (Grade 1 or 2) or PPGL. Treatment schedule was ≤4 cycles of 177Lu-DOTATATE (4×7.4 GBq) administered every 8±1 weeks. Amino acid solution was given for renal protection. Safety was assessed during treatment and follow-up. Dosimetry and pharmacokinetic assessments were performed during Week 1 after the first cycle (C1) of 177Lu-DOTATATE (or after C2 if not feasible after C1). Primary endpoints were incidence of adverse events (AE) and laboratory toxicities during C1 of 177Lu-DOTATATE, and absorbed radiation dose in target organs (kidney and bone marrow). ***Results:*** At the time of this analysis, 9 patients were treated (median age 15 years [range: 13-16]; GEP-NET, n=4; PPGL, n=5). Overall, 8/9 patients experienced ≥1 AE during C1 of 177Lu-DOTATATE (considered treatment-related in 7 patients). The most common AEs were headache (n=4) and fatigue (n=3). AEs of special interest during C1 were reported in 5/9 patients (hematotoxicities [n=3], nephrotoxicities [n=1], cardiovascular and electrolyte disorders [n=1]). All patients experienced ≥1 AE during the overall treatment period. Treatment-related AEs were reported in 8 patients; none were considered serious. No deaths or AEs leading to treatment discontinuation were reported. In patients evaluable for dosimetry (n=8), estimated mean (standard deviation [SD]) cumulative absorbed dose for 4 cycles of 177Lu-DOTATATE was 23 (8.5) Gy in the kidneys and 0.79 (0.16) Gy in the bone marrow (by blood). Estimated mean (SD) cumulative tumor absorbed dose was 76 (35) Gy in GEP-NET (n=8) and 27 (20) Gy in PPGL (n=6). 177Lu-DOTATATE blood pharmacokinetic analysis (n=9) showed a bi-exponential clearance with a rapid first phase until 24 hours and a slower second phase until 72 hours post-administration. Population pharmacokinetic model-derived parameters of 177Lu-DOTATATE in adolescents were comparable with those derived for adults with GEP-NET. All adolescent results, except tumor dosimetry, were consistent between GEP-NET and PPGL cohorts. ***Conclusion:*** No new safety signals were identified to date in 9 adolescents with SSTR+ GEP-NET or PPGL treated with 177Lu-DOTATATE. The estimated cumulative absorbed doses of 177Lu-DOTATATE were comparable with those observed in adults. Funded by Advanced Accelerator Applications, a Novartis company.

EP-0585

Real-world efficacy and safety of re-treatment with [177Lu]Lu-DOTA-TATE in patients with neuroendocrine tumors (NETs)

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Aim/Introduction: The established efficacy and safety of [177Lu]-DOTA-TATE in metastatic gastroenteropancreatic neuroendocrine tumors (GEP-NETs) and bronchial NETs (G1, G2) have paved the way for exploration into re-treatment ([177Lu] RR-PRRT) safety and efficacy, an area with limited available data.This study aims to evaluate the safety and efficacy of [177Lu] RR-PRRT in patients with progressive GEP-NETs or lung NETs following standard-dose PRRT. ***Materials and Methods:*** A retrospective multicenter study conducted from July 2018 to October 2023 involved 31 patients. Tumor characteristics, treatment history, outcomes, and adverse events (AEs) were comprehensively analyzed. ***Results:*** The cohort comprised 61.3% males, with predominant tumor locations in the intestinal (58.1%), pancreatic (22.6%), and lung (16.1%) regions. NETgrades included 32.3% NET-G1, 51.6% NET-G2, and 16.1% NET-G3. Predominant metastatic locations were the liver (90.9%), lymph nodes (64.5%), bone (45.2%), peritoneum (35.5%), and lung (12.9%). Treatment lines varied, with 6.5% in the first, 41.9% in the second, 35.5% in the third, 6.5% in the fourth, and 9.7% in the fifth. Previous treatments included 90.3% somatostatin analogs (SSA), 25.8% everolimus, 22.6% chemotherapy, 16.1% tyrosine kinase inhibitors (TKI), and 6.5% other modalities. The overall response rate (ORR) to initial PRRT was 54.8% partial

response (PR) and 45.2% stable disease (SD), with 100% clinical benefit. Progression-free survival (PFS) post-PRRT was notable at 29.37 months (range 13.8-120.67). Notably, 19.3% received more than one line of treatment between PRRT and RR-PRRT. Response to RR-PRRT revealed an ORR of 4.5% and a disease control rate (DCR) of 59.1%. With a median follow-up of 25.8 months, PFS RR-PRRT was 11.5 months (95% CI, 9-14), and OS RR-PPRT was 27.7 months (95% CI, 14.7-40.6). RR-PRRT-associated AEs (grade 3-4) included thrombocytopenia (12.9%), lymphopenia (9.7%), anemia (6.5%), and leukopenia (3.2%). Importantly, no nephrotoxicity was observed during RR-PRRT. ***Conclusion:*** [177Lu] RR-PRRT in progressive GEP-NETs or lung NETs post standard-dose PRRT demonstrated favorable efficacy with manageable AEs.

EP-0586

Sequence of cancers - GEP NET

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Aim/Introduction: With longer patient survival, secondary, tertiary, etc. neoplasms are increasingly relevant to patient care and quality of life. However, are there any specific neoplasms following or primordial cancers leading to GEP NETs that we should or could be aware of when treating patients? ***Materials and Methods:*** We searched the SEER Research Plus Data, 8 Registries, Nov 2023 Sub (1975-2021), released April 2024, based on the November 2023 submission. We limited our search to patients with a GEP NET at any time in their history regardless of sequence and considered any tumor during their lifetime. ***Results:*** A total of 4323 patients was included, median age 62 years, 2389 male, 1934 female. The most common site for the primary was the small intestine (1095), followed by the rectum (905), stomach (436), pancreas (423), appendix (221), cecum (150) and sigmoid colon (132). The most common secondary neoplasia's were prostate (546) and breast cancer (383) followed by recurrent NET in the small intestine (402), rectum (255), stomach (265) and pancreas (213) as well as lung and bronchial cancer (361) and kidney cancer (163) This pattern is similar for tertiary and quaternary cancers although on a significantly lower level: small intestine 86 and 8, stomach 76 and 22, prostate 103 and 27, breast cancer 129 and 30. Histologic variation was significantly lower when compared to other cancer with 8240/3 and 8140/3 being the type of about 90% of all neoplasia's considered. ***Conclusion:*** GEP NETs show little histologic variance with regard to consecutive cancers. They recur most commonly in the gastrointestinal tract. For most patients the GEP NET is their first primary, the secondary and consecutive tumors are either common place like breast and prostate cancer or recurrences of GEP NETs in a different location.

EP-0587

^{177}Lu-DOTATATE in patients with well-differentiated neuroendocrine tumors and skeletal metastases: A single-centre experience

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Aim/Introduction: Peptide receptor radionuclide therapy (PRRT) with 177Lu-DOTATATE has emerged as a mainstay in the treatment of advanced well-differentiated neuroendocrine tumors (WD-NETs). Bone metastases have been known to portend a poor prognosis in patients with WD-NETs. However, there is scarce literature on the role of 177Lu-DOTATATE PRRT in such cases. Here, we report our institutional experience with 177Lu-DOTATATE in patients of WD-NETs with skeletal metastases. ***Materials and Methods:*** This was a retrospective, single centre study. Data of consecutive patients of advanced WD-NETs with skeletal metastases treated with 177Lu-DOTATATE, between 2014 and 2021, were collected and analyzed. The various outcome measures included objective response rate (ORR), disease control rate (DCR), and overall survival (OS). ***Results:*** Of the 310 patients treated with 177Lu-DOTATATE PRRT at our centre, 77 patients (median age: 62 years, range: 26-79) having WD-NETs with skeletal metastases were included in this study. Gastrointestinal NET was the most common site of primary (30/77, 39%), followed by pulmonary carcinoid (17/77, 22%) and pancreatic NET (12/77, 16%). 18 (23%) patients had unknown primaries. Tumor grades were available in 65 patients, of which, 25 (38%) patients had grade 1, 33 (51%) patients had grade 2, and 7 (11%) patients had grade 3 NETs. Apart from the skeletal involvement, liver and lung metastases were also seen in 62/77 (81%) and 38/77 (49%) patients, respectively. Prior treatments included somatostatin analogues in 57 (74%) patients, everolimus in 9 (12%) patients, and cytotoxic chemotherapy in 30 (39%) patients. The patients received a median cumulative activity of 16.7 GBq (range: 5.55-44.4) of 177Lu-DOTATATE over a median of 3 cycles (range: 1-7). Radiographic responses were available for 50 patients, of which 8 (16%) patients had partial response, 34 (68%) had stable disease, and 8 (16%) had progressive disease. The ORR was 16% while the DCR was 84%. The patients were followed up for a median duration of 26 months during which 28 (36%) patients expired. The median OS was estimated to be 45 months (95% CI: 40-50). ***Conclusion:*** 177Lu-DOTATATE PRRT showed clinically meaningful responses and survival in patients of WD-NETs with skeletal metastases, despite such patients having an adverse prognosis. With the advent of targeted alpha therapy having high linear energy transfer, future studies exploring the same are expected to result in better outcomes for such patients.

EP-0588

Safety and efficacy of ^{177}Lu DOTATATE Peptide Receptor Radionuclide Therapy (PRRT) in progressive gastro-entero-pancreatic (GEP) Neuroendocrine Tumour (NET)

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Aim/Introduction: Patients with GEP NET who retain adequate somatostatin receptor (SSTR) expression upon progression after initial response to PRRT are amenable to re-treatment PRRT (R-PRRT). We aim to assess the safety and efficacy of R-PPRT in progressive metastatic GEP NET. ***Materials and Methods:*** A retrospective analysis was performed in patients with GEP NET who received R-PRRT with 177Lu-DOTATATE for symptomatically and/or radiologically progressive disease. Renal and haematological parameters at 3 months post initial PRRT (I-PRRT) were compared to each subsequent R-PRRT to assess the safety defined by common terminology criteria for adverse events (CTCAE). Molecular imaging response was evaluated on 68Ga-DOTATATE (GaTate) PET/CT on pre-defined criteria. RECIST 1.1 measurements 3 months post R-PRRT were documented when available. ***Results:*** A total of 63 patients had R-PRRT (R1) with 177Lu-DOTATATE (1-2 cycles). Majority (76%) had G2 NET followed by G1 (14%). Of the 63, 55% had intestinal primary. A second R-PRRT (R2) course was administered in 20 patients and 6 patients had a third R-PRRT (R3) course. No worsening of renal function occurred following R1. Following R2, worsening GFR from CTCAE G2 to G3 was seen in 2/20, with no GFR deterioration following R3.

No G3/4 haematological toxicity was observed after R1 or R2, but 1 G3 thrombocytopenia occurred following R3. Myelodysplastic syndrome (MDS) was diagnosed in 3 patients 18, 23 and 36 months after I-PRRT while 1 patient developed AML 10 years post I-PRRT. After I-PRRT the overall evaluable RECIST 1.1 responses CR, PR, SD, and PD were observed in 2%, 45%, 49% and 4% of patients, respectively (disease control rate - DCR 96%). Following R1, this was 0%, 10%, 76%, and 14% (DCR 86%), respectively. DCR on GaTate PET/CT was 59/60 (98%) after I-PRRT and 52/58 (89%) post R1-PRRT. The risk difference was 9% (95% CI: -2, 20). Median overall survival (OS) from I-PRRT was 6.0 years (95% CI: 4.7,7.5). Median progression free survival (PFS) from R1-PRRT was 1.6 years (95% CI: 1.2-2.3). ***Conclusion:*** R-PRRT is feasible and efficacious upon progression of SSTR expressive GEP NET following response to I-PRRT without a significantly increased risk of toxicity.

EP-0589

The Clinical Utility of Receptor Metabolic Response Evaluation Based on Somatostatin Receptor Imaging (SRI), in Patients with Advanced, Non-resectable, Progressive GEP-NET after Combine Radioligand and CAPTEM therapy.

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Aim/Introduction: Prospective, single-arm, open-label, case series study with assessment of response using somatostatin receptor imaging (SRI) after combined radioligand (RLT) and CAPTEM in therapy of advanced, unresectable progressive GEP-NET (NCT04194125). The aim of the study was evaluation of utility of SST receptor (SSTR) metabolic response on combine therapy based on somatostatin receptor imaging (SRI) in follow-up studies. SRI locally assessed. ***Materials and Methods:*** Nineteen patients in group of 21 treated subjects between 18.02.2019 to 01.04.2024 included into analysis, two of them exclude due to rapid disease progression (DP). All patients with confirmation of GEP-NETs, as advanced, non-resectable, DP. Combine therapy RLT (177Lu DOTATOC) and CAPTEM used in all. NETG1=8, G2=10, G3=1. Disease status and treatment efficiency were evaluated by clinical assessment; biochemical response, ORR (RECIST) and also changes of SSTR expression based on cyclic SRI, which utilized standard SUV of TLR (Tumor to Liver Ratio) of combine therapy. The measurement was performed in target lesions the median TLR was calculated in each follow-up study up to clinical or imaging DP. ***Results:*** Pancreatic n=13, midgut n=6. During clinical and RECIST follow-up of 60 months 7 subjects had still partial response PR or stabilization SD; overall DCR=37%, rest of them had progression (DP). PFS for all subjects 31.5 months (IQR 16.0-nr), pancreas PFS=28.0 (14.0-nr), midgut PFS=31.5 (24.5-nr). Analysis of TLR as metabolic SSTR response indicated drop of activity compared to initial SRI (before therapy) TLR=7.7 (IQR 4.7-10.4) and first follow-up SRI after 3 Months TLR=3.3 (IQR 1.7-5.9). Subjects who developed DP were noted increase TLR=4.3 (3.4-7,9), compare to those who had DCR noted further drop of TLR=1.5 (1.0-3.6).The separate analysis in group of subjects who had DP the initial TLR=7.9 (IQR 4.9-11.3) after 3M of follow-up TLR=3.6 (3.1-6.4) and after documented DP further increase TLR=4.3 (3.8-7.9).In those with PR or SD (DCR) initial TLR=6.4 (IQR 4.7-10.1) vs. follow-up after 3M TLR=1.49 (IQR 1.2-5.9) and then TLR=1,47 (IQR 1.0-3.6), during whole follow-up with no increase of TLR indicate receptor metabolic SD or PR. ***Conclusion:*** Combine therapy is effective in advance pancreatic and midgut NET in terms of improvement of PFS. Receptor metabolic response could be potentially used when standard RECIST evaluation is difficult to assessed or the results of response are uncertain. In those subjects with DCR we noted decline of TLR from initial value in those with DP after initial drop of TLR further increase of TLR noted during follow-up.

EP-0590

Post-therapy Dosimetry in Patients with GEP-NETs Treated with ^{177}Lu-oxodotreotide: a Preliminary Evaluation

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Aim/Introduction: Radioligand therapy with lutetium-oxodotreotide (177Lu-RLT) is approved for patients with advanced, well-differentiated (G1-G2), gastro-entero-pancreatic neuroendocrine tumours (GEP-NETs) that progress on cold somatostatin analogues. The approved approach of using a fixed activity of 7.4 GBq infusions of 177Lu-RLT in four cycles is safe but not necessarily the most effective. This regimen is far from a personalized medicine and may lead to under or over treatments. The aim of the study was to perform a post-treatment dosimetry in a cohort of GEP-NET patients with a heterogeneous disease extension, treated with 177Lu-RLT. ***Materials and Methods:*** Twenty GEP-NET patients (12 females; median age: 64 years, range 36-81) who underwent a standard 177Lu-RLT regimen (7.4 GBq infusions every 8 weeks) were included. Post-therapy dosimetry based on EANM 2022 guidelines was performed after each 177Lu-RLT cycle. Absorbed dose (Gy) was calculated by convolution of cumulated activity with 177Lu-VSV kernel. MIM MRT SurePlan was used for dose calculation. Clinical response was evaluated with 68Ga-DOTATOC PET/CT 4-6 months after the end of the treatment and with a follow-up evaluation. ***Results:*** Among the included patients, 12 had liver metastases plus node metastases in 11 of them, 5 liver, node and bone metastases plus lung and brain lesions in one of them, 2 both liver and peritoneal lesions plus node metastases in one of them, while one only node metastases. None of the patients reported clinically relevant toxicity except one case of myelodysplasia. The median cumulative tumours absorbed dose was 108 Gy (range 25 -361), with 50% of patients receiving <100 Gy in most lesions. No patients reached the dose limits to bone marrow or kidneys. The clinical response rate was 50% of partial response, 30% of stable disease, and 20% of progressive disease. The median duration of response was 12 months (range 4-36). Two patterns of tumours adsorbed dose were identified: the first showing high adsorbed doses after the first 177Lu-administration, significantly reduced on the other cycles (associated to a better clinical response), and the second presenting initial low adsorbed doses and remaining low in the following cycles (with a worse clinical response). ***Conclusion:*** 177Lu-RLT is an effective and well-tolerated treatment for GEP-NET patients. However, there is a high heterogeneity in the tumours absorbed doses using the current standard regimen. A personalized dosimetry is crucial to optimize 177Lu-treatment strategy, increase the response rate and duration.

EP-0591

Navigating nephrotoxicity: insights from 4 years of [^{177}Lu]Lu-DOTA-TATE therapy at our institution

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Aim/Introduction: Despite renal damage being described as a potential adverse effect of [177Lu]Lu-DOTA-TATE therapy, most research reported low nephrotoxicity. We conducted a single center, retrospective, observational study to assess potential renal damage in patients treated with [177Lu]Lu-DOTA-TATE. ***Materials and Methods:*** A total of 42 patients with neuroendocrine neoplasia (NEN) were submitted to therapy with [177Lu]Lu-DOTA-TATE from 2020 onwards were selected. Potential risk factors were evaluated (age >65 years, previous kidney disease, diabetes mellitus, arterial hypertension, previous chemotherapy or peptide receptor radionuclide therapy). Renal function assessment, including serum creatinine (Cr), blood urea nitrogen and eGFR (calculated using CKD-EPI Creatinine Equation - 2021) was performed before and 5-6 weeks after each cycle and, at least, >3 months after the last cycle. Every patient received an amino acid perfusion before each [177Lu]Lu-DOTA-TATE administration. Renal toxicity was graded according to the Common Terminology Criteria for Adverse Events (CTCAE v.5.0). ***Results:*** Of the 42 selected patients, 12 were excluded due to lack of access to clinical data, premature interruption of treatment on account of disease progression and non-kidney related complications. Of the included 30 patients, 16 were male and 14 were female. The mean age was 64 years (31-79 interval). The mean administered activity and number of cycles were 800mCi (600-1200mCi) and 4 cycles (3-6), respectively. At baseline, the mean Cr level was 0.815 (0.52-1.21) and the post-therapy mean Cr level was 0.825 (0.46-1.56). Of the 30 patients included, 6 had G1 (CKD) and 1 had G2 chronic kidney disease (CKD) at baseline. None of these had any meaningful deterioration in renal function, while 3 others developed G1 CKD. No other patient developed G2 or worse nephrotoxicity. ***Conclusion:*** Despite the limitations inherent to this study, namely its retrospective nature, low patient number and relying on eGFR, our results are consistent with previous research reported in the literature, showing minor renal toxicity associated to [177Lu]Lu-DOTA-TATE therapy, making it a safe and important therapeutic option managing patients with NEN. ***References:*** - Bergsma H, Konijnenberg MW, van der Zwan WA, et al. Nephrotoxicity after PRRT with (177)Lu-DOTA-octreotate. Eur J Nucl Med Mol Imaging. 2016;43(10):1802-1811. doi:10.1007/s00259-016-3382-9 - Baum RP, Fan X, Jakobsson V, et al. Long-term Nephrotoxicity after PRRT: Myth or Reality. Theranostics. 2024;14(2):451-459. Published 2024 Jan 1. doi:10.7150/thno.92487.

EP-0592

Analysis of factors associated with discontinuance of therapy with [^{177}Lu]Lu-DOTATATE in patients with tumors of neuroendocrine origin

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Aim/Introduction: To identify patient-related factors or related to their clinical history, in addition to those related to the primary tumor that are associated with discontinuance of [177Lu]Lu-DOTATATE therapy in patients with neuroendocrine tumors (NETs). ***Materials and Methods:*** Retrospective study of 82 patients with NETs of various primary origins (32 gastrointestinal, 29 pancreatic, 13 pulmonary, and 8 of other origins) who have been treated with [177Lu]Lu-DOTATATE between 2015-2023. The variables analyzed were: age, grade, ki67, mitotic index, primary tumor location, functionality, lines of treatment previously received (surgery, somatostatin analogues, chemotherapy, everolimus, QUETA). Statistical analysis was performed by the chi square test. ***Results:*** 82 patients with TNEs treated with [177Lu]Lu-DOTATATE with a mean age 59.95±11,46 years; 53,7% male and 15,3% functionals. Sixty-five of these patients completed the 4 cycles of treatment versus the remaining 17 who had to discontinue treatment. Patient-related factors such as age, sex, years of evolution of the disease, did not show a statistically significant association with discontinuance of treatment with [177Lu]Lu-DOTATATE. Tumor-related factors including location of the primary tumor, grade, ki67, mitotic index or functionality did not show a statistically significant association with the interruption of therapy. More than 2 lines of treatment received before radioligand therapy was the only factor associated with an increased risk of discontinuance of [177Lu]Lu-DOTATATE therapy (OR: 4,81; p=0,034). ***Conclusion:*** The lines of treatment received before therapy with [177Lu]Lu-DOTATATE seems to be an important feature to determine the outcome of the therapy. Earlier administration of radioligand therapy with [177Lu]Lu-DOTATATE is associated with a lower rate of treatment interruption.

EP-0593

Hematologic toxicity in real life population of patients treated with 177Lu-Dotatate: incidence and dosimetric correlation.

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Aim/Introduction: Hematologic toxicity (HT) in RLT is determined by irradiation of the bone marrow (BM) (aspecific binding or by skeletal metastases), renal function, gender, age, BM reserve and genetic. In NETTER1 study, predominantly mild and reversible HT (nadir 4-6 weeks after administration) was recorded. Grade 3/4 thrombocytopenia and/or leukopenia were observed in 2% and 1% of cases; long-term HT occurred with almost negligible frequency. This retrospective study compared HT incidence in real life with that of Netter1 study and evaluated the correlation between absorbed dose (AD) at BM and Spleen and HT incidence. ***Materials and Methods:*** Fifty-two patients (34M, 18F, mean age 64.4 ys, KPS>60, adequate renal, haepatic and BM functions) with metastatic or locally advanced unresectable GEP-NET G1-2 progressive during SSA, with high somatostatine receptor expression, have been treated. 177Lu-Dotatate was administered every 8 weeks (4x7.4 GBq); activity has been halved in 1 pt and infusion delayed in 2 pts. Treatment was discontinued in 2pts for nonhaematological serious adverse event. Blood count checks were performed: baseline, -7 days and +30 days from each administration, +90 days from the last administration, every 180 days in the FU (minimum duration 6 months). BM AD was calculated with the MIRD-Olinda Model (based on blood samples every 2h from administration to discharge and at 96h). Spleen AD was calculated with MIRD-Sphere Model (based on SPECT/CT at 24-48-96h). ***Results:*** HT occurred in 19% of cases; lymphopenia G1-2 5% and G3-4 0% (vs 1%) and thrombocytopenia G1-2 21%

and G3-4 0% (vs 2%). G3-4 HT observed frequency was lower than expected, probably due to the sample size. No statically significant difference was found in term of HT incidence, for each grade. In the two groups without and with HT (any G and duration) a significant difference is observed for AD at the Spleen (pzTE+ 22.5 Gy; pzTE- 15.7 Gy p=0.002) with a cutoff value at the ROC curve of 16.4 Gy, while not significant for the AD at the BM (pzTE+ 0.87 Gy; pzTE- 0.80 Gy p=0.06). ***Conclusion:*** HT in real-life population is confirmed rarely severe and transient; however the risk of lasting BM damage remains an attentioned topic in course of RLT, with a view to reprocessing, dose personalization, first line use for the possible reduction of BM reserve in anticipation of subsequent myelotoxic lines. A significant role could be played by Spleen AD in identifying patients at risk of HT.

EP-0594

DUONEN trial - step towards personalized treatment of neuroendocrine tumors - RLT based on the individual dosimetry.

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Aim/Introduction: Radioligand therapy (RLT) is usually used as a second or third line of therapy for gastroeneropancreatic neuroendocrine tumors (GEP-NETs). Optimisation of RLT may include increasing efficacy and reducing side effects. Heterogeneity of tumor cells and different tumor burden may limit the effectiveness of standard, fixed-radioactivity RLT.Individualised RLT based on dosimetry seems to be a promising approach to increase its efficacy. ***Materials and Methods:*** Adult patients with advanced, unresectable, progressing, well-differentiated (G1/G2) GEP-NETs are randomized into four arms:- A: treated with [177Lu]Lu-DOTATATE with fixed radioactivity of 7400 MBq/cycle,- B: treated with a combination of [177Lu]Lu-DOTATATE and [90Y]Y-DOTATATE initially in a ratio of 3700:1850 MBq/MBq, and dosimetry-based modification of [90Y]Y-DOTATATE radioactivity in subsequent cycles,- C: treated with a combination of [177Lu]Lu-DOTATATE and [90Y]Y-DOTATATE like arm B, and dosimetry-based modification of [177Lu]Lu-DOTATATE radioactivity in subsequent cycles,- D: treated with [177Lu]Lu-DOTATATE initially with radioactivity of 7400 MBq, and dosimetry-based modification of [177Lu]Lu-DOTATATE radioactivity in subsequent cycles.In each case, the individual dosimetry of kidney and bone marrow is performed. Radioactivity adjustment in subsequent cycles is made to reach 23 Gy renal and/or 2 Gy bone marrow dose limits for a full four-cycle RLT. ***Results:*** To date, 40 patients (10 per arm) have been enrolled in the study and started RLT. Totally 97 RLT cycles were administered, including 59 fixed-radioactivity (i.e. the first administration in each arm and the subsequent administration in arm A).Of the 38 cycles requiring radioactivity adjustments, 17 were escalated and 21 were reducted.The mean kidney absorbed dose in cycles with fixed radioactivity of [177Lu]Lu-DOTATATE was 4.92 (± 1.3) Gy/cycle (i.e. 19.68 Gy/RLT) and in cycles with [177Lu]Lu-DOTATATE escalation was 5.78 (± 0.9) Gy/cycle (i.e. 22.26 Gy/RLT) which was close to the target value of 23 Gy/RLT.In patients in whom in the first cycle the combination of [177Lu]Lu-DOTATATE and [90Y]Y-DOTATATE was used the mean kidney absorbed dose was 8.86 (± 5.0) Gy/cycle (2.95 Gy from [177Lu]Lu-DOTATATE and 5.91 Gy from [90Y]Y-DOTATATE). The absorbed dose of 0.5 Gy/cycle in the bone marrow was exceeded only in one case (arm C). ***Conclusion:*** The individual dosimetry may identify patients (particularly those treated with [90Y]Y-DOTATATE) who are at higher risk of exceeding renal dose limits. In selected cases, RLT adjustment allows for higher radioactivity of radiopharmaceuticals, potentially increasing the efficacy of RLT. ***References:*** The study is funded by the Polish Medical Research Agency (Project number 2019/ABM/01/00077-00).

EP-0595

Use of ^{177}Lu-DOTATATE in the treatment of advanced Olfactory Neuroblastoma

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Aim/Introduction: To determine if Lutathera could be an effective treatment of advanced Olfactory Neuroblastoma.Olfactory neuroblastoma (ON), also known as esthesioneuroblastoma, is a rare malignant neuroendocrine disease which arises from the olfactory epithelium and accounts for approximately 2% of all sinonasal tumors with an incidence of 0.4 per million population. In patients with locoregional disease, the standard treatment is with surgery, with best results using a combination of surgery and radiation. For patients with advanced and metastatic disease systemic treatment have been used, however, it remains unclear if systemic treatment improves outcomes. ON tumors are known to overexpress the somatostatin receptor type 2 (SSTR2), therefore, 68Ga-DOTATATE PET/CT is often used to evaluate extent of disease. Given these tumors express SSTR2 and demonstrate robust DOTATATE uptake on PET, it is hypothesized that these patients may respond to 177Lu-DOTATATE (Lutathera). ***Materials and Methods:*** Retrospective case review of patients with advanced metastatic ON with positive DOTATATE PET/CT scans, who then completed a full course of 4 cycles of Lutathera. ***Results:*** Out of 17 patients with positive DOTATATE PET scans, 10 patients went on to receive Lutathera, and 6 patients completed the full course of 4 cycle. For each patient, 4 target lesions were identified and used to measure SUVmax both before, and after, receiving the full course of Lutathera. SUVmax from target lesions was then recorded and normalized using background liver activity to give SUVc (SUVcorrected). Pre-treatment minus post-treatment mean SUVc was equal to 3.44 with a 95% confidence interval from 1.99 to 4.89. With n of 20, results of a paired t test yielded statistical significance with a p value of < 0.0001. ***Conclusion:*** Our findings show that treatment with a full course of Lutathera significantly reduced SUVc of target lesions in patients with 68GaDOTATE PET positive, advanced Olfactory Neuroblastoma. Therefore, Lutathera may prove to be an effective therapeutic in the treatment of advanced Olfactory Neuroblastoma. ***References:*** Cranmer, Lee D et al."Chemotherapy

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EP-0596

Quantitative SPECT/CT is predictive of 6-month RECIST response in midgut neuroendocrine tumors treated with 177Lu-DOTATATE

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Aim/Introduction: Peptide receptor radionuclide therapy (PRRT) with radiolabeled somatostatin analogs, such as 177Lu-DOTATE, has become an established second-line treatment for patients with advanced small intestine neuroendocrine tumors (siNET). Treatment efficacy is often delayed and assessed 6-12 months after the end of treatment based on RECIST criteria. Posttherapeutic scintigraphy can be performed after each cycle but its usefulness in treatment follow-up has not been evaluated. The aim of this study is to assess whether quantitative posttherapeutic scintigraphy is of value in predicting response to treatment, focusing on the evolution of SUV between the first (C1) and the second (C2) cycle. ***Materials and Methods:*** All patients with siNET referred to our center for treatment with 177Lu-DOTATATE were analyzed. The SUVmax of the lesion with the greatest uptake was measured on the post-therapy quantitative SPECT/CT at C1 and C2. ΔSUVmax was calculated. The 6-month PRRT response was evaluated quantitatively using the RECIST 1.1 percentage. Linear regression between ΔSUVmax and RECIST percentage was used. ***Results:*** Twelve consecutive patients with progressive metastatic siNET were included. One patients was in partial response at 6 months (-32.0%), the other were considered as stable (percentage ranging from -15.0% to 18.0%). ΔSUVmax was strongly linked to 6-month RECIST percentage ($p<0.001$) with the following formula : 6-month RECIST = -0.05 + 0.36 x ΔSUVmax. Out of the 3 patients with a positive RECIST percentage at 6 months, 2 progressed on long-term follow-up. No progressive disease was reported if the 6-month RECIST percentage was negative. ***Conclusion:*** We report a significant link between ΔSUVmax on post PRRT quantitative SPECT/CT and 6-month RECIST percentage in patients with siNET. Quantitative imaging would thus make it possible to detect the long-term efficacy of PRRT as early as C2. This study needs to be confirmed on a larger population.

EP-0597

Safety of [^{177}Lu]Lu-oxodotreotide in gastroenteropancreatic neuroendocrine (GEP-NET) patients. Experience in our hospital.

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Aim/Introduction: [177Lu]Lu-oxodotreotide is a radiopharmaceutical indicated for the treatment of somatostatin receptor-positive neuroendocrine tumours (NETs).The aim of the study was to evaluate adverse drug reactions (ADRs) and the safety of this treatment during infusion and post-administration of the radiopharmaceutical in our centre.This study will allow us to incorporate a pharmacovigilance programme in our Unit. ***Materials and Methods:*** 77 patients were treated with [177Lu] Lu-oxodotreotide (52 males and 25 females; average age 60.5±13.8 years).25 patients had NETs pancreas (G1=1, G2=14, G3=10), 19 intestinal (G1=5, G2=12, G3=2), 15 ileal (G1=10, G2=5), 8 in lungs (5 atypical and 3 typical carcinoids), 3 patients had paraganglioma, 1 duodenal (G2), 1 rectum (G2), 1 had pheochromocytoma, 1 meningioma and 1 thymic.2 patients had NETs of unknown primary.All of these patients had SSTR-overexpressing, histologically confirmed neoplasm.The treatment regime consists of 4 infusions of 7.4GBq doses spaced 8 weeks apart.[177Lu]Lu-oxodotreotide was administered by slow intravenous infusion over approximately 30 minutes.For renal protection purpose, an amino acid solution was administered intravenously during 6 hours, 30 minutes prior to the start of [177Lu]Lu-oxodotreotide infusion.Adverse reactions for all patients were registered during, just after each administration and between each cycle. ***Results:*** 54 patients (70.1%) completed 4 cycles.23 did not complete treatment:11 due to progression (47.8%), 8 due to severe haematological toxicity (34.8%), 2 due to exitus (8.7%), 1 due to diarrhoea and vomiting (4.3%) and 1 (4.3%) decided to leave treatment.During and just post radiopharmaceutical administration 24 patients (31.2%) had ADRs.The most common ADRs were gastrointestinal (59%), followed by facial flushing (29.4%).The most common gastrointestinal ADRs were nausea and vomiting related to amino acid solution administration. Other less frequent were dizziness (5.9%), tachycardia (2.9%) and headache (2.9%).All of them were mild and self-limited.Between each cycle, the milder ADRs recorded were: asthenia (53.2%), nausea and vomiting (16.9%), diarrhoea (13%), alopecia (10.4%), abdominal pain (11.7%), weight loss (6.5 %), osteoarticular pain (5.2 %), decreased appetite (3.9 %), steatorrhea (2.6%), and fever (1.3%).The most severe ADR after treatment was haematological toxicity (19 patients) and resulted in discontinuation in 8 of them (10.4%). ***Conclusion:*** Acute and mild side effects of [177Lu]Lu-oxodotreotide were mainly related to amino acids administration and were self-limiting.Subacute side effects were related to the absorbed dose of radiation in the bone marrow.In most cases, they were reversible, and only 10.4% of patients required treatment suspension.Despite the observed side effects, the treatment is generally well tolerated by the majority of patients.

EP-0598

Predictive Parameters of a Worse Prognosis in Patients with G2 Neuroendocrine Tumors Treated with Peptide Radio Receptorial Therapy

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Aim/Introduction: Peptide Receptor Radionuclide Therapy (PRRT) has significantly improved the prognosis of patients with neuroendocrine tumors (NET). However, a subset of patients experiences disease progression following PRRT. This study aims to identify prognostic predictors in patients with G2 NET who underwent PRRT. ***Materials and Methods:*** Between January 2011 and March 2023, we conducted a retrospective analysis of data from 142 patients (81 females, 57%; 61 males, 43%; median age: 59

years) diagnosed with G2 NET originating from the gastrointestinal tract (GEP-NET). We focused on patients who received PRRT (n=24, 17%). Clinical and histopathological data were collected for each patient. 68Ga-DOTATOC PET/CT scans were performed at the time of initial NET diagnosis and qualitatively analyzed using the Krenning score, which assesses SSTR ligand uptake (0=no uptake, 1=very low uptake, 2=uptake less than or equal to that of the liver, 3=uptake greater than the liver, and 4=uptake greater than that of the spleen). Additionally, the tumor burden liver score (0=no lesions; 1=25%, 2=25-75%, and 3=>75% of liver involvement) was evaluated on CT images obtained before PRRT. ***Results:*** Among the 24 patients (13 females, 54%; 11 males, 46%; median age: 62 years), 15 (63%) had pancreatic NET, and 9 (37%) had other types of NET. At baseline 68Ga-DOTATOC PET/CT, the Krenning score was 2 in 1 patient, 3 in 8 patients, and 4 in 15 patients. Thirteen (54%) out of 24 patients had liver involvement at the initial diagnosis. Moreover, all subjects received treatment with somatostatin analogs, and 11 (46%) also underwent targeted therapy. After PRRT, 9 (37%) patients experienced disease progression, while 15 (63%) did not. Only tumor liver burden and Krenning score showed significant differences between patients with and without disease progression (both $p < 0.05$). Following a median follow-up period of 52 months (range: 21-145), 6 patients (25%) died. Among these, three (50%) had progressive disease after PRRT. ***Conclusion:*** Among the patients who underwent PRRT, tumor liver burden and Krenning score emerged as significant predictors of disease progression. These results underscore the importance of assessing these factors to better stratify patients and optimize treatment strategies. Moreover, the study highlights the need for further research to refine prognostic indicators and enhance patient outcomes in this population.

EP-0599

Gastrointestinal NET tumors: The importance of Administered Activity and Absorbed Dose in Relation to Tumor Shrinkage During [177Lu]Lu-DOTA-TATE Treatment

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Aim/Introduction: In a cohort of ileal and pancreatic NET (p-NET) with widespread disease, we aimed to determine if differences in absorbed dose (ABD, Gy) in lesions or administered activity (ADA, GBq) related to tumor response during treatment with [177Lu]Lu-DOTA-TATE. We also aimed to study differences in tumor response in relation to primary tumor site. ***Materials and Methods:*** 36 patients (47% men) were included. [177Lu]Lu-DOTA-TATE treatment was normally given as four cycles (7.4 GBq per cycle) with 6 - 10 weeks in between. [68Ga]Ga-DOTA-TOC-PET/CT or CT performed before and 3 months after last treatment were re-studied. Up to three target lesions were selected for evaluation in each patient, normally 2-3. Total ADA and mean ABD in target lesions were determined. Tumor response according to RECIST was estimated before and after treatment with the sum of largest diameter (SLD). Progressive disease (PD) was defined as at least 20% increase in the SLD of target lesions, taking as reference SLD recorded before treatment started or the appearance of new lesions. Partial response (PR); at least 30% decrease of SLD, stable disease (SD); neither partial response nor progressive disease. ***Results:*** The group consisted of patients with ileal NET (n=27) or p-NET (n=7), mean age (range) 65 (35-82) years. Two patients with lung carcinoids were studied seperately. 28% were NET grade 1, 58% NET grade 2 and 8 % NET grade 3, in two patients, grade was indetermined. Median (range) nr of treatments were 4 (1-7). Mean (+/- 95% CI) ABD was 23 (19-27) Gy per treatment and total ADA was mean (range) 26.7 (6.7-51.4) GBq. After treatment 17% had PR, 64% SD and 19% had PD. In the entire cohort total ADA (Bq) was inversely correlated with SLD-change (%) (—0.5, $p<0.01$); in patients with p-NET the inverse correlation was stronger ; r= —0.89, $p<0.01$, n=7. An inverse correlation was found between mean ADD and SLD-change ($p=0.34$, $p<0.05$).There was no significant correlation between ABD and SLD-change (r= —0.03, p=ns). In patients with a positive SLD-change an inverse relation was found between ABD and tumor shrinkage (r= —0.6, $p<0.001$, n=13). ***Conclusion:*** Total administered activity seems to be of greater importance for tumor response / shrinkage than absorbed dose. P-NET seems more sensitive to response to the total administered activity compared with ileal NET.

EP-0600

An evaluation of Progression-Free Survival (PFS) and Overall Survival (OS) in Patients with Advanced, Non-resectable, Progressive rectal NET Treated Using Radioligand therapy.

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Aim/Introduction: Retrospective, single-arm, open-label, case series study evaluating the efficacy of radioligand therapy (RLT) including 90Y or 177Lu DOTA-TATE and mix of both in advanced, unresectable progressive rectal NETG1/G2. The primary endpoint was local RECIST 1.1 progression-free survival (PFS). Secondary endpoints: overall survival (OS) and clinical response based on performance status. ***Materials and Methods:*** Twenty-four patients in group of 156 screened subjects with GEP-NET treated with RLT between Oct 2008 to Apr 2024 included. All patients with histopathologic confirmation of rectal NETG1/G2. All subjects with advanced, unresectable, progressive disease stage prior to RLT. RLT used 90Y; 177Lu DOTA-TATE or mixture of both in different regimens, first with 90Y and then with 177Lu DOTA-TATE and mixture of both. Mean age of subjects 58.8 +/-12.8, male/female ratio 10/14. NETG1=7 and G2=17. Disease status and treatment response were evaluated by clinical assessment; biochemical response, PFS based on local RECIST 1.1 assessment and OS during follow-up. Calculation of OS and PFS using standard KM estimator, differences between groups using T.Cox Mantel test. ***Results:*** All subjects had an average of 4.5 therapy sessions, range 2 to 9, and 1.5 therapy courses per patient, range 1-3. Initially 8 subjects were treated with 90Y, then 9 with 177Lu, the remainder had mixed 90Y and 177Lu with 50% of each. Median PFS for all subjects (IQR) 34.7 months (16.8-43.7), OS for all subjects 61.1 months (IQR 40-100.4).There was a significant difference in median OS between female OS=73.1 (IQR 48.9-114.0) vs. male OS=42.1 (26.5-53.4) ($p=0.02$), bulky liver disease >25% involvement OS=42.5 (23.9-

57.1) vs. less than 25% OS=100.8 (53.5-116.3); p=0.005. There was no significant difference in median OS including number of therapy courses, age (below or over 58.8, years), BMI (less or over 25.8), presence of bone and other mts also G1 vs. G2 tumors;Median PFS was only significantly different between bulky liver disease >25% PFS=19.3 months (IQR 14.3-23.4) vs. less than 25% liver involvement PFS=42.0m (25.5-45.0); p=0.04. There was no significant difference in median PFS including: female vs. male; number of therapy sessions, age (below or over 58.8 years), BMI (less or over 25.8), presence of bone and other mts also G1 vs. G2 tumors. ***Conclusion:*** Patients with advanced rectal NET1/G2 treated with different regimens of RLT are beneficial in terms of improvement of OS in group of female subjects and low volume liver involvement. In PFS only low volume liver involvement is predictor of PFS improvement.

EP-0601

Effectiveness and Safety of a Rechallenge PRRT in Patients With Progressing Neuroendocrine Tumors

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Aim/Introduction: Peptide receptor radionuclide therapy (PRRT) is an established treatment for patients with unresectable neuroendocrine tumors (NETs) G1-G3. PRRT is usually well tolerated and has demonstrated the ability to enhance progression-free survival (PFS). Currently only up to 4 cycles have been approved by EMA and FDA. As treatment options in NETs are limited, additional cycles of PRRT may improve PFS and open new opportunities for these patients. The benefits and side effects of a retreatment are poorly described. In this study, we evaluated treatment response and tolerability in patients undergoing a rechallenge of PRRT. ***Materials and Methods:*** Retrospectively, we analyzed 29 patients (15 women and 14 men) with NETs: n=25 with gastroenteropancreatic NETs, n=3 NETs of unknown origin and n=1 with a bronchopulmonary NET, G1: 13%, G2: 74% and G3: 13%. All patients were treated with an initial PRRT (median = 4 cycles) and showed a controlled disease for at least 6 months. Re-PRRT was carried out with at least 2 cycles. SSTR-PET/CT-scans and regular blood samples were performed for treatment monitoring. PFS was evaluated using RECIST 1.1 criteria. Hematotoxicity was graded according to CTCAE 5.0. ***Results:*** Following rechallenge PRRT, 79,3 % of patients presented stable disease, 3,4% achieved partial response while 17,3% showed progressive disease. The median PFS was 20 months. All patients showed some degree of anemia (19/29 Grade 1, 9/29 Grade 2 and 1/29 Grade 3). A decreased platelet count was observed in 13 of 29 patients (11/29 Grade 1, 1/29 Grade 2 and 1/29 Grade 3). 12 of 29 patients exhibited leucopenia (Grade 1: 5/29, Grade 2: 5/29 and Grade 3 2/29). Only a few patients had elevated AST and ALT (5/29 and 7/29 respectively), no severe nephrotoxicity was observed. ***Conclusion:*** Rechallenge PRRT seems to be an effective option for patients with unresectable NETs predominantly resulting in good tumor control. Only mild to moderate side effects were observed.

EP-41

e-Poster Area

C: Therapy Clinical Study -> C1 Oncological Therapy Clinical Study -> C12 Prostate Cancer Therapy

EP-0602

Therapeutic response with B-OT as a radiosensitizer after disease progression with TANDEM PSMA radioligand therapy (PRLT) - first case report.

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Aim/Introduction: PSMA-radioligand therapy (PRLT) with α- or β-emitting radionuclides has demonstrated efficacy in the therapy of metastatic castration-resistant prostate cancer (mCRPC). Nevertheless, certain patients are non-responders to initial PRLT or exhibit progression after successful PRLT with α- or β-emitting radioligands. The acquired resistance might be linked to alterations in the DNA repair system of the tumor cells. Benfo-oxythiamine (B-OT) is a prodrug that releases oxythiamine, a thiamine antagonist that interferes with the biochemical synthesis of ribose-5-phosphat (R5P), a substrate required for DNA-replication and -repair. The combination of PRLT with the radiosensitizer B-OT ('B-OT-PRLT') might overcome radiation resistance and achieve better efficacy of PRLT as decreased levels of R5P could diminish the repair rate of radiation-induced double-strand breaks. ***Materials and Methods:*** A 79-year-old mCRPC patient underwent radical prostatectomy (pT3ba pN0 (0/7) M0 L0 V0 R0 G3, Gleason 5+5=10, iPSA 4.05 ng/ml). Soon after radical prostatectomy, PSMA-PET/CT revealed lymph node metastases. Subsequent treatment lines included androgen deprivation therapy and radiotherapy, chemotherapy (with docetaxel), followed by the androgen receptor antagonist enzalutamide and 4 cycles of 177Lu-PRLT and 1 cycle of TANDEM-PRLT. Even after the resumption of chemotherapy, progress was observed. Due to the intense PSMA expression, PRLT was resumed. For cycles 6 to 9 (177Lu-PRLT), the patient was additionally treated with B-OT (B-OT-PRLT, 1-2 x 3 mg/d p.o., starting before PRLT, on 2-5 consecutive days). Total activity over 9 cycles was 67 GBq Lu-177 and 2.1 MBq Ac-225. ***Results:*** B-OT-PRLT was well tolerated. No significant changes in laboratory results (hematology, liver, kidney) were observed. Additionally, significant improvement in clinical symptoms was reported by the patient. Post-treatment 177Lu-PSMA SPECT-CT (7th cycle/after 2 cycles of B-OT-PRLT) revealed excellent regression of the metastases (compared to SPECT-CT after 6th cycle) and after former non-controllable disease progression, a mixed response was found in 68Ga-PSMA PET-CT (before 8th cycle). PSA showed a 50% decline from 264 to 132 ng/ml after one cycle with B-OT-PRLT. Although the patient had massive progression before the first B-OT-PRLT cycle, the patient survived a further 12 months. ***Conclusion:*** This case demonstrates exceptional effectiveness of B-OT-PRLT in overcoming radiation resistance in mCRPC not responding anymore to 177Lu- or 225Ac-PRLT alone. Even though the patient showed later progression after TANDEM-PRLT, a sustainable PSA decline and partial response/regression of metastases were observed after B-OT-PRLT. The combination was well tolerated. In summary, the potential of B-OT-PRLT needs to be explored in a larger patient populations.

EP-0603

Matched-pair analysis comparing 4-week and 6-week treatment intervals of prostate-specific membrane antigen targeted radioligand therapy in patients with metastatic castration-resistant prostate cancer

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Aim/Introduction: This retrospective study evaluated the effects of 4-week versus 6-week intervals in prostate-specific membrane antigen targeted radioligand therapy (PSMA RLT) on treatment toxicity, prostate-specific antigen (PSA) response, PSA progression-free survival (PFS), and overall survival among cohorts of matched metastatic castration-resistant prostate cancer (mCRPC) patients. ***Materials and Methods:*** Forty-six mCRPC patients who received 7.4 GBq of PSMA RLT were analyzed retrospectively, divided equally into two groups based on treatment intervals (23 patients each in 4-week and 6-week intervals). Matching was based on clinical and laboratory data, including baseline LDH, prior treatments, and molecular imaging TNM classification. Treatment toxicity was monitored up to the final treatment cycle and compared with baseline values. Adverse effects were assessed using the Common Terminology Criteria for Adverse Events version 5.0. The efficacy was evaluated by measuring best PSA response and comparing PSA-PFS and overall survival between the two groups. ***Results:*** A significant decline in PSA (>50%) was noted in 47.8% of patients in the 4-week interval group versus 21.7% in the 6-week group (p=0.12). There was a non-significant trend towards longer PSA-PFS in the 4-week group (median 26.0 weeks) compared to the 6-week group (median 18.0 weeks; HR 0.6, p=0.2). Overall survival was not significantly different between groups (median OS, 15.1 months for 4-week vs. 18.4 months for 6-week; HR 1.3; p=0.5). The 4-week group also experienced significantly more substantial reductions in leukocyte and platelet counts (38.5% and 26.7% respectively) compared to the 6-week group (18.2% and 10.7%; p=0.047 and p=0.02). Severe adverse events were minimal in both groups. ***Conclusion:*** Shortening the interval of PSMA RLT from 6 weeks to 4 weeks showed some improvement in PSA response and PSA-PFS in mCRPC patients but did not significantly impact overall survival. The intensified regimen also led to more significant bone marrow suppression. The overall advantage of shorter treatment intervals is still unclear, calling for more prospective studies to fully evaluate the impacts on toxicity, treatment response, and efficacy.

EP-0604

Comparative Analysis of 177Lu-PSMA Radioligand Therapy Efficacy in Metastatic Castration-Resistant Prostate Cancer: Impact of Taxane Chemotherapy Precedence

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Aim/Introduction: This study looks into the effectiveness of 177Lu-labelled prostate-specific membrane antigen (PSMA) radioligand therapy in treating metastatic castration resistant prostate cancer (mCRPC). The study focuses on evaluating the clinical outcomes of 177Lu-PRLT in two groups of patients: those who have undergone taxane chemotherapy (T-pretreated) and those who have not (T-naïve). ***Materials and Methods:*** In this study, a retrospective analysis was conducted on 35 patients who were diagnosed with metastatic castration resistant prostate cancer (mCRPC) and received at least 2 cycles of 177Lu-PRLT treatment between 2017 to 2022. Patients were categorised as either T-pretreated or T-naïve based on whether they had received chemotherapy before undergoing 177Lu-PRLT. The clinical outcomes of both groups were evaluated based on prostate-specific antigen (PSA) response rate. Univariate and multivariable analyses were performed to identify predictors of outcome for both groups. ***Results:*** Out of the total 34 patients who received 177Lu-PRLT treatment, 18 were T-pretreated and 16 were T-naïve. 11 out of 18 chemo pretreated patient responded to 177Lu-PRLT which was defines as decrease in S.PSA > 50 % from baseline while 7 were non responder. 9 out of 16 chemo-naive patients were responder while 7 were non responder. ***Conclusion:*** The use of 177Lu-PRLT as a treatment for mCRPC shows similar response rate and similar overall survival with observed in patients who were both treatment-naïve and treatment-pretreated. So 177Lu-PSMA can be taken as an option before starting chemotherapy. Hence reducing the toxicity and side effects of chemotherapy in the patients. However this results should be validated in a multicentric study on a larger number of patients.

EP-0605

The Patterns and Approach to Hyperprogression after Lutetium-177 PSMA-617: Semi-manual AI-based Analysis

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Aim/Introduction: Not all patients benefit from the Lutetium-177 PSMA-617 therapy, as some patients may experience significant progression of disease (more than 100% increase in disease burden). It is unknown which patients may experience "hyperprogression". This study aims to analyze the characteristics of hyperprogression and identify possible therapeutic approaches. ***Materials and Methods:*** All patients undergoing Lutetium-177 PSMA treatments were identified. Baseline and follow up F-18 DCFPyL (PSMA) PET/CTs were analyzed via a software to segment total, osseous and soft tissue volumes (all mm3) before and after the radioligand therapy. All patients had laboratory work at 4 weeks after treatment. Follow-up PSMA PET/CTs were done as needed basis if there was a significant increase in PSA. Patients were characterized as "hyperprogression" if they had more than %100 increase in total tumor volume compared to the baseline. All patient demographics and prior treatments were then analyzed. ***Results:*** 45 patients were identified. Ten patients had interim PET/CTs after a median of 3 cycles, of these 7 patients (16%) were in the hyperprogression group. Hyperprogression group predominantly had progression in the bones (7/7, 100%), with a median increase in bone tumor volume of 232 (vs -59 in others) and a decrease in soft tissue volume -26 (vs -0.8 in others). Hyperprogression patients had a higher median ALP 166 (vs 85), and a median PSA 51 (vs 78), both p >0.05. These patients had a median increase in PSA of 19.6 ng/mL and a median increase in ALP of 5. Despite a greater increase in PSA, ALP had a better correlation than PSA (spearman correlation 0.71 vs 0.59, p < 0.05) with the total tumor volume in the whole cohort. There was no difference in baseline and follow up SUVmax, SUVmean

and SUVmin. Patients who experienced hyperprogression were older (median age 79 vs 71, p=0.04), and had a greater median Gleason score (8.5 vs 8, p=0.04). Three patients elected to proceed with Radium-223 dichloride treatment, and two of these had subsequent decrease in ALP after their first Radium-223. One patient expired after the first dose of Radium-223. ***Conclusion:*** Hyperprogression throughout the Lutetium-177 PSMA-617 therapy is not uncommon, and predominantly occurs in the bone. Both PSA and ALP are important biomarkers to detect the hyperprogression, however given bone predominant progression pattern ALP may be a better biomarker than PSA. Radium-223 dichloride shows promise for further treatment in patients who had hyperprogression.

EP-0606

Prognostic parameters in ^{68}Ga-PSMA-11-PET-CT in mCRPC patients undergoing ^{177}Lu-PSMA-radiologand therapy

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Aim/Introduction: Advanced, metastatic castration-resistant prostate cancer (mCRPC) has a poor prognosis. Use of PSMA-targeting radioligands has revolutionized the diagnostic and therapy of these patients. Many studies have aimed for establishing one or few prognostic and predictive parameters. The aim of this study was to compare the various published parameters in one cohort, in terms of progression-free (PFS) and overall survival (OS). ***Materials and Methods:*** In this study, the data of 68Ga-PSMA-PET-CT of 82 patients undergoing 177Lu-PSMA-RLT were analyzed. The studied parameters include total tumor volume (tumor volume), average SUVmean of all tumor lesions (SUVmean) and the quotient of mean of SUVmean of all tumor lesions to SUVmean of the parotid glands (tumor-parotid-ratio; TPR) and to SUVmean of kidneys (tumor-kidney-ratio; TKR). PFS was defined as the time to PSA increase of ≥ 25% above nadir (at least 2 ng/ml) and confirmation via a control test in 3 weeks according to PCWG3, OS was defined as time to death or time to last follow-up. ***Results:*** In this cohort a higher tumor volume is associated with worse prognosis (tumor volume < 290.6 ml, PFS: 4.2, OS: 13.2 months; tumor volume > 290.6 ml, PFS: 3.4 months, OS: 6.2 months (PFS: p = 0.01; OS p < 0.001)). Average SUVmean inversely correlates with survival, with an average SUVmean > 10.7 (PFS: 4.2 months, OS: 11.4 months) versus SUVmean < 10.7 (PFS: 1.6 months, OS: 5.0 months) (p <0.001). A TKR > 0.33 showed a PFS of 4.2 months vs 2.9 months for TKR < 0.33 (p-value = 0.009). But there was no significant difference regarding OS. There was also no significant relationship between TPR and PFS or OS. ***Conclusion:*** The present study confirms that PSMA-PET-CT can reveal prognostic factors, however the majority seems to be dependent on the study population, taking into account partly contradictory results in recently published studies . Prospective confirmation is warranted before implementation into clinical use.

EP-0607

Response to ^{177} Lu-PSMA-617 radioligand therapy of liver metastases in patients with metastatic castration-resistant prostate cancer (mCRPC)

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Aim/Introduction: Prostate cancer is one of the most common malignancies in men, with a significant portion of patients progressing to metastatic castration-resistant prostate carcinoma (mCRPC). Studies on the overall survival (OS) of patients diagnosed with mCRPC have shown that the worst median OS in those with liver metastasis. Recently, various studies have shown promising results of 177Lu-PSMA-617 radioligand therapy in advanced-stage mCRPC patients. However, limited information is available regarding the efficacy of this treatment specifically against liver metastases. Therefore, we conducted a retrospective study to assess the therapeutic effect of 177Lu-PSMA-617 RLT on patients with mCRPC and liver metastasis, as well as to evaluate the relationship between liver lesion response and OS. ***Materials and Methods:*** Patients diagnosed with mCRPC with liver metastases between 2015 and 2023 (mean age 66) who received at least 2 cycles of 177Lu-PSMA-617 radioligand therapy were retrospectively evaluated. Patients were initially planned to receive 4-6 cycles of treatment at 2-4 week intervals. The mean activity administered to patients was 6 GBq, with a cumulative activity of 20.5 GBq. Response assessment post-treatment was evaluated using the Solid Tumor PET Response Criteria (PERCIST 1.0) on 68Ga PSMA PET/CT imaging. ***Results:*** Evaluation of post-treatment 68Ga PSMA PET/CT images revealed partial response (PR) in liver lesions of 3 patients (27%), stable disease (SD) in 2 patients (18%), and progressive disease (PD) in 6 patients (55%). Median overall survival among patients exhibiting partial or stable response in liver lesions was 15 months (range: 7-16 months), while for patients evaluated as PD, the median overall survival was 5 months (range 3-7 months). Mean pre-treatment liver PSMA-positive tumor volume was 114.2 cm3, post-treatment was 261.3 cm3. The mean pre-treatment liver tumor SUVmax/Mediastinum SUVmax ratio was 19 and post-treatment was 32. Mean pre-treatment PSA levels measured 101.8 ng/ml and post-treatment was 286.2 ng/ml. ***Conclusion:*** Our findings highlight that liver lesion management was successful in 45% of patients treated with 177Lu-PSMA-617 radioligand therapy. However, to reach more robust statistically significant results, conducting larger-scale and comprehensive studies involving a broader patient cohort is needed.

EP-0608

Factors Influencing Clinical and Biological Response in Patients Treated with [177Lu]Lu-PSMA-617 under France's early access program.

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Aim/Introduction: The VISION study showed that [177Lu]Lu-PSMA-617 combined with best standard of care prolonged progression-free survival confirmed by imagery (rPFS), overall survival, and delayed time to worsening in health-related quality of life in patients with PSMA-positive mCRPC previously treated with at least one taxane-based chemotherapy and a novel hormonal therapy (NHT). Various factors related to patients, their disease, and the treatment sequence may impact the treatment's effectiveness. This retrospective analysis aims to evaluate the influence of these factors on the clinical and biological response of patients receiving [177Lu]Lu-PSMA-617 under France's early

access program. ***Materials and Methods:*** Between December 1, 2021, and April 30, 2023, 790 PSMA positive patients with mCRPC pretreated with 1-2 taxane chemotherapy and ≥1 NHT who received [177Lu]Lu-PSMA-617 under France's early access program were included. Among these, 685 patients were categorized into two groups: responders (experiencing reduced PSA levels and improved clinical symptoms) and non-responders (experiencing PSA progression and/or worsening clinical symptoms). Group characteristics were compared using bivariate analysis (Chi-squared test, Fisher's exact test, or Mann-Whitney test). Odd ratios (OR) and their 95% confidence interval [95CI] were calculated. A p-value <0.05 was considered statistically significant. ***Results:*** In our sample, 311 patients (39.4%) were classified as responders, and 374 as non-responders (47.3%). Responders had received more cycles of [177Lu]Lu-PSMA-617 (median 6 vs. 3; p<0.0001), more frequently showed uptake in all lesions on PSMA PET (85.2% vs. 69.5% of patients; OR 2.5 [95CI: 1.7, 3.7]; p<0.001), and more frequently received concurrent NHT (33.1% vs. 18.7%; OR 1.9 [95CI: 1.3, 2.7]; p<0.001). No significant differences (p>0.05) were observed between the responders and the non-responders with respect to patient age, ECOG score, initial PSA levels, metastasis locations, the number of previous NHT, the number of lines of taxane-based chemotherapy, and treatments received such as external radiotherapy, bisphosphonates, denosumab or immunotherapy. Additionally, Patients with PSMA PET uptake in all lesions experienced prolonged rPFS (median 7.9 vs. 5.5 months; p<0.001) and delayed symptom worsening (median 8.1 vs. 7.0 months; p=0.046). Previous treatment with 1 taxane was associated with delayed symptom worsening (8.2 vs 7.5 months; p=0.007). Concurrent NHT administration was also associated with a longer rPFS (median 8.3 vs. 6.1 months; p=0.0001) and delayed time to symptom worsening (median 8.6 vs. 7.4 months; p<0.001). ***Conclusion:*** The response to [177Lu]Lu-PSMA-617 may be influenced by the number of [177Lu]Lu-PSMA-617 cycles administered, PSMA-PET lesion positivity and concurrent NHT administration.

EP-0609

177Lu-PSMA in Metastatic Castration Resistant Prostate Cancer: Preliminary Analisys of Brazilian Multicentric Study

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Aim/Introduction: Investigate 177Lu-PSMA therapy in Brazilian patients with metastatic castration resistant prostate cancer (mCRPC). ***Materials and Methods:*** Data for this retrospective multicentric study was collected from 9 Brazilian centers from 6 federative units (SP, PE, CE, RJ, SC and DF) that performed at least two cycles of 177Lu-PSMA therapy in mCRPC. Data with skewed distribution were reported as median (min-max). Primary outcome was overall survival. Secondary outcomes was the maximal PSA response and hematological adverse events (HAE). ***Results:*** A total of 100 males were included, median age = 74 years old (min-max: 54 - 96 years old). 177Lu-PSMA was the fifth (median) line of therapy (min-max 2-10). A total of 333 cycles were performed with a median of 4 cycles (min-max 1-10). The median overall survival was 16.9 months. Among the 72 patients with data available for the maximal PSA response at any time, 65% presented any PSA decline. 42% presented PSA decline ≥ 50% from baseline. 89% of patients did not present HAE or presented grades 1 or 2 HAE. Only 11% of patients presented grade 3 HAE. 0% of patients presented grade 4 HAE. ***Conclusion:*** 177Lu-PSMA therapy was effective and safe in the Brazilian population even with a median of 5th line of therapy (maximum 10th line). Overall survival and PSA decline ≥ 50% from baseline were similar to the literature data. Only 11% of patients presented grades 3 or 4 hematological adverse events. ***References:*** 1. Rahbar et al. JNM 2017; 58: 85-90 2. Hofman et al. Lancet. 2021; 397: 797-804 3. Sartor et al . N Engl J Med 2021; 385: 1091-1103 This study was supported by Fundação de Apoio ao Ensino e à Pesquisa do Estado de São Paulo - Cancer Theranostics Innovation Center - CEPID, Proc. 2021/10265-8).

EP-0610

Evaluating the response and side effects of Lu177-PSMA therapy in mCRPC patients, a single center experience from Iran

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Aim/Introduction: Investigation of clinical and laboratory findings of patients during treatment with lu177-PSMA in metastatic prostate cancer patients resistant to anti androgen therapy. ***Materials and Methods:*** In this cross-sectional study, all patients with metastatic prostate cancer resistant to hormone therapy who were referred to the nuclear medicine center of Ghaem Hospital for treatment with lu177-psma therapy between 2019 and 2021 were included in the study. During the treatment period, the patients were routinely monitored by a nuclear medicine specialist in one week, 4 weeks and 8 weeks intervals after the treatment.Laboratory tests including PSA, CBC, creatinine and liver tests were performed and recorded. Lu177-PSMA therapy repeated every 8-10 weeks and the treatment response was thoroughly evaluated after each cycle. ***Results:*** In this study, 133 patients with metastatic prostate cancer resistant to hormone therapy underwent a course of treatment with 177Lu-PSMA radiopharmaceutical. decline in PSA level was observed in 122 patients, of which 39 patients had a ≥50% PSA decrease after the first dose. Stabilization of the disease was observed in 79 patients and progression of the disease was observed in 24 patients. Out of 72 patients who had bone pain, pain improvement was seen in 81% of patients. 67% grade 1 hematological toxicity and 34% grade 2 hematological toxicity were observed. No kidney or liver complications occurred. ***Conclusion:*** According to the results, it seems that treatment with 177Lu-PSMA radiopharmaceutical in metastatic prostate cancer patients resistant to hormone therapy has a favorable therapeutic response with limited side effects.

EP-0611

Simple method for production and quality control of ^{225}Ac- PSMA-617 for the targeted alpha therapy of castration-resistant prostate cancer.

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Aim/Introduction: Prostate cancer (PC) is the second most

common cause of cancer in men of all races [1]. Targeted alpha therapy (TAT) has a great potential for the treatment of metastatic castration resistant Prostate Cancer. Therefore, interest treatment of prostate cancer 225Ac-PSMA-617 for PSMA-Targeted a Radiation Therapy in nuclear medicine in all of the world is increasingly growing. After binding at the tumor cell surface, the PSMA ligands are internalized allowing radioisotopes to be concentrated within the cell and therefore, a suitable target for PC imaging and therapy [2]. An increasingly popular alternative can be the use of αemitting radionuclides for the therapy of PC patients such as Ac225, and Ra223 which have successfully been used to treat different tumors. Therefore a simple method without purification of 225Ac-PSMA-617 was evaluated. Labeling yield and radiochemical purity were >99%. ***Materials and Methods:*** For synthesis of 225Ac-PSMA-617 Radiopharmaceuticals, the Ac-225 radionuclide sample, dissolved in 0.1 M HCl in a 15R vial, was obtained from IPPE Co. PSMA-617 peptide was from Arian pazho Co. The 200 µl (250µCi) Ac-225 solution was transferred into the reaction vial which contains 0.9 mL of 1M sodium acetate buffer and 70 µg PSMA-617. The pH of the reaction mixture was determined to be 4.0- 5.0. The labeling was accomplished for 30 minutes at 95°C. Determine to the radiochemical purity of the 225Ac-PSMA-617 radiopharmaceuticals uses the ITLC method. ***Results:*** Based on the synthesis results, the production yield of 225Ac-PSMA-617 is usually around (95 %). The radiochemical purity of samples was at least 99%. The pH of the final product was 7.0. After QC, the final product could be used directly without need for a final purification step. ITLC analysis of the final product revealed no evidence of free 225Ac after 14 days in room temperature. ***Conclusion:*** According to the results, the possibility of safety form synthesizing 225Ac-PSMA-617 has been confirmed. This protocol allows a routine production for the treatment of patients with metastatic prostate cancer. ***References:*** 1. Ferlay J, Colombet M, Soerjomataram I, Dyba T, Randi G, Bettio M, et al. Cancer incidence and mortality patterns in Europe: Estimates for 40 countries and 25 major cancers in 2018. Eur J Cancer 2018;103:35687. 2. Hofman MF, Violet J, Hicks RJ, Ferdinandus J, Thang SP, Akhurst T, et al. [177 Lu]PSMA617 radionuclide treatment in patients with metastatic castrationresistant prostate cancer (LuPSMA Trial): A singlecentre, singlearm, phase 2 study. Lancet Oncol 2018;19:82533.

EP-0612

PACS-integrated, AI-based Monitoring of Body Composition in Patients with Metastatic Castration-Resistant Prostate Cancer undergoing Radioligand Therapy with [^{177}Lu]Lu-PSMA.

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Aim/Introduction: Patients with metastatic castration-resistant prostate cancer (mCRPC) receiving radioligand therapy (RLT) are showing a variable response to the therapy. Prognostic factors that allow an estimation of the overall survival (OS) are required. Body composition (BC) describes the percentages of different body tissues as a measure of physical fitness and tumor cachexia. We evaluated the impact on OS of relative changes in BC parameters between baseline imaging before the start of RLT and interim staging after two cycles of RLT. ***Materials and Methods:*** This is an unicentric, retrospective analysis of 87 patients undergoing RLT with a median of 3 cycles (range 2 - 8 cycles) [177Lu]Lu-PSMA. Patients received baseline staging within 6 weeks before RLT and interim staging 6-8 weeks after the second RLT cycle. BC parameters were obtained from CT on the height of vertebrae L3 using an AI-based, PACS-integrated software tool. Relative BC changes were determined as the percentage deviation at interim staging from baseline. Cox regression was used to determine the prognostic value on OS. All variables with a p-value below 0.1 in univariable Cox regression were included in multivariable regression following stepwise inclusion (likelihood ratio). ***Results:*** During follow-up, 74 patients (85%) died. The median OS was 16.3 months, the median follow-up in survivors 25.2 months. In univariable Cox regression, 6 parameters representing relative changes in BC, previous treatment with Xofigo, higher number of previous chemotherapy lines, lymphonodal metastases, liver metastases, baseline PSA level, hemoglobin level and De Ritis ratio were significant predictors of OS (each $p<0.05$). In multivariable regression, higher relative decrease of the total fat area (TFA) (HR: 0.10; $p = 0.001$), higher number of previous chemotherapy lines (HR: 2.2; $p = 0.006$) and a higher baseline De Ritis ratio (HR: 1.4; $p = 0.001$) remained independent predictors of a shorter OS. Patients with high decrease in TFA (≤ -14%) had a median OS of 10.2 months compared to 18.5 months in patients with lower TFA decrease > -14% (logrank test: $p = 0.001$). In a separate Cox model, the TFA decrease predicted OS ($p < 0.001$) independent from the PSA trend after two RLT cycles ($p = 0.006$), and there was no interaction between the two (p=0.11). ***Conclusion:*** PACS-integrated, AI-based monitoring detects relative decrease of the TFA which was an independent predictor of shorter OS in this cohort of patients undergoing RLT.

EP-0613

Reduced total tumor volume on post-therapeutic SPECT - a cause for early treatment failure of patients undergoing PSMA-radioligand therapy?

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Aim/Introduction: 177Lu-PSMA-based radioligand therapy (RLT) in mCRPC patients is increasingly used since its FDA-approval. However, some patients comprise inferior treatment response despite comparable pre-RLT conditions. We could observe that pre-therapeutic total tumor volume on PSMA-PET (PSMA-TTV) partially differs from post-therapeutic TTV on SPECT-imaging (SPECT-TTV) after the first cycle. We aimed at comparing pre- and post-treatment TTV on PSMA-PET with SPECT-TTV after therapy cycle 1 and 2 in patients with early tumor progression during PSMA RLT. ***Materials and Methods:*** We conducted a retrospective study including 11 patients who received 2 cycles [177Lu]Lu-PSMA I&T and who showed early progressive disease after cycle 2 as defined by PSMA-PET and PSA. Pre-therapeutic PET-TTV on [^{18}F]F-PSMA-1007 PET was compared to SPECT-TTV at cycle 1. Similarly, PET-TTV after cycle 2 was compared to SPECT-TTV at cycle 2. Additionally, percentage TTV-changes on PET- and SPECT-imaging were assessed. For statistical analysis, paired t-tests were performed. ***Results:*** The patients (mean age 74.3 ± 7.6 years) received their first therapy cycle 27.3 ± 14.2 days after baseline PSMA-PET. Follow-up PSMA-PET was performed 45.0 ± 6.3 days

after cycle 2. PSA was significantly rising between the timepoint of pre-therapeutic PSMA-PET and the timepoint of PSMA-PET after cycle 2 (62.7 ± 62.9 ng/ml vs. 231.1 ± 247.3; p < 0.001). Also, PSMA-TTV was significantly increasing after cycle 2 compared to baseline PSMA-PET (181.8 ± 134.4 ml vs. 516.2 ± 263.0 ml, p < 0.001). In total, pre-therapeutic PET-TTV did not significantly differ from SPECT-TTV at cycle 1 (181.8 ± 134.4 ml vs. 178.0 ± 160.9 ml; p = 0.765). However, PET-TTV after 2 cycles was significantly higher than SPECT-TTV at cycle 2 (516.2 ± 263.0 ml vs. 178.9 ± 147.7 ml; p < 0.001). The percentage changes for PET-TTV, SPECT-TTV and PSA after second therapy cycle compared to baseline were 265.8 ± 208.0%, -7.3 ± 58.4% and 330.3 ± 363.6%, respectively. ***Conclusion:*** In this preliminary analysis, mCRPC patients with early progression after cycle 2 of PSMA-RLT showed a drastically lower tumor volume on post-therapy SPECT-TTV compared to PSMA-TTV. This suggests that a generally lower radioligand uptake on SPECT than on PSMA-PET might influence treatment failure and might allow early identification of non- responders. Analyses in a larger patient cohort, comparisons to patients with response to PSMA-RLT and correlation with the further disease are underway.

EP-0614

Radiomic ^{18}F-Fluorocholine PET/CT variables as stronger predictors of overall survival in patients with metastatic castration-resistant prostate cancer treated with^{223}Ra dichloride.

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Aim/Introduction: To determine the impact of prognostic factors in overall survival (OS) of metastatic castration-resistant prostate cancer patients (m-CRPC) treated with 223Ra-dichloride (223Ra). ***Materials and Methods:*** Multicenter, prospective, non-randomized study where all patients treated with 223Ra from January/15 to December/22 were collected. Baseline, interim, and end-treatment bone-scintigraphy (BS) and 18F-Fluorocholine PET/TC (FCH-PET/TC) scans were performed. Clinical and imaging variables were collected, including age, Gleason score, lactate dehydrogenase (LDH) or alkaline phosphatase (ALP) levels prior and during treatment, bone treatments and related events, lesions number on FCH-PET/TC, predominant activity, concordance between techniques, and treatment response both biochemically and by imaging, among others. Response assessment, concordance between techniques (Kappa=k) and OS relationship were analyzed using cross-tabulations and Log-Rank test, respectively. ***Results:*** 100 patients were included with a mean age of 72.7 years (±8.5). Gleason score was ≥8 in 45%. 56% did not complete 223Ra treatment, 92% died during follow-up. Median progression free survival and OS were 4 and 14 months, respectively. Concordance between techniques for interim was k=0,447 (p= <0.001) and for end-treatment k=0.211 (p=0.075). Clinically, statistically associated variables with increased OS were: ECOG status 0 (p=<0.001, χ2=23.3), non-pathological ALP (p=<0.001, χ2=12.5) and LDH levels (p=0.033, χ2=4.5) prior 223Ra, treatment completion (p=<0.001, χ2=29.1), PSA non-progression during treatment (p=0.004, χ2=8.5), bone events history during or after treatment (p=0.025, χ2= 4.9), receiving abiraterone (p=0.010, χ2=6.6) and/or enzalutamide (p=<0.001, χ2=11.3) thereafter. Regarding imaging variables, FCH-PET/CT findings were associated with lower OS such as >5 lesions (p=0.028, χ2=4.8) or superscan pattern (p=<0.001, χ2=16,7), axial lesion localization (p=<0.001, χ2=14.7), high tumor burden (p=0.003, χ2=9.0), bone marrow involvement (p=<0.001, χ2=27.2), uptake higher than liver (p=<0.001, χ2=13.1), non-blastic lesion on CT (p=0.047, χ2=3.9), soft-tissue involvement (p=0.048, χ2=3.9), and poor concordance between techniques (p=0.026, χ2=4.9). Regarding interim and end-treatment imaging techniques, interim non-progression in both BS and FCH-PET/CT showed statistical significance with OS (p=0.004, χ2=8.3 and p=<0.001, χ2=17.0, respectively). ***Conclusion:*** Characteristics like improved ECOG status, normal LDH and ALP levels pre-223Ra treatment, completing 223Ra, PSA non-progression during treatment, or receiving bone-protective therapy were associated with increased OS.Baseline and post-therapy FCH-PET/CT derived radiomics, including disease extent, metabolic activity and extraosseous involvement, were more robust than BS disease characteristics in the survival prediction.

EP-0615

[177Lu]Lu-PSMA selection criteria, PSMA SPECT TTV post-cycle and dosimetry: our LATAM experience.

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Aim/Introduction: Theranostics is growing fast. New evidence around potential imaging biomarkers is available. Dosimetry is a powerful tool to evaluate noble organs and target lesions absorbed dose as a prognostic factor. Join together all pieces could be challenging. ***Materials and Methods:*** We present our proposal for an integral patient road. Our sample case is male, 73 years old, metastatic castration-resistant prostate cancer (mCRPC), treated before with novel-generation androgen, taxane and biochemical relapse. Even when FDG PET is not necessary according to VISION trial, we prefer when possible use TheraP criteria and FDG PET TTV (total tumor volume). We plan first cycle administration with dosimetry protocol that include first cycle SPECT/CT with 2 time points (24, 72 hours). For cycles 2 and 3 we do just 24 hours SPECT/CT. We use software tool to get cycle 2 and 3 dosimetry results using cycle 1 multi-point time activity curves. We also implement PSMA SPECT TTV post-cycle as a potential biomarker. ***Results:*** Our sample case had a PSMA PET uptake lesions over spleen ([18F]PSMA-1007) and many even above parotid uptake. Complementary FDG PET show complete match with PSMA PET, and FDG PET TTV was 84 mL (below 200 mL suggested prognostic biomarker). Cycle 1 multipoint dosimetry results (Gy mean dose): parotids: 0.7 Gy, kidneys: 0.6 Gy, tumor 1: 12.7 Gy, tumor 2: 37.3 Gy, tumor 3: 18.4 Gy and after 3 cycles accumulated absorbed dose were parotids: 1.8 Gy, kidneys: 3.2 Gy, tumor 1: 27.2 Gy, tumor 2: 119 Gy, tumor 3: 37 Gy. PSMA SPECT TTV results showed cycle 1: 2688 mL, cycle 2: 1812 mL and cycle 3: 665 mL with a delta between cycle 1 and 2 of 32% and cycle 1 and 3 of 75%. ***Conclusion:*** Guidelines describe selection criteria and follow up for [177Lu]Lu-PSMA but in latinamerica we should take consideration about local radiotracers availability. On the other hand, complementary FDG PET seems to be an interesting potential prognostic biomarker. New evidence about PSMA / FDG PETS discordance or PSMA SPECT TTV can be implemented in daily practice with technology with AI that simplify steps. Finally, 72 hours SPECT/CT is not always possible so multi-time point first cycle dosimetry for 24 hours single timepoint next cycle could be a solution. ***References:*** Emmett L et al. 177Lu-PSMA SPECT

Quantitation at 6 Weeks (Dose 2) Predicts Short Progression-Free Survival for Patients Undergoing 177Lu-PSMA-I&T Therapy. J Nucl Med. 2023 Mar;64(3):410-415.

EP-0616

Therapy-related Myeloid Neoplasms Following Lutetium-177 [^{177}Lu]Lu-PSMA Therapy in patients with Metastatic Castration-Resistant Prostate Cancer: A Case Series

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Aim/Introduction: [177Lu]Lu-PSMA therapy has a favourable toxicity profile in patients with metastatic castration-resistant prostate cancer (mCRPC). Therapy-related myeloid neoplasms (t-MN) are described following [177Lu]Lu-DOTATATE but have not yet been reported following [177Lu]Lu-PSMA. This case series describes five patients with mCRPC who developed t-MN following [177Lu]Lu-PSMA at our institution. ***Materials and Methods:*** In this single-centre retrospective analysis, we reviewed all patients with mCRPC treated with [177Lu]Lu-PSMA at a high-volume centre. Patients who developed biopsy-proven t-MN during or following [177Lu]Lu-PSMA treatments are summarised with descriptive statistics. ***Results:*** Between August 26 2015 and December 31 2022, 5 of 381(1.3%) patients treated with [177Lu]Lu-PSMA were subsequently diagnosed with t-MN. Their median age at cycle 1 (C1) was 78 years [range 65-80]. The median time from C1 to t-MN diagnosis was 32.4 [range 6.0-58.8] months. Previous treatments included docetaxel (n=5), external beam radiotherapy to metastases (n=5), abiraterone (n=4), enzalutamide (n=3) and cabazitaxel (n=3). On PSMA PET/CT, 4 (80%) patients had predominantly bone metastases and 1 (20%) had predominantly nodal metastases. They were treated with [177Lu]Lu-PSMA-617 (n=3) or [177Lu]Lu-PSMA-I&T (n=2). A median of 7 (range 4-12) cycles of [177Lu]Lu-PSMA was administered with a median total cumulative activity of 49.5GBq (range 31.3-60.4). Prostate-specific antigen (PSA) reduction ≥50% or ≥80% from baseline was seen in 5 (100%) and 4 (80%), respectively. All had PSA progression preceding t-MN diagnosis. t-MN diagnosis included: myelodysplastic syndrome with single-lineage dysplasia (MDS-SLD) (n=2), myelodysplastic syndrome with excess blasts-1 (MDS-EB1) (n=1), acute promyelocytic leukaemia (APML) (n=1) and AML (n=1). At t-MN diagnosis, all patients presented with ≥ grade 2 cytopenia and involving one or more blood cell lines. Marrow genetic analysis revealed unfavourable karyotype and/or mutation variants in all patients, including tumour protein 53 (TP53) mutations in two patients and MECOM rearrangement AML in one patient. Most patients transitioned to best supportive care once diagnosed with t-MN; induction therapy was initiated in the patient with APML. Survival was 8.1, 31.3, 43.0, 56.0 and 60.4 months from C1 and 1.8, 2.1, 6.8, 10.3 and 12.4 months from t-MN diagnosis. ***Conclusion:*** In the mCRPC population after chemotherapy, we describe a 1.3% incidence of t-MN following [177Lu]Lu-PSMA therapy. Ongoing follow-up is necessary to further define true incidence of t-MN or other unexpected delayed toxicities, particularly with earlier use of [177Lu]Lu-PSMA in the disease course.

EP-0617

The radium-223 in mCRPC with bone metastases: 6 years of experience in our center.

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Aim/Introduction: Radium-223 is an alpha emitter used as a palliative treatment for bone metastases in patients with metastatic castration-resistant prostate cancer (mCRPC), often administered after multiple other treatments have failed. This study aims to evaluate the outcomes, efficacy in pain control, and patient reality in our service after receiving Radium-223. ***Materials and Methods:*** We retrospectively reviewed medical records of 57 patients treated with Radium-223 from 2016 to 2023. Patient demographics, treatment history, dosage details, hematological toxicities, and pain control effectiveness were analyzed. ***Results:*** The average patient age was 73 years, ranging from 57 to 84 years. A majority had bone metastases at diagnosis (84%), and more than 50% had received medical treatment initially. Only 17.5% underwent surgery. Prior to Radium-223 treatment, 98% of patients had received at least one line of non-androgen hormonal (NAH) and taxanes treatments. Over 50% had more than 20 bone metastases identified via scintigraphy. 63% received 5 to 6 doses of Radium-223 intravenously every four weeks, 37 % had between 1-4 injections of radium-223, of wich 1 % died, 21% had progression disease, 7% had hematological toxicity (decrease platelet count) and 8% were suspended due to other reasons. 64% had adverse events during the treatment, wich were all hematological, including anemia (28%), decreased platelet (18%), neutropenia (2%) and lymphopenia (51%). Pain control improved significantly, with 70% of patients experiencing diminished pain or better management. The overall survival from the start of treatment was 7 months, extending to 12 months in patients who completed 5 to 6 cycles. ***Conclusion:*** Radium-223 demonstrates significant efficacy in controlling pain and managing bone metastases in mCRPC patients who have undergone extensive prior treatments. However, hematological toxicities remain a concern, highlighting the need for careful patient selection and monitoring during treatment to achieve finishing the 6 inyections of radium-223 in order to raise de overall survival.

EP-0618

A single-center experience in compassionate use of ^{177}Lu-PSMA-617 in advanced prostate cancer.

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Aim/Introduction: Radioligand therapy (RLT) with 177Lu-PSMA-617 targeting the prostate-specific membrane antigen (PSMA) has emerged as an innovative and promising approach in the management of metastatic castration-resistant prostate cancer (mCRPC). This single-center observational study reports on the compassionate use of 177Lu-PSMA-617 for patients with advanced mCRPC at the Fondazione IRCCS Istituto Nazionale dei Tumori, Milan. ***Materials and Methods:*** The clinical protocol comprised up to four cycles of 177Lu-PSMA-617, administered every 6 weeks in patients affected by PSMA-positive mCPRPC showed at 68Ga-PSMA-11 PET/CT. Overall survival (OS), PSA response rates, and adverse events (AEs) were assessed. ***Results:*** A total of 24 men received 177Lu-PSMA-617 between October 2021 and June 2022, with a focus on evaluating efficacy, safety, and patient outcomes. Since compassionate use program eligibility required patients with advanced metastatic disease, RLT was dispensed after several prior treatments, including surgery, radiotherapy, antiandrogen therapy, and chemotherapy. The median activity administered was approximately 6.93 GBq (6.72-7.29) per cycle. Out of the 24 patients, 12 completed the full treatment protocol. The primary endpoint, overall survival (OS), revealed a median OS of 14 months for patients who completed the treatment. This result aligns with previous studies highlighting the potential benefits of 177Lu-PSMA-617 in a heavily pretreated mCRPC population. As a secondary endpoint, the study reported a median PSA reduction of 26.94% following the first RLT cycle, with 6 patients achieving a reduction of over 50%. In subsequent cycles, 4 additional patients showed similar reductions, and notably, in 3 cases, PSA levels decreased by more than 90%. While the treatment was predominantly well-tolerated, monitoring for adverse events based on the Common Terminology Criteria for Adverse Events (CTCAE) revealed that hematologic toxicities were the most frequent serious side effects, with 4 subjects experiencing toxicities at grade 3 or 4 levels. No other grade 3 or 4 toxicities have been documented. ***Conclusion:*** This study presents 177Lu-PSMA-617 as an effective option under compassionate use, providing crucial data on its application in a real-world setting. The findings suggest that 177Lu-PSMA-617 is a viable treatment option for patients with advanced mCRPC, especially those with limited alternative. Moreover, with the expectation of wide use of this treatment in the near future, the study highlights the importance of patient selection and the potential for radioligand therapy in mCRPC. This forward-looking perspective underscores the evolving paradigm towards more personalized and effective treatments in oncology.

EP-0620

Clinico-radiological factors determining progression free survival following 177Lu PSMA therapy in metastatic castrate resistant prostate cancer, an Indian scenario

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Aim/Introduction: Introduction:177Lu PSMA radio ligand therapy is an established treatment modality for the management of metastatic castrate-resistant prostate cancer. However, in practice the effect of radio ligand treatment is often short-lasting. A variety of clinic-radiological factors affect response to PSMA radioligand therapy. The purpose of this study, was to to elucidate these factors in predicting progression-free survival in Indian patients treated with radioligand therapy. ***Materials and Methods:*** Methods: In this retrospective observational study total 52 patients of mCRPC treated with 177Lu PSMA therapy from the year 2019 to 2021 were included. Various patient specific characteristics like age, past history of treatment with chemotherapy, PSA value, baseline hemoglobin, combination therapy (novel androgen receptor pathway inhibitors(ARPI) like enazluatmide, abriratarone) with 177Lu PSMA, and various scan specific characteristics (on pre-therapy PSMA PET scan) such as SUVmax of the most avid lesion, number of bony lesions, presence of visceral metastasis, presence of PSMA negative soft tissue lesions were also recorded. Kaplan-meier method was used to assess cumulative PSA progression free survival(PFS) and log rank test was used evaluate prognostic value of various clinic-radiological factors. Cox proportional hazard model was used for multivariate analysis, to find independent prognostic factors. ***Results:*** Median PSA-PFS was 8 months (95% CI, 3.2,12.7). ROC analysis was done to find SUVmax cutoff of 29.025 for PSA-PFS 8 months or higher (AUC: 0.756, P value:0.002). In univariate analysis, only this SUVmax-based division was shown to be significant predictor for PSA-PFS (P value: 0.033). Of all the patient-specific variables only ARPI combination therapy was found to be significant predictor for PSA-PFS in univariate analysis (median PSA-PFS 3 vs 10 month, p value=0.027). In multivariate analysis, both combination therapy and SUVmax of most avid lesion was found to be independent prognostic factor for PSA-PFS (HR: 0.465, 95% CI 0.234,0.922, P: 0.028 and HR 0.478, 95% CI 0.247,0.925 P value: 0.029) . ***Conclusion:*** SUVmax > 29 of most avid lesion in pretherapy PSMA PET and combination therapy with ARPI were independent predictors of PSA-progression-free survival in mCRPC patients treated with 177Lu PSMA therapy. ***References:*** Gafita, A., Marcus, C., Kostos, L., Schuster, D. M., Calais, J., & Hofman, M. S. (2022). Predictors and Real-World Use of Prostate-Specific Radioligand Therapy: PSMA and Beyond. American Society of Clinical Oncology educational book. American Society of Clinical Oncology. Annual Meeting, 42,1-17.

EP-0621

Evaluation of the therapeutic efficacy of ^{225}Ac-PSMA I&T in advanced prostate cancer: preliminary results

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Aim/Introduction: Prostate-specific membrane antigen (PSMA) is a protein highly expressed on the surface of prostate cancer cells, making it an ideal target for therapy. The use of 225Ac-PSMA-617 to treat advanced prostate cancer has shown remarkable efficacy without significant side effects. The treatment relies on accurately delivering the radiopharmaceutical to cancer cells with elevated PSMA receptor expression, leveraging the potent impact of alpha radiation on tumor DNA. Our study aims to assess the efficacy and safety of 225Ac-PSMA I&T in patients with prostate cancer who have shown disease progression despite previous treatment modalities. ***Materials and Methods:*** Ten patients diagnosed with metastatic castration-resistant prostate cancer underwent a treatment regimen involving four cycles of 225Ac-PSMA I&T at 100 kBq/kg, administered at two-month intervals. All patients had previously received extensive chemotherapy and hormonal therapy before their enrollment. After each treatment cycle, urine and blood samples were collected at three-time points for up to 24 hours to assess the clearance rate. The prostate-specific antigen

(PSA) levels and blood cell counts were measured throughout the treatment regimen every four weeks. PET/CT using 68Ga-PSMA-11 was used for baseline staging and imaging control after treatment. The local research ethics committee approved the study. ***Results:*** Preliminary results from this ongoing study demonstrate the auspicious therapeutic efficacy of 225Ac-PSMA I&T in patients with progressive prostate cancer. The early evaluation shows favourable response rates, including significant reductions in PSA concentrations of 26.7% to 36.5% after the first dose of 225Ac-PSMA I&T and from 77.5% to 93.8% after the second dose compared to baseline. The 68Ga-PSMA-11 PET/CT images prove tumor regression compared to baseline scans. Importantly, the treatment is well-tolerated, with no significant treatment-related adverse events reported thus far. ***Conclusion:*** Targeted α-therapy with the use of 225Ac-PSMA I&T is very promising and provides the possibility of effective treatment of advanced-stage prostate cancer patients progressing on existing treatment lines. Additional research involving a larger cohort of patients is necessary to evaluate the efficacy and safety of the treatment comprehensively.

EP-42

e-Poster Area

C: Therapy Clinical Study -> C1 Oncological Therapy Clinical Study -> C13 Local Radionuclide Therapy (including Spheres)

EP-0622

Yttrium-90 resin microsphere radioembolization-induced liver disease and associations with predictive dosimetry

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Aim/Introduction: Hepatocellular carcinoma (HCC) is the sixth most frequent malignancy and fourth leading cause of cancer-related death worldwide. Yttrium-90 (Y90) is a high energy beta-emitter used for locoregional therapy of HCC, with secondary Bremsstrahlung photons and positrons that can be imaged for dosimetry calculations. Radioembolization-induced liver disease (REILD) is a potentially life-threatening complication post-Y90 radioembolization (RE). We report on cases of clinical REILD that developed after Y90 resin RE, with pre- and post- therapy dosimetry measurements. ***Materials and Methods:*** Data was extracted from a database of 472 patients who underwent Y90 resin RE at a tertiary centre between 2008 to 2019. REILD was defined as development of jaundice and ascites 4 to 8 weeks post-RE without tumour progression or bile duct obstruction. Pre-therapy planning dosimetry was obtained via artery-specific partition model based on medical internal radiation dose macrodosimetry. Post-therapy dosimetry was obtained using voxel-based MIM LiverY90 SurePlan Local Deposition Method. Visual agreement between pre- and post-RE scans were scored independently by three senior Nuclear Medicine Physicians. ***Results:*** 12 REILD cases were identified, all were BCLC stage C with portal vein thrombosis (PVT) at baseline. This represents 2.54% of the entire database, and 6.28% of BCLC C with PVT patients. 6 of the REILD cases had available for pre-therapy dosimetry and 7 had adequate scan data for post-therapy dosimetry. Visual assessment revealed that all pre- and post- Y90 scans had complete/ near complete or partial overlap. Median Y90 activity administered was 1.5 GBq. Both predicted and actual median absorbed doses to non-tumoral liver (41.5Gy and 33.0 Gy respectively) were within the recommended threshold for whole liver treatment of 40Gy. ***Conclusion:*** In our cohort, all patients that developed REILD post-Y90 were BCLC stage C with PVT at baseline. The median absorbed radiation to normal liver was within the recommended threshold, suggesting that a lower threshold for absorbed dose to non-tumoral liver may be required for patients with risk factors such as advanced BCLC stage.

EP-0623

Radioembolization as bridging therapy in the treatment of hepatocellular carcinomas in patients who are candidates to liver transplantation. Our experience.

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Aim/Introduction: A review of patients diagnosed with hepatocellular carcinoma (HCH) in our centre who underwent liver transplantation between January 2018 and December 2023 and who previously had received radioembolization with glass microspheres labelled with 90Y with the aim of stabilizing and, in some cases, achieving a downstaging of the disease to meet the Milan criteria for liver transplantation. ***Materials and Methods:*** Retrospective study of 8 patients, 7 men and 1 woman with a mean age of 63 ± 7 years with HCH on cirrhotic liver (2 ethanolic, 4 HCV and 2 HBV; 6 CHILD A, 1 B and 1 C) treated with radioembolization as a bridging therapy to transplantation (2 left and 8 right lobectomies). Until December 2023, clinical and radiological monitorization was pursued to assess treatment response and to meet the transplant criteria, as well as to assess progression-free survival (PFS) and overall survival (OS). ***Results:*** Before radioembolization, only 1 patient met the Milan criteria and after radioembolization, 5 patients. The dose administered to the liver was 185.87 ± 55.2 Gy. Partial response was obtained in 62% of patients, complete necrosis of the lesion in 13% and progressed in 25%. The size of the lesions was reduced by 37%. The PFS was 6.89 ± 7 months, and the waiting time between radioembolization and transplantation was 9.33 ± 7.3 months. OS was 38.1 ± 20.87 months. ***Conclusion:*** The preliminary results of our sample indicate that radioembolization is effective in reducing the size of liver lesions, achieving a downstaging of the disease that allows the patient to meet the Milan criteria and stabilizing it until the moment of transplantation.

EP-0624

Overall survival (OS) as function of tumor absorbed dose (T) in hepatocellular carcinoma (HCC) treated with Y-90 microspheres

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Aim/Introduction: The aim of our study was to investigate the relationships between mean absorbed tumor (T) dose, obtained from PET/CT post-therapy studies in hepatocellular carcinoma (HCC) treated with yttrium-90 microspheres (Y-90), and overall survival (OS) of treated patients. ***Materials and Methods:*** After treatment with Y-90 microspheres, 27 patients (10 female and 17 males, mean age 69.0± 7.8y), underwent PET/CT imaging. PET/CT studies were conducted with an acquisition time of 15 minutes, using the reconstruction matrix of 200x200x75 and voxel size 4.07x4.07x3.00 mm3. Low dose, non-diagnostic CT images were used for attenuation correction (1). PET/CT reconstructed images were transferred to a common platform and Y-90 dosimetry was calculated utilizing the local deposition method. Regions-of-interest (ROIs) for whole liver and tumor(s) were manually created for each patient, while the normal tissue ROI was automatically generated. Patients were categorized into two groups: Groupe 1with T less than 215 Gy and Groupe 2 with T equal or greater than 215 Gy, based on literature values for tumoricidal dose. Survival analysis was performed using Kaplan-Meier survival plot. ***Results:*** In Groupe 1, consisting of 13 patients, the range of T was 22Gy to 213Gy. For Group 2, comprising 14 patients, the range for T was 258Gy to 1370Gy. The mean and median OS for Group 1 were 16.1 and 9.0 months, respectively, while for Group 2, they were 24.1 and 18.0 months, respectively. ***Conclusion:*** Although the differences in mean and median OS were not statistically significant (p=0.2), the trend indicated that both values were higher for Group 2. Group 2 exhibited a mean OS longer by 8 months and a median OS longer by 9 months compared to Group 1. The limitation of the study is the relatively small sample size of 27 patients; with a larger number of cases, the mean and median OS differences between Groups 1 and 2 may become statistically significant and larger than observed in this study. ***References:*** 1.Knešaurek K, Tuli A, Kim E, Heiba S, Kostakoglu L. Comparison of PET/CT and PET/MR imaging and dosimetry of yttrium-90 (90Y) in patients with unresectable hepatic tumors who have received intra-arterial radioembolization therapy with 90Y microspheres. EJNMMI Phys 5: 23, 2018 https://doi.org/10.1186/s40658-018-0222-y.

EP-0625

Lung dose verification after ^{90}Y-microsphere radioembolization treatments

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Aim/Introduction: To estimate the delivered lung doses using post-therapy 90Y-SPECT/CT and 90Y-PET/CT imaging and to evaluate its concordance with doses predicted with pre-therapy 99mTc-macroaggregated albumin (99mTc-MAA) planar and SPECT/CT imaging. ***Materials and Methods:*** Thirty-five 90Y-microsphere therapy patients underwent pre-therapy 99mTc-MAA planar and SPECT/CT and post-therapy 90Y-SPECT/CT and 90Y-PET/CT imaging (as part of a prospective clinical trial, RAPY90D, NCT03896646). Lung shunt fractions (LSFs) were calculated by contouring lungs and livers on corresponding CTs and determining their volumes, masses, and either the mean SPECT count density or the median PET activity concentration. Appropriate techniques, based on previous techniques,1 to minimize biases from noise, respiratory-motion, and mis-registration were implemented. Lung doses (in Gy/GBq of administered 90Y) were calculated by multiplying LSFs by 49.7 Gy*kg/GBq and dividing by patient-specific lung mass. In cases with truncated lungs in the field-of-view (FOV) of hybrid scans, diagnostic chest CTs were used to calculate total lung masses and adjust net lung uptake determined from the hybrid scans.1 As typically done, 99mTc-MAA planar dosimetry was performed assuming 1 kg lung mass. ***Results:*** Estimated lung masses ranged (median) between 506-1567 (901) g, with only 17 (49%) cases containing the full lungs in >1 hybrid-CT FOV. There was good concordance between 90Y-SPECT (range 0.3-2.3 Gy/GBq) and 90Y-PET (range 0.1-4.1 Gy/GBq) based lung dose estimates, with a paired-difference mean ± SD of -0.1 ± 0.6 Gy/GBq and 92% of cases within 1 Gy/GBq of the verified dose. SPECT and planar MAA imaging over-estimated the verified lung dose by a mean ± SD difference of +0.1 ± 1.2 Gy/GBq and +0.9 ± 1.6 Gy/GBq, respectively, demonstrating good agreement in most cases. In the worst 2 cases, verified lung doses of 2.1 and 3.7 Gy were grossly over-predicted to be 12.1 and 18.6 Gy with 99mTc-MAA SPECT/CT and 22.9 and 28.1 Gy with 99mTc-MAA planar imaging, respectively. ***Conclusion:*** Good agreement between post-therapy 90Y-SPECT/CT and 90Y-PET/CT lung doses suggest high confidence in methodology developed to verify lung doses. While there was overall good correspondence, cases exist where over-estimated predicted lung doses could negatively impact current or future treatments. ***References:*** [1] Lopez et al. Calculation of lung mean dose and quantification of error for 90Y-microsphere radioembolization using 99mTc-MAA SPECT/CT and diagnostic chest CT. Med Phys 46(9):3929-3940, 2019.

EP-0626

Radioisotopic synoviorthesis as a treatment for refractory or relapsing chronic arthritis

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Aim/Introduction: To evaluate the results of radioisotopic synoviorthesis (RSO) therapy in patients with chronic synovitis refractory to first-line therapy. ***Materials and Methods:*** This is an observational and retrospective study that included all RSO performed in our department, between September 2014 and 2023, in patients with large and/or medium-sized chronic inflammatory mono/oligoarthritis refractory to first-line treatment and with no or minimal cartilage or bone destruction. Pain, joint mobility/functionality and quality of life were assessed at 2, 6 and 12 months. ***Results:*** 35 patients (age: 51.06 ± 14.15, 57.1% male) underwent 41 therapeutic procedures (dose: 176.49 ± 35.2 MBq). The most frequent underlying pathology was autoimmune (51.4%) followed by proliferative arthritis (17.1%). 34.3% had received previous local treatment. 91.4% had local pain and 94.3% had limited mobility. 54.3% of patients had multifocal involvement. The most frequent location was the knee (91.2%) and left side (62.9%). At 2 months follow up, 80% of the patients had improved pain, 65.7% improved joint mobility and 60% improved quality of life. At 6 months, 45.7% of patients reduced analgesic treatment and 68.6% improved joint dynamics. At 12 months,

48.6% had a relapse of symptomatology. Retreatment occurred in 17.1% of our population. The probability of relapse was 27%, 38% and 45% at 3, 6 and 12 months, respectively. The only factor significantly associated with the likelihood of relapse was male sex (HR: 3.87, p=0.049). One patient showed an acute complication and none had chronic complications related to RSO. ***Conclusion:*** RSO is an effective and safe treatment in patients with chronic inflammatory synovitis refractory to first-line therapy. ***References:*** 1: Kampen WU, Boddenberg-Pätzold B, Fischer M, Gabriel M, Klett R, Konijnenberg M, Kresnik E, Lellouche H, Paycha F, Terslev L, Turkmen C, van der Zant F, Antunovic L, Panagiotidis E, Gnanasegaran G, Kuwert T, Van den Wyngaert T; EANM Bone & Joint Committee, the Dosimetry Committee, the Oncology & Theranostics Committee. The EANM guideline for radiosynoviorthesis. Eur J Nucl Med Mol Imaging. 2022 Jan;49(2):681-708. doi: 10.1007/s00259-021-05541-7. Epub 2021 Oct 20. PMID: 34671820; PMCID: PMC8803784. 2: Zwolak R, Majdan M. [Contemporary use of radiosynoviorthesis in chronic polyarthrtitis]. Wiad Lek. 2017;70(3 pt 2):677-684. Polish. PMID: 28713102.

EP-0627

Survival biomarkers of radioembolization with Yttrium-90 glass microspheres in metastatic colorectal cancer

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Aim/Introduction: To evaluate the prognostic factors and survival outcomes of colorectal cancer liver metastasis (lmCRC) treatment by transarterial hepatic radioembolization with yttrium-90 (TARE). ***Materials and Methods:*** Prospective longitudinal study, which included patients with colorectar liver metastases treated by TARE, between November 2015 and October 2023. The therapeutic response was evaluated at 3 and 6 months of the TARE (criteria RECIST1.1). Predictive biomarkers associated with survival was explored. ***Results:*** 48 TARE were performed in 39 patients (age 61.58 ± 8.56 years, 61.5% men). Ten patients (25.6%) underwent surgery for the primary tumor and 27 cases (69.2%) presented liver metastases synchronous with the primary tumor. Prior to TARE, 36 (92.3%) patients had received at least one line and 13 (33.3% patients) received at least 2 lines of QT. The most frequent type of TARE was lobectomy (74.4% cases) followed by segmentectomy and bilobar (12.8%). The average perfused volume was 922.15 ± 553.00 cm3, absorbed dose in the tumor tissue of 207.55 ± 113.90 Gy, and an average tumor-to-normal-liver ratio (TNR) of 27.76 ± 44.47. Median OS was 46 months (95%CI 29.77-62.23 months) from CRC diagnosis and 11 months (95%CI 8.03-13.98 months) from TARE. PFS was 5 months (95%CI 3.17-6.84). The factors associated with a lower OS were: synchronous metastases (HR: 3.329; p= 0.035), extrahepatic disease (HR: 4.730, p= 0.002), ascites (HR: 8.835, p= 0.012) , treatment with aflibercept (HR: 2.679, p= 0.039), baseline AST (HR: 1.026, p= 0.041), platelet-to-lymphocyte ratio (PLR) (HR: 1.01, p= 0.049), neutrophil-to-lymphocyte ratio (NLR) >4 (HR : 4.04, p=0.044), Y-90 activity (HR: 1.47, p<0.001), perfused volume (HR:1.001, p= 0.008), absorbed tumor Y-90 dose <150 Gy (HR: 3.24, p =0.014). After TARE, urea (HR: 1.02, p= 0.023), AST (HR: 1.02, p< 0.001), ALT (HR: 1.01, p 0.022), alkaline phosphatase (HR :1.01, p= 0.006), GGT (HR: 1.002, p< 0.001), total bilirubin (HR: 1.29, p< 0.001), lactate dehydrogenase (HR: 1.004, p< 0.001), NLR (HR: 1.04, p= 0.002), PLR (HR: 1.006, p= 0.001), and toxicity (HR: 4.35, p= 0.002) were associated with OS. 25 patients died (64.1%). ***Conclusion:*** TARE is a safe therapeutic procedure for the treatment of lmCRC. Prognostic biomarkers include biochemical parameters to factors related to tumor dosimetry.

EP-0628

Treatment of liver metastases from colorectal carcinoma by radioembolization with Yttrium-90 glass microspheres: efficacy and safety results

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Aim/Introduction: To analyze the efficacy and safety of treatment by hepatic transarterial radioembolization with yttrium-90 (TARE) of liver metastases from colon cancer (lmCRC). ***Materials and Methods:*** Prospective longitudinal study, which included patients with lmCRC treated by TARE, between November 2015 and October 2023. The therapeutic response at three and six months (RECIST1.1 criteria) by calculating objective tumor response rates (ORR) and disease control (DCR) and toxicities by Common Terminology Criteria for Adverse Events, version 5 were evaluated. ***Results:*** 48 TAREs were performed in 39 patients (age 61.58 ± 8.56 years, 61.5% men). Ten patients (25.6%) underwent surgery for the primary tumor and 27 cases (69.2%) presented liver metastases synchronous with the primary tumor. Prior to TARE, 36 (92.3%) patients had received at least one line and 13 (33.3% patients) received at least 2 lines of QT. The most frequent type of TARE was lobectomy (74.4% cases) followed by segmentectomy and bilobar (12.8%). The average perfused volume was 922.15 ± 553.00 cm3, absorbed dose in the tumor tissue of 207.55 ± 113.90 Gy, and an average tumor-to-normal-liver ratio (TNR) of 27.76 ± 44.47. At 3 months, 3 patients (7.7%) had a complete response (CR), 7 (17.9%) had a partial response (PR), 13 (33.3%) had stable disease (SD) and 16 (41%) patients progressed (PD). This represents an ORR of 25.6% and DCR of 59%. AT 6 months after TARE, there was no CR, 1 patient (2.6%) maintained PR, 8 (20.5%) had EE and 19 (48.7%) patients had PD. The ORR was 2.6% and the DCR was 23.1%. Only, 1 patient presented an acute complication (pain) after the procedure and 12 (30.8%) patients showed some degree of late toxicity, with hyperbilirubinemia being the most frequent toxicity (7 patients, 17.9%), grade 3-4 in 5 patients. (12.8%). ***Conclusion:*** TARE is a safe and effective therapeutic procedure for the treatment of liver metastases from unresectable colorectal carcinoma.

EP-0629

Radioembolization with Yttrium-90 glass microspheres in hepatocellular carcinoma: factors impacting survival

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Aim/Introduction: Transarterial radioembolization (TARE) with yttrium-90 microspheres is an established treatment option for patients with hepatocellular carcinoma (HCC). However, optimization of treatment as well as patient selection remains a challenge. Here we report on the effectiveness and prognostic factors, including dosing methods, associated with TARE for HCC in the prospective observational study. ***Materials and Methods:*** This prospective longitudinal study enrolled 43 consecutive patients with HCC between Jan 2022 and Sep 2023 treated with TARE (glass microspheres). Patient characteristics and treatment-related data were collected at baseline. Therapeutic response at three months (RECIST1.1 criteria) by calculating objective tumor response rates (ORR) and disease control (DCR) was evaluated. Kaplan-Meier and multivariate Cox regression were conducted to identify independent prognostic factors for overall survival (OS). ***Results:*** forty-three TAREs were performed (mean age, 71.52±9.56 years; 62.8% male). The median OS was 20.5 months, the median PFS was 16.1 months. At three months, the objective response rate (ORR) was 73% and the DCR 80%. OS was significantly associated with tumour-absorbed dose >300Gy (p=0.042), NIACE score (p=0.020), presence of cirrhosis (p = 0.007), radiation segmentectomy vs. lobectomy (p< 0.001), target volume <500 cm3 (p=0.008) and % perfuses volume (0.033). ***Conclusion:*** TARE is an effective treatment in patients with HCC. Target volume and tumor dosimetry impact on survival.

EP-0630

Assessment and Safety of High Pulmonary Uptake on Holmium-166 Scout Imaging

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Aim/Introduction: Lung shunt assessment during radioembolization (RE) work-up is essential for risk evaluation of radiation pneumonitis. Hereby, either Technetium-99m-macroaggregated-albumin (99mTc-MAA) or Holmium-166 (166Ho) microspheres are administered during hepatic angiography followed by thoraco-abdominal scintigraphy. Safety of use of 166Ho microspheres for scout imaging (166Ho-scout) has been demonstrated in a cohort study, but, to our notice, evaluation of its delivered lung dose has not been described so far. Therefore, a retrospective study in two centres was performed, covering all HCC patients referred for RE between 01/04/2021 and 31/12/2023. Presence of significant lung shunt and lung radiation dose was assessed. ***Materials and Methods:*** All work-up procedures were performed with 166Ho microspheres. Administered activity was based on angiographically determined perfusion territories not exceeding leaflet prescribed maximum activity of 250 MBq. Scintigraphic imaging consisted of planar imaging and tomographic imaging combined with computed tomography (SPECT/CT) covering thoraco-abdominal region. Based on planar and SPECT/CT-images, lung shunt fraction (LSF) was calculated. For patients with significant lung shunt, SPECT/CT assessment was applied to calculate actual and hypothetical maximum 166Ho-scout lung doses. ***Results:*** Twenty-nine HCC patients were evaluated. Twenty-two patients with favourable outcomes during work-up received subsequently 166Ho RE therapy. No significant post-therapy lung shunts were observed afterwards. Seven patients were excluded from 166Ho RE therapy of whom four based on excessive lung shunt. These four patients were suffering from large unresectable HCC (tumour diameter range 13 to 18 cm) in a non-cirrhotic liver without prior liver treatments. Planar LSF averaged 43% (range 29% - 69%). Range of SPECT/CT based LSF was between 10% and 41%. In 3 of these patients visual arteriovenous shunting was already observed during hepatic angiography and lung shunting was confirmed on scout imaging. One patient was identified with real lung shunting on scintigraphy (SPECT/CT based LSF 17%) despite no angiographic abnormalities. Based on effectively injected 166Ho-scout activity in these patients (range 100-200 MBq), mean lung dose of 0,43 Gy (range 0,11 - 0,66 Gy) was calculated. If maximum allowed activity of 250 MBq would have been administered, mean lung dose would be 0,74 Gy (range 0,29 - 1,38 Gy). No pulmonary adverse events related to 166Ho-scout were recorded in follow-up. ***Conclusion:*** This study supports the previously stated hypothesis that 166Ho-scout enables accurate assessment of post-therapy lung shunt and that 166Ho-scout is a safe alternative for 99mTc-MAA prior to SIRT. Despite significant lung shunt, acceptable low lung doses from 166Ho microspheres were demonstrated.

EP-0631

The Objective Response and Disease Control Rates in Patients with Breast Cancer: a Meta-analysis

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Aim/Introduction: The aim of this study was to meta-analyze the clinical utility of radioembolization in patients with breast cancer (BC), based on the average objective response rate (ORR) and disease control rate (DCR). ***Materials and Methods:*** A comprehensive literature research through April 2024 in the PubMed/MEDLINE and CENTRAL databases was carried out to retrieve studies with 1) a study cohort or a subset of at least 20 BC patients treated with radioembolization and 2) adequate information on response assessment to derive ORR and DCR. The methodological quality of the studies was assessed by an investigator using the "Quality Assessment of Diagnostic Accuracy Studies" tool, v. 2 (QUADAS-2). Statistical analysis was performed on a per-patient basis; the ORR was calculated as the ratio between the number of patient with complete response (CR) or partial response (PR) over the total number treated with radioembolization; the DCR was calculated as the ratio between the number of patient with CR, PR or stable disease (SD) over the total number treated with radioembolization. The I2 statistic was used to measure the degree of inconsistency across the studies, with values of 25%, 50%, and 75% representing thresholds for low, moderate, and high heterogeneity. Interpretation of heterogeneity was carried out at a significance level of p=0.05. A random-effects model was used for statistical pooling. ***Results:*** Eighteen studies were eligible for the calculation of the OOR and DCR: 10 studies included resin spheres, 4 studies used glass spheres and the remaining studies used both types of spheres in their patient cohorts. The risk of bias resulted low in most of the studies. In the all patients group (n=650) ,ORR resulted 50.71% (95% C.I.: 40.04 - 61.36; I2: 87%); DCR resulted 88.37% (95% C.I.:

81.89 - 93.57; I2: 82%). Taking into account only resin spheres (395 patients), the ORR was 60.35% (95% C.I.: 46.55 - 73.36; I2: 87%) and the DCR was 92.73% % (95% C.I.: 87.17 - 96.80; I2: 71%). Considering glass spheres (144 patients), the ORR was 32.38% (95% C.I.: 18.43 - 48.16; I2: 72%) and the DCR was 82.69% % (95% C.I.: 59.29 - 97.26; I2: 90%). ***Conclusion:*** The present meta-analysis favors the use of radioembolization in patients with breast cancer. In patients with BC, radioembolization provides good ORR and DCR either with resin or glass spheres.

EP-0632

Selective Internal Radiation Therapy With Microspheres Labeled With Holmium 166 In Liver Tumors: Experience In Our Center

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Aim/Introduction: To assess the absorbed doses and tumor response in treatments with 166Ho-labeled microspheres (166Ho-microspheres) in patients with liver tumors. ***Materials and Methods:*** Between December 2018 and January 2024, 39 selective internal radiation therapies (SIRT) with 166Ho-microspheres were performed in 38 patients with liver tumors ; one of them received two treatments with 166Ho-microspheres (14 women / 24 men; 28 - 84 years; 15 cholangiocarcinomas, 18 hepatocellular carcinomas, 3 liver metastases from colon cancer, one liver metastasis from a neuroendocrine tumor and one giant hepatic adenoma). Treatment planning was carried out with albumin macroaggregates labeled with Technetium 99 or with 166Ho-microspheres. Planning images were acquired the day of the administration using a hybrid gamma camera. Treatment doses were calculated using a single-compartment model or personalized dosimetry. The images of the treatments with 166Ho-microspheres were acquired the day after administration and the dosimetries were evaluated using the dosimetric software. Follow-up was performed 3 and 6 months after treatment using CT and/or MRI. ***Results:*** Average absorbed doses in target volumes: 52 - 563 Gy. 7 patients presented lesion progression at 6 months. 8 patients presented extralesional progression at 6 months. 7 patients presented partial response or stable disease at 6 months and underwent surgery with curative intent. 4 patients presented partial response after 6 months. 1 patient presented complete response after 6 months. 1 patient presented stable disease at 6 months. 8 patients are waiting follow-up at 6 months. 2 patients lost follow-up at 6 months. ***Conclusion:*** SIRT with 166Ho-microspheres is a safe and well-tolerated technique as a bridge to surgery and/or to treat liver tumors.

EP-0633

Mean tumour absorbed dose in the response assessment of transarterial radioembolization with 90Y-resin microspheres

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Aim/Introduction: Transarterial Radioembolization (TARE) is a locoregional radiation therapy for inoperable liver lesions that has demonstrated an embolic and biologic effects, but the clinical results have been variable between patients, therefore a better understanding of the dose-response is still necessary. The aim of this study was to evaluate the role of the mean tumour absorbed dose in 90Y-TARE as predictor of response and survival in benign and malignant neoplasms. ***Materials and Methods:*** Retrospective analysis of 20 patients affected by hepatocarcinoma (n=17) and colorectal metastasis (n=3) treated with 90Y-resin microspheres in our centre. Planification and treatment were carried out with m99Tc-MAA/90Y-resin. The activity and the absorbed dose (AD) were computed during planification (partition model) and after TARE (voxel-based model). Response assessment (RA) was obtained with morphological parameters. Statistical analysis was performed to evaluate the differences in mean tumour absorbed dose between the different responders [partial response (PR), complete response (CR)] with Wilcoxon test. Overall survival (OS) and progression free survival (PFS) were analysed, and a Cox regression was fitted using the tumour absorbed dose to obtain the hazard ratios (HZ). To obtain a dose threshold a binomial model was fitted and used in a receiver operating characteristic curve, and a threshold of 100% sensitivity for response was used as a criterion to find a minimum absorbed dose limit. Using this limit a Kaplan-Meier survival analysis (KP) was performed. The absorbed dose was log-transformed for fitting model assumptions. ***Results:*** The following values were recorded: Planned activity 3.47GBq[1.50GBq-9.00GBq], administered 3.03GBq[0.90GBq-9.27GBq]. AD planning vs treatment: tumour 395.84Gy[74.82Gy-1137.59Gy] vs 237.70Gy[50.78Gy-493.20Gy]; lungs 6.09Gy[0.1Gy-23.49Gy] vs 1.06Gy[0.00Gy-13.24Gy]. The RA observed were PR=14p and CR=6p. The mean tumour AD for PR and CR were 187±121Gy and 332±102Gy (p=0.002) respectively. An AD threshold of 183.5± 75 Gy was found. Kaplan-Meier analysis using the threshold showed a difference of mean progression time of 23 months for PR vs 34 months for CR (p = 0.052). ***Conclusion:*** Our experience confirms the efficacy of 90Y-resin microspheres in malignant tumours, obtaining high doses during planification and assuming high therapeutic doses. The mean AD was significantly different when comparing patients with PR and CR. In both cases, the mean AD was higher than others described in the literature. In our cohort, the optimal cut-off value for complete response and better survival was obtained for AD 332±102Gy. ***References:*** Weber M, Lam M, Chiesa C, et al. Eur J Nucl Med Mol Imaging. 2022;49(5):1682-1699

EP-0634

Ablative Trans-Arterial Radioembolization (TARE) of Hepatic Metastases with Yttrium (^{90}Y) Resin Microspheres

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Aim/Introduction: Ablative TARE of hepatic metastases with 90Y glass microspheres is associated with high disease control rates and minimal toxicity. We evaluated the safety and initial efficacy of ablative TARE with Y-90 resin microspheres. ***Materials and Methods:*** This retrospective study, approved by the

institutional review-board, examined 15 patients with hepatic metastases treated in the Netherlands Cancer Institute. Patients were included if aimed tumor dose was ≥200 Gy, determined by partition dosimetry, and had a minimal follow-up of three months. Primary outcomes were target tumor response at three months using Response Evaluation Criteria in Solid Tumors (RECIST) v1.1 and clinical and biochemical toxicity in the first three months after TARE using the National Cancer Institute Common Terminology Criteria for Adverse Events (CTCAE) v5.0. Secondary outcomes were time to progression (TTP) of target lesions and overall survival (OS), estimated by the Kaplan-Meier method. ***Results:*** Fifteen patients underwent ablative TARE with a median target tumor dose of 200 Gy (range, 200-350 Gy). The median follow-up was 11 months (range 2-52 months). Nine (60%) patients had a liver tumour burden of <25% and six patients (40%) had a liver tumour burden of 25-50%. The median index tumor size was 6.5 cm (range 3.9-15.8 cm) and 23 target lesions were identified for response assessment. The median age was 59 years and hepatic metastases included metastases from colorectal cancer (80%), neuroendocrine tumors (13.3%) and breast cancer (6.7%). The most common clinical grade 1-2 toxicities were fatigue (53.3%), abdominal pain (46.7%) and nausea (40.0%). One (6.7%) patient experienced a clinical grade 3 toxicity of fatigue. Six (40%) patients experienced a grade 3-4 biochemical toxicity, of which one (6.7%) patient had a neutropenia and five (33.3%) patients had increased gamma-glutamyl transpeptidase (GGT). The disease control rate at 3 months follow-up was 93% (47% partial response, 47% stable disease, 7% progressive disease). The median OS was 25.0 months (95% CI 8.9-41.1) and the mean TTP was 26.4 months (95% CI, 22.0-30.9 months). ***Conclusion:*** Ablative TARE with 90Y resin microspheres shows a high disease control rate with clinically acceptable toxicity in the treatment of hepatic metastases. Further 90Y PET post-treatment dosimetry is required to investigate dose distribution and its effects on response and toxicity.

EP-0635

Inter- and intraobserver variability in tumor segmentation for selective internal radiation therapie (SIRT) using contrast-enhanced SPECT/CT: Implications for treatment planning and predictive dosimetry

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Aim/Introduction: Liver cancer poses a global challenge. Selective internal radiation therapy (SIRT) with 90Y-resin spheres is an established therapy for inoperable tumors. However, image-guided planning with 99mTc-MAA and predictive dosimetry needs segmentation of liver lobes and tumor manifestations. This process is error-prone, affecting achieved dose and thereby outcome. In this study, contrast-enhanced CT was used together with SPECT in order to optimize tumor visibility. The inter- and intraobserver variability of tumor segmentation was evaluated as well as its impact on the the resulting tumor dose. ***Materials and Methods:*** A cohort of 19 patients were evaluated for SIRT, each presenting with 1-14 liver tumor manifestations of diverse primary origins. Patients were injected with 99mTc-MAA particles via a catheter placed in the liver arteries or its branches. A biphasic contrast-enhanced CT of the liver was acquired together with the SPECT. Two experienced nuclear medicine professionals and one medical student segmented the tumors in both lobes using SurePlan Liver Y90TM (MIM Software Inc.). The student additionally performed a repeat segmentation after three months. For the analysis of the inter- and intraobserver variability of segmentation, the Dice Similarity Coefficient (DSC), twice the overlapping volume divided by the sum of the two individual volumes, was calculated for each segmentation pair. For all segmentations, the predictive dose for tumor and normal-liver was calculated using the partition model. The deviations in tumor dose, caused by segmentation mismatch, was calculated from this data in order to assess the impact of inter- and intraobserver segmentation variability. ***Results:*** Interobserver analysis revealed mean DSC values of 0.73, 0.74, and 0.75, the intraobserver analysis a mean DSC of 0.79, i.e. intraobserver segmentations overlapped more than interobserver segmentations without a clear difference between expert and beginner observers. In comparison to the observer with the highest achieved tumor dose, the segmentations of the other two observers lead to 11% less tumor dose on average. Interestingly, DSC did not correlate with dose deviation. ***Conclusion:*** Even when using biphasic contrast-enhanced CT for improved tumor visibility, a significant inter- and intraobserver variability in tumor segmentation was seen for both expert and beginner observers. The resulting differences in predicted tumor dose as observed in this study give an indication of the size of the error made during predictive dosimetry that is caused by inexact tumor delineation. This error should be kept in mind when deciding on injected activity on the basis of predictive dosimetry.

EP-43

e-Poster Area

C: Therapy Clinical Study -> C1 Oncological Therapy Clinical Study -> C14 Thyroid Therapy

EP-0636

No Association of Preablation Thyroglobulin Antibody Positivity and Outcome in Patients with Diffuse Sclerosing Papillary Thyroid Carcinoma

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Aim/Introduction: This study was designed to evaluate the relationship between preablation thyroglobulin antibody (TgAb) positivity and clinical outcomes in patients with diffuse sclerosing papillary thyroid carcinoma (DS-PTC). ***Materials and Methods:*** In the period 2009-2023, all consecutive DS-PTC patients who underwent total thyroidectomy and radioiodine ablation at a tertiary hospital in southwestern China were retrospectively included. TgAb was measured before remnant ablation. Tumor characteristics and long-term outcomes were compared between TgAb-positive and TgAb-negative patients. ***Results:*** Forty-nine patients were analyzed. Preablation TgAb positivity was presented in 55.1% of patients. Tumor characteristics, lymph node metastases, and median duration of follow-up were similar between TgAb-positive and -negative patients. During follow-up, the percentage of patients with either surgical reintervention for lymph node metastases (3.7% vs 0.0%, P = 1.000) or repeated 131I therapy (14.8% vs 9.0%, P = 0.256) was similar between TgAb-positive and -negative patients. At the final follow-up visit, the rates of structural disease did

not differ between the two groups (11.1% vs 18.2%, P = 0.769). ***Conclusion:*** This study highlights no association of preablation TgAb positivity and clinical outcome in patients with DS-PTC.

EP-0637

Treatment Outcome ofAdjunctivePotassium Iodideinthe Radioactive IodineTreatment of Severe Hyperthyroidism. A Randomized Trial

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Aim/Introduction: This study aimed to explore the application value of Adjunctive potassium iodide in the treatment of severe hyperthyroidism with Radioactive Iodine(131I). ***Materials and Methods:*** Sixty-two patients with severe hyperthyroidism who were to be treated with 131I were randomly divided into the experimental group (31 cases of oral potassium iodide group) and the control group (31 cases of oral antithyroid drugs [ATDs] group). The differences in serum free T3 (FT3) and free T4 (FT4) 1 month after 131I treatment, the side effects, and the prognosis were compared between the two groups. ***Results:*** Comparison results indicated an insignificant difference in serum FT3 and FT4 between the experimental and control groups (FT3: P = 0.647; FT4: P = 0.176). In 31 patients treated with potassium iodide, leukopenia, impairment of liver and kidney function, and anaphylaxis were not found, or preexisting but not worsening symptoms were found. In 31 patients treated with ATDs, There was 1 case of new leukopenia, 1 case of liver function impairment and 1 case of mild drug allergy. Leukopenia was observed in one patient before iodine-131 treatment and worsened after iodine-131 treatment with ATDs, One patient had liver function injury before iodine-131 treatment, and increased liver function injury after iodine-131 adjuvant MMI treatment. the remission rate between the experimental and control groups was insignificantly different (P = 0.059), and the effective rate was 100%. ***Conclusion:*** The effect of potassium iodide on reducing thyroid hormone level and prognosis in the treatment of severe hyperthyroidism with 131I was insignificantly different from that of ATDs. However, the side effects were less than those of ATDs, and potassium iodide played an important role in the radioactive iodine treatment of severe hyperthyroidism.

EP-0638

Relationship Between Factors in the Treatment Process of Xerostomia Developed Due to I-131 Therapy

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Aim/Introduction: I-131 therapy administered in patients with differentiated thyroid carcinoma (DTC) causes damage to the salivary glands. Approximately 40% of patients develop long-term xerostomia after treatment. In this study, we aimed to compare complaints related to salivary glands in patients who received I-131 therapy with gender, I-131 dose, use of chewing gum, lemon, and findings of I-131 whole-body scanning (WBS). ***Materials and Methods:*** Symptoms of salivary gland damage in 101 patients with DTC who received I-131 therapy between 2004 and 2021 were retrospectively queried, including dry mouth, taste disturbance, incresed water intake during meals, and presence of swelling in salivary gland areas. The use of chewing gum, and lemon during treatment was noted. WBS findings obtained post-therapy and at 9-12 months were evaluated, and asymmetric salivary gland uptake was considered positive. The relationship between patient complaints and gender, I-131 dose, use of chewing gum-lemon during treatment, and WBS findings were statistically evaluated. ***Results:*** The ages of the patients ranged from 9 to 72 years, with 79 females and 22 males. Patients received a cumulative I-131 dose ranging from 30 to 550 mCi (mean: 97.5 mCi ± 76.8). I-131 therapy was administered 1 to 3 times. During treatment, 53 (52.5%) patients had a history of chewing gum, and 50 (49.5%) had a history of lemon use. Complaints included dry mouth in 26 patients (25.7%), swelling in salivary gland areas in 17 patients (16.8%), incresed water intake during meals in 22 patients (21.8%), and taste disturbance in 21 patients (20.8%). Asymmetric uptake in salivary glands was found in 5 patients (4.9%) on post-therapy WBS and in 21 patients (20.8%) on WBS at 9-12 months. There was a significant correlation between post-therapy I-131 WBS findings and dry mouth ($p < 0.05$). There was no significant link found between WBS results and swelling in salivary glands, incresed water intake during meals, or taste disturbance complaints. Similarly, no significant associations were observed between total I-131 dose, chewing gum or lemon Usage, patient gender, and reported complaints. ***Conclusion:*** In this study, a relationship was demonstrated between dry mouth complaints and WBS findings, but no relationship was found between other xerostomia complaints and WBS findings. There is no relationship between the total I-131 dose and xerostomia findings. The recommended use of lemon and chewing gum during patient admission was found to be ineffective in preventing xerostomia development.

EP-0639

Evaluation of response to radioiodine therapy in thyroid oncocytic carcinoma patients, a single center experience from Iran

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Aim/Introduction: Thyroid oncocytic carcinoma, also known as Hürthle cell carcinoma (HCC), is a rare subtype of thyroid cancer with unique characteristics. Radioiodine therapy, while less effective for HCC due to poor radioiodine accumulation in tumors, has shown improved survival rates for tumors larger than 2 cm. Adjuvant radioiodine therapy is recommended in certain cases, particularly for older patients with a worse prognosis. ***Materials and Methods:*** This study reviewed data from 18 HCC cases compared to the overall patient population (OPP) at Qaem Hospital's nuclear medicine department. ***Results:*** The mean age at diagnosis was higher for HCC patients compared to OPP, with varying responses to therapy observed. Assessment of response to therapy after one year revealed 26.7%, 20%, 20%, and 33.3% of HCC patients with excellent, indeterminate, biochemical incomplete, and structural incomplete responses, which were 41.5%, 24.7%, 13%, and 20.7% in OPP, respectively. The Kaplan curve of patient survival showed an average of 100±13.5 months. ***Conclusion:*** Approximately 44% of HCC patients showed excellent survival outcomes after radioiodine therapy, highlighting its importance as a treatment option for HCC. Further research is needed to optimize treatment choices and improve patient outcomes in this less common subtype of thyroid cancer.

EP-0640

Long-term therapeutic morbidity in patients treated for Differentiated Thyroid Cancer

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Aim/Introduction: The standard strategy of special treatment of differentiated thyroid cancer (DTC) consists of surgery, radionuclide therapy and hormone therapy being sequentially applied. Theoretically, each component of the treatment process can cause adverse somatic consequences in future, the study of which can help to prevent and correct them. Our aim was to evaluate possible long-term effects of the treatment of DTC in the form of the therapeutic pathologies on the basis of follow-up data of long-term observation using sophisticated information technologies. ***Materials and Methods:*** The study was based on follow-up data of 157 individuals who were undergoing combination treatment of DTC at the Institute clinic from 1993 to 2015, received it in full and underwent regular screening examinations after treatment. The database created for the study contained, as much as possible, digitized arrays of follow-up data of paper case-records on the disease and its consequences in patients with a follow-up period exceeding 12 years after special treatment. Wiz Why packages (Data Mining category) and the general purpose software package STATISTICA were used to make hypotheses and test them. ***Results:*** According to a retrospective case-control analysis, it was found that in the long term after treatment of DTC the number of cases of coronary heart disease increased by 1.3 times. Provocative factors of this increase is radioiodine therapy and the duration of suppressive hormone therapy, which exceeds 6 months. Also, a comprehensive analysis revealed a statistically significant increase of urological system (US) disease cases within the period of 3.75 - 4.8 years after special treatment. It was shown that the total number of US pathologies was 2.04 times higher in comparison with US incidence before the special treatment. The total onset frequency of gallbladder, liver and pancreas disorders was increased by a factor of 1.6 in a statistically significant manner in DTC patients. Patients initially presenting gallbladder disorders received shorter cures of hormone therapy (4 versus 13 months), and lower levels of L-thyroxine in a context of uncompensated hypothyroidism (2.3 versus 3.5 mg/kg). A statistically significant relation was established between the total duration of breastfeeding in women presenting metabolic health disorders, and onset of liver pathology (essentially non-alcoholic steatohepatitis). ***Conclusion:*** The foregoing allows us to state that a reasonable element of post-treatment screening of patients who have undergone special treatment for DTC should be a mandatory comprehensive regular therapeutic study.

EP-0641

What is the optimal number of lymph nodes to resect in papillary thyroid carcinoma? - hints from the SEER database

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Aim/Introduction: Radioiodine therapy is currently regarded as expendable by some, especially in lower tumor stages, and widely regarded as indispensable in metastasized disease.While we could already show that the side effects of radioiodine therapy are limited, we wondered whether its full potential is already being realized.Since surgery is one of the cornerstones of curative therapy we wanted to see whether there are improvements to be made in the interplay of surgical resection and radioiodine therapy.Here we focus on the optimal number of lymph nodes to resect. ***Materials and Methods:*** We searched the SEER Research Plus Data, 8 Registries, Nov 2023 Sub (1975-2021), released April 2024, based on the November 2023 submission. Included were papillary thyroid carcinomas with ICD-O-3 8260/3.Cause-Specific-Survival was calculated for Tumorsizes 0, 1-10, 10-20, 20-40 and 40+ mm respectively with examined vs. positive lymphnodes as X and Y axis. ***Results:*** Small tumors almost never have lymphnode metastasis, unless they do. Distant metastasized tumors almost always have lymphnode metastasis, unless they don't. The number of lymophnode metastasis is not easily determined by tumor size. There is however a correlation between the number of positive and examined lymphnodes where as if examined lymphnodes > positive lymphnodes prognosis is always better than if examined = positive nodes (true for positive lymphnodes < 6) hinting at the possibility that positive lymphnodes were missed initially. However even excessive resection of lymphnodes does not improve prognosis.In this dataset the resection of positive lymphnodes + 1 generally already leads to the best prognosis. Due to the small populations (at most 1435 patients) in every comparison the results are not significant, however the effect is consistent throughout the different tumor sizes. ***Conclusion:*** Removing healthy lymphnodes while leaving metastasis is likely detrimental to patient health- Removing an excessive amount of lymphnodes likely provides no advantage for the patient - It is unlikely that the correct number of lymphnode metastasis can be found by resection alone - In this dataset outcome for patients where metastasis + 1 lymphnode are removed is better than if all resected lymphnodes are positive - It seems reasonable that determining the optimal number of lymphnodes to be resected before actually doing so could provide the patient with a curative treatment - Determining the correct number of lymphnodes to be resected likely requires imaging, be it in the form of 124-I and FDG-PET/CT or 131-I therapy.

EP-0642

Evaluation of quality parameters in the clinical pathway of treatment with I-131 in differentiated thyroid cancer

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Aim/Introduction: A clinical pathway (CPW) is a management tool that allows for periodic evaluation of the quality of care, improving the trasmission of information to the patient, their subjetive apreciation of the clinical process and safety, the optimization of resources and the updated training of professionals. The objective of a CPW is to reduce the variabiliity in care and help in decision making, based on a multidiciplinary approach in which the sequence of interventions of the healthcare professional involved is detailed. After the planning, development, and implementation of a CPW for the metabolic therapy with I-131 in differentiated thyroid cancer (DTC) at hospital, the aim was to meet the quality objectives in ≥ 80% of patients and to identify areas for improvement. ***Materials and Methods:*** During the implementation (2019-2024), data from the CPW and satisfaction surveys from all patients with DTC and an indication for post-surgical therapy with I-131 was analyzed. We evaluated the fulfillment of following time interval objectives: surgery to I-131 administration <4 months; Nuclear Medicine appointment to I-131 administration <2 months. Other objetives were median hospital stay 1-3 days and a global patient satisfaction index >8 (scale 1 to 10). ***Results:*** CPW of 170 patients were analyzed, 112 women (65.9 %) with a median age of 53 years. 154 (91%) had papillary carcinoma; 16 (9%) follicular carcinoma. 127 patients

(74.7%) stage 1, 30 patients (17,6%) stage 2, 5 (2.9%) stage 3, and 8 (4.7%) stage 4. The dose of 131-I administered was 1.11-7.4 GBq. The median surgery to I-131 administration was 115.28 days (27-460), meeting the objective in 159 patients (93.5%). The median Nuclear Medicine appointment to I-131 administration was 37.72 days (13-171), meeting the objective in 150 patients (88.2%). In pre-treatment appointment 24 patients (14.11%) presented variations in healthcare; being the most frequent due to concurrent clinical process and language barriers. During hospitalization 17 patients (10%), showed clinical variations, most due to the appearance of concomitant pathology. The median hospital stay was 2.04 days (1-8). Satisfaction surveys were collected from a total of 72 patients. Overall, 92% of patients assessed their care with 8-10 points. ***Conclusion:*** All the quality objectives met. Most frequent variability registered is inherent to the patient and therefore unavoidable.

EP-0643

Dynamic risk stratification and analysis of influencing factors in patients with differentiated thyroid cancer following radioiodine therapy

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Aim/Introduction: Dynamic risk stratification, with tailored treatment and follow-up recommendations, is currently the cornerstone of thyroid cancer management. The aim of our study was to investigate and confirm known and novel factors that may have a prognostic impact by influencing risk assessment in the local patient population. ***Materials and Methods:*** In our retrospective study, we selected 139 patients with differentiated thyroid cancer (34 men, 105 women, mean age 50 years) who received high-dose radioiodine treatment between 2016 and 2021. These patients participated in a follow-up study at both 6 and 12 months after the initial treatment. In total, the effects of 35 different oncological and pathological factors were evaluated separately on biochemical and structural responses (ultrasound, iodine whole body SPECT/CT) and combined them to assess dynamic risk stratification. ***Results:*** Of the 139 patients, 120 had papillary, 15 had follicular, and 4 had oncocytic thyroid cancer. Significantly better prognosis was observed in patients with papillary type thyroid cancer (Chi-squared, p=0.005) and without lymph node metastasis (Mann-Whitney, p=0.0128). Primary histological thyroiditis, which is not part of conventional risk assessment, showed significant differences by tumour markers (Mann-Whitney; p<0.0001), and unexpectedly, anti-thyroglobulin was found to be more sensitive for monitoring disease progression (Wilcoxon test; p=0.002). Surprisingly, primary T-stage, lympho-vascular infiltration, and dose did not affect dynamic risk stratification. The overall success rate was over 75% in the low- and medium-risk groups and over 60% in the high-risk population. In low- and intermediate-risk patients, a significant, sustained improvement in therapeutic outcome was observed at 6 and 12 months; however, in high-risk cases, this sustained improvement was not seen after the 6-month mark. ***Conclusion:*** Our findings suggest that histological thyroiditis, a previously underrepresented factor, might play a significant role in both initial risk estimation and dynamic risk stratification. The prognostic potential of anti-thyroglobulin was notably superior to general tumour markers in cases of thyroid inflammation and among high-malignant-risk patients. Unlike primary tumour size, initial histology and metastatic tendency emerged as key prognostic factors. Moreover, the high-risk group exhibited a significantly lower rate of substantial improvement after 6 months compared to lower-risk patients, indicating the potential benefit of initiating alternative therapeutic interventions promptly after 6 months following radioiodine ablation in cases of incomplete response. This highlights the importance of time in high-risk cases and suggests that alternative interventions should be used earlier in non-responders.

EP-0644

The optimal thyroglobulin cut off for detecting FDG-avid disease in TENIS syndrome in a resource constrained setting

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Aim/Introduction: Differentiated thyroid cancer (DTC) has a good prognosis, with a 10-year survival rate ranging from 85% to 99%. However, 20-30% of papillary and follicular thyroid cancers may de-differentiate and lose the sodium-iodine symporter (NIS) expression, leading to thyroglobulin-elevated negative iodine scintigraphy (TENIS) syndrome. Thyroglobulin (Tg) is a glycoprotein synthesized by thryocytes. ATA-guidelines postulate ,a postoperative Tg value greater than 10ng/ml suggests potential persistent or recurrent disease, metastases or unsuccessful I-131 ablation, requiring further evaluation. One of the investigations includes ^{18}F-FDG PET-CT. 18F-FDG PET-CT imaging is costly and not a feasible option for resource limited centers such as ours. The study aimed to assess the prevalence of TENIS syndrome in our setting and to determine the optimal thyroglobulin level for detecting FDG-avid disease in TENIS syndrome. ***Materials and Methods:*** A retrospective analysis of 62/70 patients with proven differentiated thyroid cancer (Papillary or follicular) who developed TENIS syndrome who underwent 18F-FDG PET/CT to rule out dedifferentiation from 2016-2024 was carried out. Patients had follow-up whole body Iodine scans and serum thyroglobulin tests were with TSH stimulation.8 patients were excluded from the analysis: medullary and anaplastic histopathology and anti-thyroid antibodies >20. T-test or Wilcoxon were used to assess the distribution between two independent groups, mean or median differences. To determine association between categorical variables, a Chi-Square test was used. Sensitivity and specificity analysis were used to determine optimal cut off points of numeric predictors of metastasis. ***Results:*** Sixtry-two patients had a median age of 59 range (14.0-81. years), 76% were females. 45%had follicular and 59% had papillary thyroid cancer. The use of ^{18}F-FDG PET-CT showed 38 patients (60%) with ^{18}F-FDG avid metastases suggesting dedifferentiation. 27% had lung metastases whilst 27% had cervical lymph node metastases. The median thyroglobulin level during the time of the ^{18}F-FDG PET/CT was 52ng/ml. 23 of the 38 patients with positive FDG had Tg > 30ng/ml. Thyrogloblin levels were significantly higher in patients with positive ^{18}F-FDG than patients with a negative PET, median(Q1-Q3) Tg 79.9(32.9-1080) ng/ml for ^{18}F-FDG positive and 34.3(16.5-73.9) ng/ml for ^{18}F-FDG negative p=0.035. The optimal cut-off point for detecting positive ^{18}F-FDG was 30ng/ml youden 0.213 with a sensitivity of 74% and specificity 48%. ***Conclusion:*** In this study, the probability of ^{18}F-FDG avid disease suggesting de-differentiated thyroid cancer is higher when thyroglobulin is >30 ng/ml. Therefore, in resource constrained settings, performing ^{18}F-FDG when Tg is more than 30ng/ml is advisable compared to the recommended 10ng/ml.

EP-0645

X2X2

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Aim/Introduction: The aim of this study was to validate the effectiveness of dynamic risk stratification (DRS) in predicting structural progression in patients with differentiated thyroid cancer (DTC). ***Materials and Methods:*** This is a retrospective cross-sectional study in which we evaluated 100 patients (M:F 26:74) for a median of 3 years having differentiated thyroid cancer after total thyroidectomy and radioactive iodine remnant ablation in our department. As part of the initial staging, patients were categorized into three ATA risk categories: low, intermediate, and high. This information was then compared to the outcomes of dynamic risk stratification based on therapeutic response after six to twelve months following radioiodine ablation and the most recent visit, including whole body radioiodine scan, thyroid ultrasonography, anti-thyroglobulin antibody, and thyroglobulin level. These measures allowed for the division of subjects into four groups: excellent response (ER), incomplete structural response (ISR), incomplete biochemical response (IBR), and indeterminate response (IR). The ATA and DRS risk classification results were compared with clinical outcome. ***Results:*** Twenty patients were classified as high-risk, 15 patients as intermediate-risk, and 65 patients as low-risk at baseline. After 6 to 12 months of radioiodine ablation, 64.6% of patients in the low-risk group showed signs of ER response, 7.6% showed IBR response, 6.1% showed ISR response, and 21.5% showed IR response. In the intermediate-risk group, the following responses were noted: ER in 46.6% of patients, IBR in 13.3%, ISR in 20%, and IR in 20%. In the high-risk group, 40% of patients had ER response, 55% had ISR response, 5% had IBR response, and none had IR response. At the time of the last visit, 15.3% of ATA low risk, 26.6% of intermediate, and 55% of high risk had persistent disease. whereas according to dynamic risk stratification, of people who had excellent responses, only 2.3 % of low risk and 12.5 % of high-risk had persistent disease, and none were in the intermediate risk group. The combined use of the ATA and the DRS systems was statistically significant to predict the persistent disease (P< 0.00001). ***Conclusion:*** The use of dynamic risk classification in the follow-up of patients with differentiated thyroid carcinoma has shown improved accuracy in predicting disease progression and tailoring individualized treatment plans. Furthermore, through the refinement of initial ATA risk estimations based on response evaluation to radioiodine therapy, a more precise dynamic risk assessment is achieved, enabling tailored and effective ongoing follow-up care.

EP-0646

Are Differentiated Thyroid Cancer patients presenting with biochemical only evidence of disease receiving additional radioiodine therapy doomed to develop structural disease in the future?

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Aim/Introduction: Additional radioiodine therapy (RAI-Tx) may be considered in patients with differentiated thyroid cancer (DTC) who underwent first-line treatment with total thyroidectomy and RAI-Tx. However, evidence fails to definitively underscore the benefits of this decision in patients with positive tumour marker but without evidence of disease in the imaging procedures. This study aimed to access the DTC patient's outcomes (tumour marker evolution and occurrence of structural disease), presenting with negative imaging but receiving additional RAI-Tx due to biochemical evidence of disease and having negative post-treatment whole-body scan (ptWBS). ***Materials and Methods:*** This retrospective study included DTC patients, that underwent additional RAI-Tx between 02/2009 and 12/2022, after the first-line treatment. We selected patients with biochemical disease but in whom imaging procedures, including ptWBS, failed to identify the source of the tumor marker. Demographic data and thyroglobulin(Tg) and anti-Tg-antibody(TgAb) values before, at the time of treatment and 12 months after treatment were collected. The occurrence of structural disease during follow-up was documented. Statistical analysis was conducted using SPSS-Statistics v.27.0 software. P values<0.05 were considered statistically significant. ***Results:*** Fifteen patients (10 female; mean age: 51.07±11.79y) met the criteria for inclusion in the study. The median follow-up was 156 (IQR 130) months. For patients with high Tg and without positive TgAb (n=11), the median Tg was 4.70ng/mL (IQR 22.50, range 1.60-75.0). In the 4 patients with positive TgAb, the median TgAb was 538.0UI/mL (IQR 475.5, range 331.0-538.0). The median TSH stimulated Tg at treatment was 33ng/mL (IQR 142, range 3.1-780.0) in negative TgAb patients. At the 1-year follow-up, there was a median increase in Tg of 1.36ng/mL in negative TgAb patients, nevertheless, this change was not statistically significant (p=0.44). For patients with positive TgAb, a median reduction of 206.5UI/mL was noted, although, this was not statistically significant (p=0.273). Nine patients showed unequivocal imaging evidence of disease during the follow-up period, with detection occurring at a mean of 59.11±49.67 months after the additional RAI-Tx. Uncertainty regarding structural disease persisted in 2 patients. ***Conclusion:*** This study highlights the uncertainty regarding the benefits of empirical RAI-Tx in patients with biochemical disease not seen on imaging procedure. The detection of structural disease in a significant number of patients emphasizes the need for continued surveillance. Further studies with larger cohorts and comparative arms are warranted to validate these findings and elucidate optimal management strategies for these patients, namely, regarding the role of additional RAI-Tx.

EP-0647

Efficacy of Radioactive Iodine (131I) Therapy and Prognostic Factors in Pulmonary Metastases of Differentiated Thyroid Cancer: A 10-Year Follow-Up Study on 25 Patients

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Aim/Introduction: Pulmonary metastases are the most common distant site of spread in patients with differentiated thyroid cancer (DTC). Following surgical resection of the thyroid gland, radioactive iodine (131I) therapy and thyroid hormone suppression therapy are pivotal in managing these metastases. This study aims to assess the effectiveness of iodine therapy and identify prognostic factors in patients with lung metastases from differentiated thyroid cancer. ***Materials and Methods:*** A retrospective analysis was conducted on 25 patients with pulmonary metastases from DTC, initially treated with complete thyroidectomy followed by 131I therapy. Based on 131I whole body scan results, metastases were categorized as iodine-avid or non-avid. Treatment response

was evaluated using serum thyroglobulin levels, chest computed tomography (CT), and post-therapeutic 131I whole body scan. Prognostic factors for favorable outcomes at 10 years were determined based on therapeutic response and patient survival. ***Results:*** Of the 25 patients, 22 were female with an average age of 45 years. Papillary carcinoma was the predominant histological type (76%), while follicular carcinoma accounted for 12% of cases. Iodine-avid metastases were observed in 68% of patients. Among those with iodine-avid metastases, 47% showed significant reduction in thyroglobulin levels and 47% experienced reduction in metastatic lesion size on CT. In contrast, patients with non-avid metastases demonstrated disease progression in 87.5% of cases based on thyroglobulin levels and 75% based on CT imaging. Sub-radiological or micro-nodular pulmonary metastases were more prevalent in patients under 40 years (92%), while macro-nodular lesions were more common in patients over 40 years (40%). Patients under 40 years with stable or favorable biological and radiological evolution constituted 90% of cases. ***Conclusion:*** Iodine avidity, micro or infra-radiological metastatic forms, and younger age are favorable prognostic factors associated with a positive response to iodine therapy and improved outcomes over a 10-year follow-up period.

EP-0648

Iodine-refractory thyroid cancer: A review of 9 cases.

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Aim/Introduction: Small groups of thyroid cancer patients might have unfavorable outcomes during the course of the disease, with 10 year survival rate about 47%. More than half population of the patients with distant metastasis can develop iodine-refractory thyroid cancer (IR-TC). ***Materials and Methods:*** We report nine cases of thyroid cancer with distant metastasis who progress to IR-TC, based on American Thyroid Association Thyroid Nodule/Differentiated Thyroid Cancer Guidelines 2015 categories. ***Results:*** Only one case showed tumor inability to concentrate I-131 since the first therapy, and stay stable after an accumulating doses of 500mCi. While one case with I-131 uptake, on the neck and the lung, developed negative iodine bone metastasis during follow-up, other seven cases showed I-131 uptake on all of the lesions. Despite of the uptake, all showed biochemical progression, and only one cases without evidence of anatomical progression. No cases showed negative I-131 uptake after prior evidence of I-131 uptake. The characteristic of the subjects were assessed. Four subjects were male, and five were female. Most of the subject were papillary cancer, interestingly, only one subject with follicular type. The latest, showed T2 multifocal tumor without extra-thyroid extension and nodal metastasis, while those characteristic presented in others. Only two subjects with T2 tumor, while other with T3-T4 tumor. Stimulated pre-ablation thyroglobulin level, range 108-618 ng/mL in those with lung metastasis, and 3,250-328,800 ng/mL in those with bone metastasis. In subjects with I-131 uptake, five showed residual disease on the second post-therapy scan, four of those with biochemical progression. Following anatomical imaging of those subjects, denote disease progression. Three subjects were died during follow up, all showed biochemical progression. ***Conclusion:*** Early identification of factors related to IR-TC development can be a challenge. Patient characteristic, such as tumor size, extra-thyroid extension, multifocality, nodal metastasis, distant metastasis, and stimulated pre-ablation thyroglobulin level might provide incremental value for predicting IR-TC development. Moreover, proven residual disease, biochemical, and anatomical progression after second RAI might also be considered. ***References:*** 1.Haugen BR, Alexander EK, Bible KC, et al. 2015 American Thyroid Association Management Guidelines for Adult Patients with Thyroid Nodules and Differentiated Thyroid Cancer. Thyroid. 2016; 26(1). 2.Vaisman F, Carvalho DP, Vausman M, et al. A new appraisal of iodine refractory thyroid cancer. Endocr Relat Cancer. 2015; 22(6).

EP-44

e-Poster Area

C: Therapy Clinical Study -> C1 Oncological Therapy Clinical Study -> C15 Other Oncological Treatments

EP-0649

Low dose 177Lu-EDTMP therapy for palliation of painful bone metastases.

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Aim/Introduction: Multiple bone metastases is usually seen in later stages of cancer leading to pain in multiple bony sites. This increases the patient morbidity. They often require a range of non-opioid to opioid analgesics to control the pain in order to improve the quality of life. These analgesics also cause side-effects like constipation and loss of appetite. 177Lu-EDTMP at prescribed dosage of 1 mCi/kg has been found to be quite successful. But it often adds to the myelotoxicity of the ongoing chemotherapy in these patients. To minimize the toxicity a low therapeutic dose of 177Lu-EDTMP was planned and its efficacy and safety was assessed. ***Materials and Methods:*** Ethical clearance was obtained from Institutional Ethics Committee, AIIMS Jodhpur. Patients were prospectively recruited between the period of March 2021 to September 2022. A bone scan was done to establish the finding of multiple osteoblastic bone metastases. Subsequently a dose of 0.5 mCi/kg of 177Lu-EDTMP was administered intravenously to seven patients who consented for this therapy protocol. Visual Analog Score (VAS), Analgesic score (AS), Karnofsky Performance Scale (KPS), ECOG was documented at baseline and at 3 months while haematological parameters were documented at baseline and at 2, 4, 8 and 12 weeks post therapy. ***Results:*** The mean VAS score dropped from 8.00 + 1.52 at baseline to 3.00 + 3.41 at 3 months (p=0.006). The mean AS score dropped from 3.29 + 0.76 at baseline to 2.00 + 1.91 at 3 months (p=0.049). According to CTCAE grading of haematological toxicity, 1/7 patients had grade III anemia, 1/7 had grade II anemia and 2/7 patients experienced grade I anemia. 1/7 experienced grade I leukopenia. 2/7 patient experienced grade I thrombocytopenia. None of the patients required blood transfusion. No much difference was seen in KPS and ECOG scores between baseline and at 3 months. The reason being that the baseline scores were close to normal (Median KPS 80 and Median ECOG 1). Overall response rate was 71%, with complete response seen in 4/7 (57.14%) patients, partial response in 1/7 (14%) and no response in 2/7 (29%) patients. ***Conclusion:*** Low dose 177Lu-EDTMP therapy (0.5mCi/kg) is effective, safe and economical.

EP-0650

Initial Clinical Experience with ^{177}Lu-EB-FAPI Radioligand Therapy in Patients with End-StageMetastatic Cancers

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Aim/Introduction: Fibroblast activation protein (FAP) is overexpressed in several solid tumors and therefore represents an attractive target for radiotheranostic applications. Here, we report the efficacy and safety of 177Lu-EB-FAPI radioligand therapy (RLT) in patients with various end-stage metastatic cancers. ***Materials and Methods:*** FAPI radioligand therapy included a fixed doses of 177Lu-EB-FAPI (3.2 GBq) per cycle using a combination of clinical and statistical expertise design, and intervals of 6 weeks were considered between each cycle. Up to four cycles of radioligand therapy were offered to patients with (i) progressive metastatic malignancy, (ii) exhaustion of approved therapies, and (iii) high fibroblast activation protein (FAP) expression, defined as SUVmax≥ 10 in more than 50% of tumors. Biodistribution and dosimetry were examined by planer whole-body scans. We applied the NationalCancer Institute Common Terminology Criteria for Adverse Events (version 5.0) to measure RLT-associated toxicity. The primary endpoint was the RECIST response after RLT. Secondary endpoints included overall survival (OS), dosimetry, and safety of FAP-RLT. ***Results:*** A total of 32 patients with advanced cancers with unresectable tumors, or tumors refractory to conventional therapies, were prospectively enrolled. These patients include thyroid cancer (n=18), breast cancer (n=3), lung cancer (n=2), colorectal cancer (n=2), sarcoma (n=2), renal cancer (n=1), prostate cancer (n=1), nasopharyngeal cancer (n=1), esophageal cancer (n=1), and gastric cancer (n=1). Eastern Cooperative Oncology Group (ECOG) ≥2 was observed in 69 % of the patients. The patients were treated between June 2020 and December 2023. Overall, 78 RLT cycles with 177Lu-EB-FAPI were performed, and 23 of 32 (72%) patients underwent repeat RLT. The therapy was well tolerated in almost all patients. By RECIST, disease control was confirmed in 17 of 32 patients [53%; 27/32 (84%) of evaluable patients]. There were five partial response (PR) and twelve stable diseases after RLT. Disease control was associated with prolonged OS ($P < 0.01$). Dosimetry was acquired in 30 (94%) patients. The mean absorbed dose was 6.7± 11.3 Gy/GBq in the tumor. Treatment-related grade 3 or 4 adverse events were observed in 9 (28%) patients with thrombocytopenia (n=9), leukopenia (n=2), and anemia (n=1) being most prevalent. ***Conclusion:*** FAP-targeted radioligand therapy with 177Lu-EB-FAPI was well tolerated, with a low rate of attributable adverse events. We observed signs of tumor response, but further studies are warranted to determine efficacy and the toxicity profile in a larger cohort.

EP-0651

First evidence of 64CuCl2 treatment efficacy in recurrent glioblastoma patients

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Aim/Introduction: Glioblastoma (GBM) is a highly malignant brain tumor that in most cases unavoidably progresses or recurs after first line treatments. Due to the complexity of disease, the available therapeutic options are limited, often highly toxic and there is no consensus regarding the best treatment choice. Copper-64 Chloride (64CuCl2) has been tested as a theragnostic method to evaluate treatment preliminary efficacy. ***Materials and Methods:*** We conducted a phase I monocentric, open-label, 2-stages design study on recurrent/progressive GBM adult patients previously treated with standard treatments (surgery, radiotherapy, chemotherapy). Only patients with a positive 64CuCl2 PET/CT scan at diagnostic dosage were selected for treatment. Stage 1 let to determine the maximum tolerated dose (MTD) based on dose-limiting toxicity (DLT). Stage 2 (Expansion cohort) was useful to define the anti-tumor activity administering 64CuCl2 once a week for a total of 7 fixed doses. The primary objective was the response to treatment expressed as objective response and defined as stable disease, partial response (reduction), complete response (disappearance of lesions) or disease progression, measured by MRI and defined according to Response Assessment in Neuro-Oncology (RANO) criteria. ***Results:*** 21 patients were screened, 18 patients were treated with 64CuCl2 and 10 patients were evaluated for preliminary efficacy. All Stage 2 patients were evaluated after 7 64CuCl2 administrations (day 42) and MRI assessment showed that 7 patients resulted as responders to the treatment and 3 resulted as non-responders. Among the responder patients, 3 patients showed stable disease and 4 patients resulted as partial responders showing a reduction in the sum of product of perpendicular diameters of all measurable enhancing lesions ≥50% compared to baseline MRI examination. ***Conclusion:*** In the challenge of recurrent GBM management, considering the aggressiveness of the disease, 64CuCl2 treatment gave promising results to proceed with clinical investigations on recurrent glioblastoma patients.

EP-0652

FAP-Targeted Radiopeptide Therapy using ^{177}Lu-, ^{90}Y-, ^{225}Ac-labelled 3BP-3940 in 19 Different Advanced Malignancies: First-in-Humans Results

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Aim/Introduction: Fibroblast activation protein (FAP) has emerged as a highly promising target for imaging and targeted radiopharmaceutical therapy of diverse malignancies. The purpose of this study was to determine the feasibility of using a novel FAP-targeted cyclic peptide, 3BP-3940, for peptide-targeted radionuclide therapy (PTRT) and present first-in-humans results using 177Lu, 90Y, and 225Ac labeled 3BP-3940. ***Materials and Methods:*** Seventy patients with 19 distinct malignancies were treated (Mar'21-Feb'24) using 3BP-3940 after exhaustion of all conventional therapy options. 16 had pancreatic ductal adenocarcinoma (PDAC), 8 lung, 7 breast, 5 rectum, 6 colon, and 28 other types of cancer. PET/CT imaging was done with 68Ga-3BP-3940 to select patients for treatment. CTCAE v.5.0 was used to grade toxicity. Treatment response was evaluated by PET/SPECT and morphological imaging. Overall survival (OS), defined from the start of PTRT, was calculated (Kaplan-Meier survival analysis). ***Results:*** Administrations of 177Lu-/90Y-/225Ac-3BP-3940 were

well tolerated (dose/patient and range: 177Lu, 15 ± 11 GBq; 90Y, 7 ± 5 GBq; and 225Ac 14 ± 10 MBq) Pain flare occurred in 9/70 (13%) patients, nausea in 11/70 (16%), vomiting in 6/70 (9%), headache in 2/70 (3%), partial alopecia in 7/70 (10%), and intensified fatigue in 4/70 patients (6%); no other clinically relevant adverse symptoms were reported by patients. Dosimetry results after 9.73GBq 177Lu-3BP-3940: PDAC 2200mGy, brain 37mGy, lungs 168mGy, liver 86mGy, pancreas 142mGy, kidneys 265mGy. Posttherapy SPECT/CT scans demonstrated very high tumour-to-background ratios and long retention in tumour lesions on delayed imaging (up to 7 days). Tumour responses after 2 cycles of PTRT according to molecular imaging criteria were complete remission in 1/44 (2%), partial remission in 14/44 (32%), mixed response in 11/44 (25%), stable disease in 2/44 (5%), and progressive disease in 16/44 (36%). For the entire cohort, the median OS was 7 months from the start of PTRT; in patients with refractory, heavily pretreated pancreatic ductal adenocarcinoma, the median OS was 7 months. ***Conclusion:*** 3BP-3940 PTRT is feasible with 177Lu/90Y/225Ac either alone or as TANDEM treatment in end-stage cancer patients. Treatments were relatively well-tolerated without serious adverse effects. 3BP-3940 PTRT demonstrated a very favorable biodistribution (especially very low renal accumulation), with significant uptake and long retention in tumor lesions. Objective responses in very advanced metastatic adenocarcinomas and sarcomas were noted (one CR in a patient with ovarian cancer lasting now for two years). The survival benefit for PDAC patients seems to be very promising. Further prospective randomized studies are warranted.

EP-0653

^{68}Ga/^{177}Lu-PSMA theranostics in recurrent high-grade glioma - First study results & future perspectives

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Aim/Introduction: In this clinical study, 68Ga/177Lu-PSMA theranostics is evaluated as a treatment alternative for patients with recurrent high-grade glioma. The main goal is to improve existing diagnostic and therapeutic methods in glioma management, and introduce a novel treatment that possibly can increase the overall suvival and quality of life for patients with very poor prognoses and no standard of care today. Safety, tolerability and efficacy of 177Lu-PSMA therapy are evaluated and the pre-therapeutic tumor uptake of 68Ga-PSMA is compared to the tumor absorbed doses from 177Lu-PSMA to establish an appropriate indication for therapy. This is one of the first studies in the world exploring theranostics as a treatment alternative for patients with glioma. ***Materials and Methods:*** Patients with a positive 68Ga-PSMA-PET/MRI examination are eligible for 177Lu-PSMA treatment. The patients are carefully monitored during each treatment cycle (PET/MR, SPECT/CT, neurological tests, blood tests, and quality of life questionnaires). Two patients with CNS WHO grade 4 glioblastomas have been included in this ongoing study to date. Both patients received standard treatment with surgery, radiotherapy and chemotherapy prior to inclusion, and were left with no other treatment options at recurrence. 177Lu-PSMA (7.1-7.3 GBq) was administered intravenously (Patient A: 1 treatment, Patient B: 5 treatments) and SPECT/CT scans were performed for dosimetry. ***Results:*** 68Ga-PSMA-PET prior to treatment demonstrated tumor uptake in both patients (SUVmax_A:9.0 and SUVmax_B:4.4) as well as uptake in the parotid glands (SUVmax_A:21.8 and SUVmax_B:15.9). 68Ga-PSMA uptake in normal brain was low, yielding high TBR (TBRA: 136.0 and TBRB: 45.4). Post treatment SPECT/CT revealed a rapid wash-out of activity, resulting in low absorbed doses (A: Tumor 1.4 Gy, kidneys 2.0-2.1 Gy, parotid glands 1.1-1.4 Gy, B: Tumor 2.6-2.9 Gy, kidneys 3.2-3.7 Gy, parotid glands 1.7-3.1 Gy). The patients reported no subjective side effects of the treatment, apart from transient xerostomia. Based on radiological evaluation (MRI), both patients demonstrated stable disease during the treatment cycles. ***Conclusion:*** Despite low tumor doses, the radiological stability of disease in these two patients is promising. Boosting brain tumor doses could potentially result in better treatment effect, and an innovative approach to achieve this is to use intraarterial administration instead of intravenous administration. A change in the current study protocol will now be made to implement this method.

EP-0654

Efficacy, Safety and Cosmetic in an Elderly Population after 188Rhenium Brachytherapy in NMSC: Long Term Follow Up Data

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Aim/Introduction: Mohs'surgery is the best treatment for non-Melanoma-Skin-Cancers(NMSC). However, brachytherapy with 188Re-resin is an option in "difficult to treat" lesions. Our aim was to assess efficacy, early side effects and cosmetic results after long term follow up. ***Materials and Methods:*** Enrollment criteria were: histologically proven NMSC; thickness<3.0mm, lesions categorized as "difficult-to-treat" with surgery or contraindication/ refUNITED STATES OF AMERICAI of surgery. Early toxicity(ET) was assessed between 14-32days after treatment according to Common Terminology Criteria Adverse Events 5.0(CTCAE). Efficacy and cosmetics were evaluated with videodermoscopy and biopsy (if needed) and a clinical aesthetic evaluation according to RTOG scale. Patients were followed after 6-12-24 months and, if needed, during the period of the whole FU (mean37mo; range 3-77). In our population 53pts died for other causes during FU. ***Results:*** 168 lesions were treated (92/168 BCC; 70/168 SCC; 6/168 mixed SCC-BCC) in 115 patients(mean age 82yo). 73/92 BCC were nodular-subtype, 11/92 nodular-sclerodermiform, 8/92 sclerodermiform; 35/168 located on the scalp, 94/168 in the H-area(forehead, nose, ears, cheeks), 21/168 in the extremities, 16/168 in the thorax and 2/168 on the scrotum. Mean surface area was 6,4cm2 (1-60cm2), mean thickness 1,3mm (0.2-3mm), mean volume(TV) 1,3cm3 (0,05-15cm3); mean dose at 0,5mm depth was 50Gy, mean target dose 25Gy, mean dose-at-surface 161Gy, and mean treatment's time 85 minutes. In 95/168 Re-brachitherapy was the first treatment; in 37/168 was performed after other therapies failure (Criotherapy, Laser, Imiquimod, photodynamic), 22/168 after surgery, 14/168 after RT. Efficacy: We evaluated 164/168 lesions with at least 6mo

FU. During FU we observed: 10/164 relapses(7pts) in the TV (6mo 5/10; 12mo 1/10; 18mo 1/10; 24mo 2/10; 36mo 1/10) and 5/164 at the external margins of TV (6mo 1/5; 18mo 1/51; 24mo 2/5; 36mo 1/5). We did not observe any relapse after 36mo.Safety: CTCAE grades: G1=81/168; G2=75/168; G3=12/168. All G1-G2 lesions resolved completely within 32days(mean 24days); G3 resolved in up to 90days (mean 54days). 98/168 needed local therapy (hyaluronic acid, antibiotics, steroids); 70/168 needed just cleaning-disinfection of the wound. Cosmetic ***results:*** At 6mo, 113/164 were excellent=CS1; 46/164 good=CS2; 4/164 poor=CS3; one was not valuable. At 12mo, 117/158 excellent=CS1, 38/158 good=CS2, 3/158 poor=CS3. At 24mo 96/124=CS1; 25/124=CS2 and 3/124=CS3. No significant cosmetic differences have been observed after 24mo in the available population. ***Conclusion:*** Brachytherapy with 188Re-resin showed: excellent efficacy in terms of local control, few early side effects and excellent cosmetic results. So far we did not observe relapses after 36 months from treatment.

EP-0655

Initial clinical experience of Rhenium-188 Therapy for Keloids

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Aim/Introduction: The current management options of keloids are limited. Although there are several recommended strategies as a first-line therapy, these treatments have variable rates of success with high recurrence rate. Inhibition of the proliferation of fibroblasts and prevention of the synthesis of collagen is essential for treatment of keloids. The purpose of this study is to provide initial clinical data on the effectiveness of non-sealed beta emitter rhenium-188 for the treatment of keloids. ***Materials and Methods:*** Twenty-eight patients with keloids were recruited between November 2019 and November 2023. Treatment with Rhenium-188 via a specialized unit was applied onto the keloid lesion. A personalized treatment time was calculated for every patient. Topical 188Rhenium delivered as a jelly like matrix containing an insoluble dirhenium-heptasulfide was applied to every target lesion in a single session. The goal was to deliver 30Gy to the lesion per session. Patients were followed up at 2 weeks, 1, 3, 6 and 12 months for side effects as well as clinical and cosmetic outcomes. Subjective assessment of treatment was performed using the Dermatology Quality of Life (QoL) questionnaire which was completed before and after the treatment. ***Results:*** A total of 28 patients with 58 lesions were treated. Majority of the lesions were in the head and neck region. Previous therapies included surgery, radiotherapy, intralesional steroids and cryotherapy. The commonest symptom was itchiness followed by cosmetic concerns. The smallest area for treatment was 0.25cm2 and the largest area treated was 46.52cm2. With the exception of four patients (2 sessions to the same lesion), all the other patients received a single session of therapy. The average activity administered was 256,7MBq (range: 35MBq - 663,50MBq). The treatment time averaged 6 hours. There was complete response in 80% of the lesions, while the remainder had partial response (reduction in size and height). Hypopigmentation was the commonest expected long term side effect. After a median follow-up period of 36 months (range: 7 - 53), there was a 15% recurrence rate. ***Conclusion:*** In patients with keloids, single therapeutic session with Rhenium-188 appears to be effective and safe. While in firmer and thicker keloids require more than a single session of therapy.

EP-45

e-Poster Area

C: Therapy Clinical Study -> C2 Non-Oncological Treatments -> C21 Non-Oncological Treatments (including Thyroid Benign)

EP-0656

Safety and efficacy of radiosynoviorthesis: a prospective multicentre Canadian trial

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Aim/Introduction: Radiosynoviorthesis, an intra-articular radionuclide treatment, is approved in several European countries and in the United States of America to treat refractory synovitis in many inflammatory joint diseases, such as rheumatoid arthritis (RA), spondyloarthropathies and other arthritic joint diseases. Unfortunately, no radiopharmaceuticals for radiosynoviorthesis are currently approved and available in Canada. The aim of this Health Canada-approved clinical trial is to demonstrate the safety and efficacy of radiosynoviorthesis. ***Materials and Methods:*** Between July 2012 and November 2017, we conducted a Canadian multicentre prospective clinical trial (NCT01615991). Patients (n = 360) with various inflammatory joint diseases, including 6 paediatric patients, who had refractory synovitis to standard treatment, defined as failure after two intra-articular glucocorticoid injections, were included. All the patients included received radiosynoviorthesis, and it was possible to treat several joints during the same appointment. In the absence of improvement in the clinical signs of synovitis (pain, swelling and effusion) at six months, a joint could receive a second radiosynoviorthesis. They were followed up clinically, serologically and radiologically at 3, 6 and 12 months after radiosynoviorthesis. Outcome measures at each visit included adverse events (AEs) and clinical signs of synovitis measured with Health Assessment Questionnaire Disability Index (HAQ-DI), Disease Activity Score (DAS28) and Visual Analogue Scale (VAS 100 mm). ***Results:*** In the cohort, 30.6% (110/360) of patients suffered from spondyloarthropathies, 24.7% (89/360) from RA and 11.9% (43/360) from osteoarthritis. A total of 392 joints were injected, including 82.7% (324/392) of knees. 83.4% (327/392) of large joints were treated with 90Y and 10.0% (39/392) with 186Re for medium-sized joints. 34 joints required a second radiosynoviorthesis six months after the first attempt, of which 17.6% (6/34) were RA-related. 55 AEs of all types, most of them of low severity, occurred and resolved without sequelae and were not life-threatening. The incidence of radiosynoviorthesis-related AEs was 9.4% (34/360). The proportion of patients showing an improvement in synovitis symptoms after radiosynoviorthesis was significant at 3 months, and was maintained up to 12 months ($p<0.001$). A non-significant improvement in HAQ-DI ($p=0.3$) and DAS28 ($p=0.1$) from 3 months was observed. No significant change in VAS 100 mm was observed ($p=0.5$). ***Conclusion:*** This study confirms the safety of

radiosynoviorthesis in the treatment of various inflammatory joint diseases with refractory synovitis to standard treatment. There is evidence of sustained clinical efficacy at 12 months, suggesting that radiosynoviorthesis is an effective treatment for improving the symptoms of synovitis.

EP-0657

Radiosynovectomy with Lu-177 MAA in Patients with Inflammatory Knee Joint: Preliminary Results

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Aim/Introduction: Osteoarthritis is the most common chronic rheumatic disease characterized by destruction of joint cartilage. Different types of arthritis include osteoarthritis, rheumatoid arthritis, psoriatic arthritis, pigmented villonodular synovitis (PVNS), ankylosing spondylitis, and nonspecific chronic synovitis. Various treatment methods successfully are used for inflammatory arthritis including radiosynovectomy. Radiosynovectomy procedure carried out by intra-articular injection of suitable radionuclides in colloidal form. Yttrium-90, Lutetium-177 and Rhenium-188 can be used for radiosynovectomy. The aimof this study is to investigate the feasibility of radiosynovectomy with Lutetium-177, since commonly used radionuclide Yttrium-90 is expensive and has difficulties regarding its supply. Lutetium-177 radiosynovectomy is applied for pain palliation in patients with inflammatory joint disease. There is a possibility that this compound may reach extra-articular tissues in small amounts. The Lutetium molecule is 99.5% bound to the macro aggregate albumin and is too large (10-90 microns) in size to leak of the joint space. ***Materials and Methods:*** Patients diagnosed with PVNS by clinical, laboratory and imaging findings were prospectively selected. An average dose of 8-10 mCi of Lu177-MAA labeled radiopharmaceutical injected intra articularly. Knee arthro-scintigraphy and SPECT/CT imaging performed with a medium-collimator with gamma rays of the Lu-177 MAA radiopharmaceutical. If possible, patients were evaluated with the Knee Injury and Osteoarthritis Outcome Score (KOOS), control SPECT or MRI imaging. ***Results:*** Injection was performed in 9 patients. Distribution of the injected radsiopharmaceutical was checked by SPECT/CT. Two of the patients had 6-month and 3 of them had 3-month KOOS follow-ups. An average of 35% improvement in KOOS was observed after 3-6 month clinical evaluations. ***Conclusion:*** This study is an ongoing study. It is expected that with more patients being followed for longer periods, more data will be available to assess about the use of this radiopharmaceutical in PVNS patients. The results so far showed us that Lu-177 MAA is a promising radiopharmaceutical for radiosynovectomy applications.

EP-0658

Insights from radiosynoviorthesis in the treatment of haemophilic arthropathy: a retrospective analysis

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Aim/Introduction: Haemarthrosis and synovitis are frequent among patients with haemophilia despite optimal replacement therapy, compromising the quality of life of patients due to the pain and stiffness associated with synovial effusion, and representing a risk of severe haemarthropathy. Our centre, national reference in haemophilia management, has used radiosynoviorthesis (RS) as a localized treatment for persistent or recurrent synovitis over the past three decades, owing to its recognized safety and efficacy. In this study, we review the outcomes of radiosynoviorthesis in haemophilic arthropathy at our centre over 2010-2020. ***Materials and Methods:*** We retrospectively reviewed 39 patients with severe haemophilia A and B and chronic synovitis (55 joints) treated with RS between 01/2010-01/2020. We used 90Y (5 mCi) for the treatment of large joints, and 186Re (2mCi) for medium-sized joints. Evaluation of results included assessing clinical improvement in terms of haemarthrosis, pain reduction or improvement in joint range of motion. Repeat the treatment was indicated (RS2) when 2 or more joint effusions occurred within 6 months after the initial synoviorthesis. The mean follow-up period of the joints was 79 months (13-146 months). ***Results:*** We treated a total of 55 joints (20 elbows, 10 knees and 25 ankles) in 39 patients with haemophilia, with a mean age of 35 years (SD±13). The youngest patient was 11 years old. In 35 joints (64%) post-treatment cessation of haemarthrosis was achieved, with a mean rebleeding free interval (RFI) of 70 months (SD±43); 29 joints did not showed rebleeding during the follow-up. Of the remaining 20 joints (36%) with persistent symptoms, 12 underwent RS2, 1 synovectomy, 1 received a joint prosthesis, 1 is pending RS2, whilst 5 are pharmacologically managed together with intra-articular infiltrations. In the case of the 12 RS2, 5 (41.6%) showed cessation of haemarthrosis with a mean RFI of 42 months (SD±22). Four of the remaining patients received pharmacological treatment, and 3 were summited to new RS (3 or 4 RS), two of them requiring synovectomy. The other patient was lost to follow-up. Overall, remission of haemarthrosis was achieved in 40 out of 55 joints (73%) with one or two RS, achieving complete remission with just one RS in 52% of patients. ***Conclusion:*** RS proves to be safe, minimally invasive and well-tolerated procedure in patients with chronic haemophilic synovitis, achieving complete response or prolonged RFI in a significant amount of patients.

EP-0659

I-131 Thyrotoxicosis Therapy - Audit of Repeated Treatments

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Aim/Introduction: Radioiodine treatment using I-131 is offered as a first-line definitive treatment for patients with hyperthyroidism at University Hospital Coventry, UK. Since 2019, patients are administered an activity of 400 MBq for their first therapy. EANM guidance states 'The range of activities currently prescribed, vary in the range 200-800 MBq', and ARSAC Notes for Guidance states 'total activity administered to be a matter of clinical judgement by the responsible licensed practitioner holder' [1,2]. An audit was conducted to investigate the rate of occurrence of repeat treatment, to see if improvements could be made, and evaluate the appropriateness of the initial administered activity. ***Materials and Methods:*** Data for the audit were extracted from the hospitals radiology information system between 2014 and 2024. The examined parameters were number of repeat treatments per patient, time between treatments, and the administered activities per treatment. ***Results:*** A total of 501 patients underwent I-131 thyrotoxicosis therapy between 1/1/2014 and 1/2/2024. Of these, 472 patients received an initial DRL activity of 400 MBq, 27 received 500 MBq, and 2 received 550 MBq. Patients treated for the first time between 1/2/2023 - 1/2/2024 were excluded (assuming

an average time to retreat of 1 year). Of the 467 patients to be considered; 38 received one further treatment, 1 received two additional treatments, and 1 received three further treatments. Forty patients (8.6%) underwent repeated thyrotoxicosis therapy. From the 40 repeat patients, all received an initial activity of 400 MBq, 32 received a second dose of 400 MBq, 1 received a second dose of 500 MBq, 7 received a second dose of 550 MBq, 2 patients had a third dose of 400 MBq, and 1 had fourth dose of 800 MBq. ***Conclusion:*** 8.6% of all I-131 thyrotoxicosis therapy patients between 1/1/2014 and 1/2/2023 underwent repeated treatment, corresponding well to previously published data [3]. In our centre, all patients will be treated with an initial activity of 400 MBq. If retreatment is necessary, patients should receive a second dose with a higher activity of 550 MBq. This reduces the probability of further retreatment and provides guidance on repeat therapies, without increasing the initial treatment activity. ***References:*** 1. Marcel et al. EANM procedure guidelines for therapy of benign thyroid disease, Published: 13 July 2010. 2. ARSAC, Notes for guidance, March 2024. 3. Madu et al. Cure Rates After a Single Dose of Radioactive Iodine to Treat Hyperthyroidism: The Fixed-Dose Regimen. Cureus. 2022.

EP-0660

Optimizing Radioiodine Therapy: Investigating Distribution Factors and Half-Life Variability in Thyroid Autonomies

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Aim/Introduction: I131-radioiodine therapy is effectively used to treat benign thyroid disorders. Despite suppressed TSH levels, patients with autonomous adenomas frequently exhibit significant iodine uptake in residual thyroid tissue. We aim to analyze the quantitative distribution of I131 to autonomous adenomas vs. residual thyroid tissue and potential variations in the effective half-life. ***Materials and Methods:*** We studied 5 patients diagnosed with hyperthyroidism due to autonomous adenoma (n=3) and disseminated autonomy (n=2), all presenting with suppressed TSH levels (<0.1 µU/ml). Prior to therapy, a diagnostic radioiodine test was conducted 4 days earlier using 2.7 ± 0.3 MBq of Iodine-131. I131 scintigraphies were performed 24 and 72h before the therapy using a high-resolution small-field gamma camera with a 256 x 256 matrix over 10 mins. Following radioiodine therapy, post-therapeutic measurements were continuously conducted over 24-48h, accompanied by additional scintigraphic imaging. Regions of Interest were automatically delineated around the entire thyroid and the adenoma using an automatic region grow function. These were precisely superimposed on the pre- and post-therapeutic scintigraphy images. A distribution factor was calculated from every scintigraphy by dividing the counts in the adenoma by those in the residual thyroid tissue. A factor > 1 indicates the adenoma absorbs more radioactive iodine, while a factor < 1 suggests higher absorption in the remaining thyroid tissue. ***Results:*** In this preliminary analysis, two out of three patients with an unifocal adenoma demonstrated a post-therapeutic distribution factor of less than 1 (0.40 and 0.79), indicating a significant disseminated component of the remaining thyroid tissue that absorbs parts of the therapeutic dosage. Furthermore, the distribution factor changed within the first 72 hours, decreasing by approximately 5.67 percentage points. For the other cases where the distribution factor was greater than 1, it also decreased by an average of 6.3 percentage points. This suggests different effective half-lives between the focal adenoma and the disseminated autonomy. ***Conclusion:*** In conclusion, our preliminary results highlight the necessity of precise calculations in radioiodine therapy, aimed at selectively targeting the autonomous component while avoiding hypothyroidism from overtreatment. Further attention should be paid to the distribution factor and the differing half-lives revealed by our data. However, further analysis involving a larger patient cohort and additional post-therapeutic measurements at later timepoints for accurate dosimetry is required.

EP-0661

Polidocanol Instillation in Predominantly Cystic Thyroid Nodules - Introducing a Re-aspiration Protocol

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Aim/Introduction: Ultrasound-guided percutaneous polidocanol instillation (PPI) may provide an alternative to percutaneous ethanol instillation (PEI) in symptomatic cystic or predominantly cystic thyroid lesions. To minimize the risk of systemic side-effects, this study aims to investigate whether treatment efficacy of PPI can be maintained when applying a re-aspiration technique. ***Materials and Methods:*** Patients with recurrent symptomatic cysts or predominantly cystic thyroid lesions underwent ultrasound-guided PPI. As set out by protocol, cystic content was aspirated, the emptied cyst was flushed with saline (NaCl 0.9%), and a median of 8 (IQR 4-10) mL of polidocanol 1% was instilled. After a retention time of 4 minutes, the instilled polidocanol was re-aspirated and local pressure was applied to the intervention site for ≥15 minutes. Patients were clinically reassessed after 6 weeks. Re-instillation was carried out in case of symptomatic recurrence. Follow-up visits were planned at a 6-month interval. The subjective symptom score for local complaints was reported on a semiquantitative scale (0-10). Data were analyzed retrospectively. ***Results:*** Twenty-one consecutive patients (median 46 (IQR 37-52) years of age, 14 females) underwent PPI. Initial cystic volume was 21 (IQR 10-47) mL. All patients achieved complete resolution of initial complaints, 14/21 (67%) reached persistent remission after a single instillation session, while 7/21 (33%) received up to 2 repeat instillations after initial recurrence within 15 (IQR 5-26) days of the preceding treatment. The volume reduction rate (VRR) was 95 (IQR 87-98)% at the 6-month follow-up. No significant pain was reported during or after PPI (VAS 0 in 18/21, ≤2 in 2/21 patients). One patient had self-limiting intracystic hemorrhage following PPI and could be successfully retreated. The subjective symptom score was significantly reduced from 3.9 to 0.3 ($p<0.001$). ***Conclusion:*** Based on findings from this pilot cohort, PPI can be carried out in predominantly cystic thyroid nodules with a re-aspiration technique maintaining good efficacy and safety results.

EP-0662

Does the therapeutic dose of 131I, based on a single measurement of iodine uptake, affect the effectiveness of radioiodine treatment for Graves' disease

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Aim/Introduction: Radioiodine therapy using 131I is widely recognized as an effective form of treatment for Graves' hyperthyroidism. The efficacy is determined by achieving euthyroid state or inducing hypothyroidism in approximately 80% of cases. However, within the hyperthyroid patient population, around 15% exhibit rapid iodine turnover, leading to a shortened effective half-life due to a limited iodine reserve in the thyroid gland (small pool syndrome). This phenomenon is more prevalent in patients with recurrent hyperthyroidism and/or in those undergoing long-term antithyroid medication treatment. In such cases, calculations of radioiodine doses can be inaccurate, leading to a possible underestimation of the 131I dose. To accurately calculate radioiodine dose, it is helpful to conduct additional iodine uptake measurements within 3 to 7 days after administering the diagnostic dose to determine the effective half-life. The aim of this study was to evaluate the impact of calculating the therapeutic dose of 131I based on a single iodine uptake measurement on the efficacy of Graves' hyperthyroidism therapy. ***Materials and Methods:*** We retrospectively analysed 339 patients (274 female, 65 male) with Graves' hyperthyroidism who underwent 131I treatment at the Nuclear Medicine Department Medical University of Lodz between 2018 and 2023. Prior to radioiodine therapy, patients underwent thyroid ultrasonography and measurement of TSH, T3, T4, and TRAb levels. Qualification for 131I treatment was based on thyroid scintigraphy results, with a single iodine uptake measurement taken 24 hours after administering the diagnostic dose. Treatment effectiveness was considered based on achieving euthyroidism or hypothyroidism within 6 to 12 months post-treatment. ***Results:*** After administering the therapeutic dose of 131I (ranging from 296 to 740MBq), determined from a single iodine uptake measurement, euthyroidism was observed in 44 patients (13%) - 33 females and 11 males - while hypothyroidism developed in 256 patients (75%) - 210 females and 46 males. Thirty-nine out of 339 patients (12%) either remained hyperthyroid or there was insufficient follow-up data due to missed appointments. The overall effectiveness of the treatment reached approximately 88% in the study group. ***Conclusion:*** This study demonstrates that administering the therapeutic dose of 131I based on a single iodine uptake measurement (24 hours after the diagnostic dose) for treating Graves' disease hyperthyroidism does not decrease the effectiveness of this therapy.

EP-46

e-Poster Area

D: Technical Studies -> D1 Instrumentation -> D11 SPECT and SPECT/CT

EP-0663

Initial Comparative Analysis of Lung Shunt Fraction Assessment via Planar Imaging and SPECT/CT in ^{90}YRadioembolization: A Pathway to Optimized Dosimetry

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Aim/Introduction: This research sought to assess the differences in lung shunt fractions (LSFs) measured by Planar imaging compared to Single Photon Emission Computed Tomography/ Computed Tomography (SPECT/CT) in patients receiving 90Y radioembolization treatment. The study aimed to comprehend the influence of these differences on dosimetric planning, with a specific focus on the use of SPECT/CT for precise LSF evaluation when levels are above 10%. ***Materials and Methods:*** A retrospective analysis was performed on nine patients who were scheduled for 90Y radioembolization. Planar and SPECT/CT imaging were used to evaluate Lung Shunt Fraction (LSF). The statistical significance of the differences between the two modalities was assessed using a paired t-test. ***Results:*** The study's findings revealed notable disparities in LSF measures between Planar imaging (ranging from 2.0 to 8.7) and SPECT/CT imaging (ranging from 1.30 to 5.86), as shown by a p-value of 0.0018, suggesting significant variations. Even though all patients included in this research had LSF values below 10%, the results emphasize the significant importance of SPECT/CT in effectively evaluating LSF for prospective adjustments in 90Y dosimetry, particularly when levels are above 10%. ***Conclusion:*** The findings of this research demonstrate significant disparities in lung shunt fraction (LSF) measures when comparing Planar and SPECT/CT imaging before 90Y Radioembolization, underscoring the need for standardised evaluation techniques. The results emphasise the significance of SPECT/CT in accurately assessing and adjusting the dose for LSF when it exceeds the limit (10%) since all recorded LSF levels are below 10%. Exclusively relying on Planar imaging may result in inaccurate dosimetric planning for individuals with increased LSF. This necessitates more investigation to authenticate these first findings, formulate comprehensive imaging methodologies, and augment the accuracy and safety of 90Y therapies. This study establishes a foundation for future endeavors aimed at enhancing dosimetric planning and therapeutic results in radioembolization. It emphasizes the need to enhance imaging methods to get more precise measurements of the LSF.

EP-0664

Validation of Tc-99m and Lu-177 quantification parameters for a SIMIND Monte Carlo modelled gamma camera

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Aim/Introduction: Simulation of medical image acquisition using voxel-based anthropomorphic phantoms with known activity uptake provides a method to determine quantitative accuracy in patient geometries. In modern nuclear medicine, the absolute quantification of SPECT images is fundamental for providing an estimate of the activity in a patient and, consequently, the absorbed dose to each organ for diagnostic assessments and therapeutic decisions. SIMIND Monte Carlo modeling techniques can assess the quantitative accuracy of both planar and SPECT Nuclear Medicine images, leading to internal dosimetry optimization. We aimed to determine if the SIMIND MC code accurately simulates emission images measured with a

Discovery NM/CT 670 system for Tc-99m and Lu-177. ***Materials and Methods:*** The validation focused on performance tests comparing MC simulation to phantom experiment results using the LEHR (Low Energy High Resolution) collimator for Tc-99m and Lu-177. The system energy resolution, system spatial resolution, system sensitivity, and SPECT image quality were studied. The geometries used for 2D planar imaging were (1) Petri dish and (2) capillary source, while for 3D volumetric imaging, it was (3) Carlson image quality phantom. For quantitative assessment, we computed the standard deviation and percentage differences for the tests between each simulation and experimental measurements. ***Results:*** The resulting energy spectra present similar peaks for the gamma energy of Tc-99m and Lu-177. The system energy resolution of Tc-99m for the simulation was calculated to be 9.57%±0.13% and 9.44%±0.21% from the experimental data. The system energy resolution of Lu-177 for 113keV photopeak was 9.92%±1.2% and 10.12%±1.01% for the experimental and simulation data, respectively. Similarly, for 208 keV photopeak of Lu-177, it was 5.37%±0.8% and 5.50%±0.51% for the experimental and simulation data, respectively. The difference in sensitivity between simulation and experimental values for Tc-99m and Lu-177 was 5.1% and 3.2%, respectively. The experimental planar spatial resolution was 7.73±0.01 mm for Tc-99m and 8.10±0.12 mm for Lu-177. The simulation planar spatial resolution for Tc-99m was 8.03±0.09 mm, while for Lu-177 it was 7.69±0.01mm. Images obtained from the Carlson phantom, experimentally and by simulation, showed similarity in contrast and resolution. ***Conclusion:*** The results indicated that the simulation and experimental data agreed rather well. These findings illustrated that SIMIND could simulate Discovery NM/CT 670 successfully and, therefore, can be used with confidence to model Lu-177 and Tc-99m images.

EP-0665

Personalized CT scan range in parathyroid scintigraphy can reduce CT radiation dose

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Aim/Introduction: Parathyroid SPECT/CT is performed before surgery to localize potential adenomas. Parathyroid SPECT/CT protocols vary between departments, including variation on single or dual scanning timepoints. Furthermore, the CT scan range varies from default full SPECT-FOV CT to CT only covering the thyroid bed and then elongating the CT scan range, if the SPECT suggests ectopia. We aimed to investigate which of the two methods to determine CT scan range are the most optimal considering CT radiation dose and the risk of missing ectopic adenomas. ***Materials and Methods:*** 40 patients with primary hyperparathyroidism were included. All patients had a dual time point 99mTc-Sestamibi parathyroid SPECT/CT performed with full SPECT-FOV CT (standard examination), with a scan range from 29,0-41,7 cm depending on camera type. Two observers (technologist and junior doctor) retrospectively reviewed the non-attenuation corrected SPECT at three different time points (early, late in combination with early, and only late) and determined personalized CT scan range based on the SPECT. Scan range was measured with a software ruler and a comparison between the personalized scan range and standard examination was conducted. The reports from the standard examination were used as reference to investigate whether potential adenomas were missed when using personalized CT scan range. If the patient had undergone surgery, the report from surgery was used additionally. ***Results:*** Standard parathyroid SPECT/CT showed adenomas in 26 out of the 40 patients, the position of the adenomas was described as posterior of, just inferior to, or within the thyroid gland. Overall, similar reductions in CT range were observed independent of timepoint (range: mean percentage CT scan range reduction 58%-63%). The mean CT scan range was reduced by 21.2 cm, 21.4 cm and 22.4 cm at the early-, late with early- and late- timepoints for the junior doctor and 21.0 cm, 21.8 cm and 20.4 cm for the technologist, respectively. Comparing the personalized CT scan range to our reference showed that no adenomas were missed for any of the two observers. 11 out of the 40 patients had undergone surgery at the time of follow up, one had an ectopic adenoma (which was not detected on the standard examination). ***Conclusion:*** Personalized CT scan range in parathyroid SPECT/CT determined by either a technologist or a junior doctor can reduce scan range with 59-65% without missing (ectopic) adenomas enabling a reduction of the radiation dose without missing clinically relevant findings.

EP-0666

Advancing Precision in Radioembolization: A Comparative Analysis of Lung Shunt Fraction Estimation Through Planar Imaging, SPECT/CT, and Y90 PET/CT (Post Therapy)

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Aim/Introduction: Radioembolization for hepatic malignancies often carries the risk of radiation-induced complications, such as pneumonitis and sclerosis, arising from hepatopulmonary shunting of 90Y microspheres. This study investigates the comparative accuracy and precision of lung shunt fraction (LSF) estimates derived from 99mTc macroaggregated albumin (99mTc-MAA) using planar, SPECT/CT, and Y90 PET/CT imaging modalities. ***Materials and Methods:*** Eight patients scheduled for radioembolization therapy were administered 99mTc-MAA and subjected to LSF measurement using planar and SPECT/CT imaging techniques. These pre-therapy LSF values were subsequently compared with post-therapy measurements from Y90 PET/CT to evaluate the precision and reliability of each imaging method. Statistical analyses were employed to quantify differences among the modalities. ***Results:*** Data analysis revealed a consistent overestimation of LSF by planar imaging in comparison to SPECT/CT and Y90 PET/CT. For example, LSF values for a typical patient (#4) were reported as 8.7% (Planar), 5.86% (SPECT/CT), and 5.512% (Y90 PET/CT). Statistically, planar imaging significantly overestimated LSF values relative to SPECT/CT and Y90 PET/CT ($p < 0.01$), underscoring the superior accuracy and agreement of SPECT/CT and Y90 PET/CT in post-therapy assessments. ***Conclusion:*** This study highlights the limitations of planar imaging in estimating LSF accurately and endorses the use of SPECT/CT as a more reliable method for pre-therapy lung shunt estimation. The findings advocate for a revision of imaging protocols to incorporate SPECT/CT, enhancing therapeutic planning and potentially improving patient outcomes in hepatic radioembolization.

EP-0667

Diagnostic Accuracy of SPECT/CT Images and SUV Values in Cardiac Amyloidosis

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Aim/Introduction: Cardiac amyloidosis (CA) diagnosis typically involves heart-to-contralateral lung ratio (H/CL) calculations from planar images at 1-hour and visual evaluation from SPECT/CT images at 3-hours. This study aims to evaluate the impact of planar and SPECT/CT images, along with SUV values, on diagnostic accuracy. ***Materials and Methods:*** The H/CL ratio was computed by dividing counts on areas of interest in planar images at 1 and 3-hours. Visual grading was performed on SPECT/CT images taken at 1 and 3-hours, and SUVmax and SUVmean values were obtained from the 3-hour images. Spearman correlation analysis compared the H/CL ratios, while Mann-Whitney U test evaluated quantitative data, considering $p<0.05$ statistically significant. ***Results:*** Seventy patients suspected of ATTR-CA were included. Using H/CL cutoff values of 1 and 1.5 on planar images at 1 hour, 9 patients were negative, 51 suspicious, and 10 positive. Upon combined visual and quantitative assessment, the median 1 and 3-hour H/CL ratios for negative patients (n=58) were 1.17 and 1.15, while for positive patients (n=12), they were 1.57 and 1.68, respectively. Strong correlation was observed between 1-hour and 3-hour H/CL ratios in positive and negative patients ($p<0.001$). The 1-hour H/CL cutoff value for distinguishing positive and negative patients was determined as 1.4 (83.33% sensitivity and 89.66% specificity), while the 3-hour cutoff value was 1.33 (83.33% sensitivity and 87.93% specificity). On 3-hour SPECT/CT images, patients were graded as Grade-0 (n=38), Grade-1 (n=20), Grade-2 (n=4), and Grade-3 (n=8). SUVmax and SUVmean cutoff values for distinguishing positive and negative patients were 4.35 and 2.92. There was a statistically significant difference in SUVmax and SUVmean values between Grade 0-1 and Grade 2-3 groups in the myocardium, sternum, ribs ($p<0.05$) and myocardial, atrium, aorta, thorax, sternum, and rib SUVmax values between Grade 0-1 and Grade 2-3 ($p<0.05$). When combining 3-hour H/CL (>1.33) and 3-hour myocardial SUVmax (>4.35) cutoff values, a sensitivity of 66.6% and specificity of 96.5% were achieved in distinguishing positive and negative groups. Planar quantitative assessment resulted in 23 patients in the suspected group reclassified as negative using SPECT/CT, thus preventing false positives. ***Conclusion:*** Planar imaging at 1 or 3-hours is recommended for diagnosis of CA. Strong correlation was found between 1-hour and 3-hour H/CL ratios in positive and negative patients. In cases of time and equipment constraints, 3-hour imaging alone may be sufficient for diagnosis. 3-hour SPECT/CT images and derived SUV parameters may reduce the number of suspected/false positive patients.

EP-0668

Fast and Furious: Optimizing Clinical Blood Pool SPECT

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Aim/Introduction: Imaging the blood pool activity imaging allows to demonstrate inflammation associated with osteomyelitis, yet traditional planar imaging methods present challenges in accurately identifying focal regions of increased activity. Integrating SPECT imaging into bone scintigraphy protocols would enhance localization accuracy and eliminate superposition artifacts. Therefore, we aimed to optimize a fast SPECT imaging acquisition specifically tailored for blood pool imaging. ***Materials and Methods:*** A Jaszczak phantom filled with 550MBq of 99mTc-MDP, a standard activity for bone scintigraphy, was scanned using various SPECT acquisition setups. The standard bone scintigraphy SPECT consisting of 60p (projections per detector head) of 18 seconds and a matrix size of 128x128 served as baseline. Setup variations included: 30p x 18s, 30p x 9s, 12p x 30s, 12p x 18s, and 8p x 30s. All acquisitions were processed using OSEM iterative reconstruction. The same reconstruction parameters of the baseline SPECT were maintained with 8 iterations and 8 subsets, utilizing a Gaussian filter of 9mm FWHM. ***Results:*** The acquisitions of 30 projections demonstrated good performance in discerning hot rods, while those based on 8 or 12 projections struggled to delineate the hot rods clearly. Cold sphere contrast was reduced notably. A balance between acquisition time and image quality was achieved with 30 projections of 9 seconds, resulting in a total acquisition time of 4.5 minutes. ***Conclusion:*** A SPECT protocol suitable for blood pool imaging was obtained, showcasing a preference for acquiring more projections using shorter acquisition times over a limited number of projections. The protocol offers improved accuracy in localizing inflammatory sites over traditional planar imaging, while still being able to image the blood pool activity. Because of this, the protocol was introduced in clinical routine.

EP-0669

Comparison of "Step and Shoot" vs. "Continuous" mode of SPECT imaging with ^{99m}Tc regarding resolution and contrast

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Aim/Introduction: SPECT-examination may be performed either by continuous movement of the detector heads (Continuous Motion (CM)) or by step-by-step acquisition in single angels (Step-and-Shoot mode (SnS)). Aim was to evaluate the influence of the acquisition mode regarding tomographic resolution and contrast for 99mTc-SPECT. ***Materials and Methods:*** SPECT-acquisition was performed with a gamma camera (IRIX, Philips) using a Jaszczak phantom filled with a total of 5,540 ml H2O and a 99mTc-activity of 45 kBq/ml in the hot regions (square pillars; volume: 13, 54 and 105 ml) and 15 kBq/ml in the surrounding volume. Beside the acquisition mode the number of views in SnS and the radius of the orbit were varied. The reconstructed transaxial slices were evaluated. An equal decay corrected examination time was used for comparison. ***Results:*** In SnS the number of views varied between 40 and 120. Tomographic resolution was not significantly impaired when using a small number of views (40). However, examination time was reduced obtaining the same net acquisition time. On the other hand, contrast was improved especially for the small pillar due to an increased number of counts per image. Concerning the acquisition mode, no significant influence in resolution and contrast of the hot regions was detected. The best results concerning contrast and resolution were obtained using a patient

contour orbit, but the deviation of image quality for the smallest possible circular orbit (22cm) and the patient contour orbit were not statistically significant (p>0.05). Further increase of the radius resulted in a decrease of contrast and resolution of up to 50% depending on acquisition mode and number of views. However, the negative correlation between orbit radius and image contrast is associated with an increased study time due to the radial motion of the detector heads during acquisition that lasted up to 120s depending on the number of steps and the transversal shape of the patient. ***Conclusion:*** Because of no significant disadvantage in image quality and its increased convenience especially for claustrophobic patients CM is the preferable acquisition mode. The number of views can be reduced to 40 to obtain an increased number of counts per view and therefore enhance tomographic contrast. Only a small improvement of image quality can be achieved with a patient contour orbit compared to the smallest circular orbit. However, the increased gross acquisition time and the radial movement of the detector heads may be unpleasant especially for the claustrophobic patients.

EP-0670

A phantom study to optimize BSREM 3D-ring cadmium-zinc-telluride SPECT/CT reconstruction parameters for sentinel node imaging of head neck melanoma

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Aim/Introduction: Sentinel node (SN) detection of head and neck melanoma may benefit from the use of a 3D-ring cadmium-zinc-telluride (CZT) SPECT/CT due to its superior sensitivity in comparison with conventional dual head SPECT/CT. Furthermore using block sequential regularization expectation maximization (BSREM) as reconstruction algorithm may also improve SN detection. Thus far, SN imaging in head and neck melanoma has not been investigated for BSREM 3D-ring CZT SPECT/CT. The aim of this phantom study is to determine the optimal BSREM parameters for 3D-ring CZT SPECT/CT SN imaging in head and neck melanoma and compare the optimal reconstruction with a conventional SPECT/CT scan. ***Materials and Methods:*** To simulate one SN and two in-plane higher echelon nodes three Eppendorf tubes with each 2MBq [99mTc]Tc-pertechnetate were positioned in the neck area of an anthropomorphic Alderson phantom. On top, 1cm tissue equivalent material was placed on which four Eppendorf tubes with each 10MBq were attached lateral from the SN to simulate injection sites. SPECT scans with 20 minutes acquisition time were performed on a conventional and 3D-ring CZT SPECT/CT. 3D-ring CZT SPECT/CT scans were reconstructed using BSREM with resolution recovery, attenuation correction, dual energy window scatter correction, bySens and 2.46mm voxels. To determine to optimal number of iterations, 10, 20 and 30 iterations with 10 subsets were reconstructed using a default factory protocol with β=0.05 and γ=2. The optimal number of iterations was used for reconstructions with β between 0.01-0.5 and γ between 1-4 to optimize β. After which γ was further optimized using values between 5-11. After a visual assessment for artefacts, optimal parameters were determined by highest SN contrast-to-noise ratio (CNR) and recovery coefficient (RCmax) values. SN detection between the optimal and conventional reconstruction was compared using SN peak to background valley ratio. Peak and valley values were determined with a line profile over the SN and background between SN and injection site. ***Results:*** Highest CNR (13.6) and RCmax (1.1) were obtained with 30 iterations. Whereas, the optimal reconstruction parameters β=0.05 and γ=10 resulted in stabilized CNR (201.2) and RCmax (1.7) values without visible artifacts. Comparison with the conventional SPECT/CT reconstruction resulted in an increase in SN peak to background valley ratio from 3.8 to infinite as the valley of the optimal reconstruction was zero. ***Conclusion:*** SN detection in head and neck melanoma improved with BSREM 3D-ring CZT SPECT/CT. Further investigation is needed to validate and optimize the results in patients.

EP-0671

High Image Quality at Reduced Time per Bed Position - an Evaluation of Posttreatment ^{177}Lu-PSMA-617 scans Using the StarGuide CZT-based SPECT/CT system

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Aim/Introduction: Single photon emission computed tomography/computed tomography (SPECT/CT) imaging post targeted radionuclide therapy is important for assessing uptake in tumor lesions, dosimetry, and identification of possible extravasation. However, whole-body SPECT/CT is constrained by long image acquisition times with respective low patient compliance, and relatively low sensitivity. We have shown that fast whole-body post-therapy SPECT/CT is feasible using the StarGuide (GE Healthcare), a next-generation multi-detector Cadmium-Zinc-Telluride (CZT) SPECT/CT system (1). In this study, we assessed the image quality of post 177Lu-PSMA-617 SPECT/CT scans with reduced time per bed position (pBp) of 1 minute and 2 minutes, and compared them to standard 3 minutes per bed position. ***Materials and Methods:*** We retrospectively analyzed SPECT/CT scans from 50 patients who received 177Lu-PSMA-617 as part of standard of care. Post-treatment whole-body SPECT/CT images were routinely acquired for 3 minutes pBp and were retrospectively reconstructed to be equivalent to 2 minutes and 1 minute pBp. Three readers independently evaluated image quality for each reconstruction using a 5-point Likert scale (1 non-diagnostic, 2 suboptimal image quality, 3 acceptable image quality, 4 good image quality, 5 excellent image quality). We assessed interreader agreement and calculated the difference of proportion of high quality image between each pair of comparison. ***Results:*** Mean image quality across all readers was nearly excellent for standard 3 minutes pBp at 4.75±0.51 (range, 2-5). The reconstructed 2 minutes pBp yielded in good image quality at 4.33±0.77 (range, 2-5) while the 1 minute acquisition pBp was acceptable at 3.05±0.95 (range, 1-5). The interreader agreement, however, was low. The per-reader analysis showed no significant difference between 3 minutes and 2 minutes for Reader 1 and 3 (P=1 and P=0.5, respectively) while for Reader 2, 3 minutes pBp showed 39% higher image quality than 2 minutes (P=<0.001). The image quality of scans acquired at 1 minute pBp was significantly lower than that of 2 minutes and 3 minutes across all three readers (P=<0.001, respectively). ***Conclusion:*** Our preliminary data showed that fast acquisition times of as low as 2 minutes per bed position for whole-body post-treatment SPECT/CT yielded in high image quality using the new StarGuide SPECT/CT system. Further evaluation in larger cohorts are needed to validate our findings. ***References:*** Song H, Ferri V, Duan H, et al. SPECT at the speed of PET: a feasibility study of CZT-based whole-body SPECT/CT in the post (177)Lu-DOTATATE and (177)Lu-PSMA617 setting. Eur J Nucl Med Mol Imaging. 2023;50:2250-2257.

EP-0672

Optimization of Collimator Design in HiReSPECT II: a Monte Carlo Study

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Aim/Introduction: Small animal imaging has an extensive variety of applications, including the design and optimization of novel imaging devices. Monte Carlo (MC) simulations are enhanced due to their high accuracy. The purpose of this investigation was to validate the MC code for a preclinical SPECT known as HiReSPECT II machine and also optimize different collimator materials and geometries for sensitivity and spatial resolution. ***Materials and Methods:*** The validation of a small animal SPECT scanner furnished with lead hexagonal parallel-hole collimator, CsI(Na) pixelated crystal and SiPM photodiodes was performed by comparing experimental results with Geant4 Application for Emission Tomography (GATE) simulation data. In the next step, the optimization appraisals for both spatial resolution and sensitivity on the collimator material and hole diameter were carried out using GATE. The experimental and simulated sensitivities were obtained using a cylindrical phantom at collimator-source distance (SCD) of 3 cm. Moreover, a line source was applied to assess the spatial resolution in the simulated and experimental environments at different SCDs. ***Results:*** The discrepancy between experimental and simulated sensitivities was less than 8%. In addition, the differences between simulated and experimental spatial resolutions were less than 12%. Also, the sensitivity for TuCu, Au, Pb and Tu was studied. Besides, the spatial resolution values of Au, Tu and Pb was close to each other and better than Tu+Cu. ***Conclusion:*** The best spatial resolution-sensitivity tradeoffs for parallel-hole collimators are observed in Au with hole diameter of 1.2 mm and Pb with hole diameter of 1.2 mm. However, lead is preferred over gold because it's considerably cheaper than gold. Additionally, the spatial resolution-sensitivity tradeoff greatly depends on the hole diameter and collimator material. Increasing the hole diameter augments the sensitivity and decreases the spatial resolution.

EP-0673

Fabrication of a patient-specific metastasized lumbar vertebra phantom with realistic attenuation properties

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Aim/Introduction: 177Lu SPECT/CT imaging is essential for bone marrow dosimetry. However, not much is known about its accuracy in bone sites, where imaging is particularly challenging due to low count rates in combination with high photon attenuation. The aim of this work was to produce and validate a phantom of a metastasized lumbar vertebra with realistic attenuation properties in cortical bone, spongiosa, and metastasis. ***Materials and Methods:*** The phantom consisted of a two-compartment lumbar vertebra (healthy spongiosa and metastasis) and a single-compartment right kidney, fitted inside a Jaszczak cylinder. Both inserts were segmented on the CT of a pretherapeutic [18F]F-PSMA-1007 PET/CT scan of a patient suffering from metastatic castration-resistant prostate cancer. While a clear resin with density similar to soft tissue was used for the kidney (HU: 121[1]), a high-density resin was used to replicate the higher density of cortical bone (HU: 813[1]). The kidney was filled with a [177Lu]LuCl3 solution of activity concentration 310kBq/ml dissolved in 0.1M HCl with 216mg/ml non-active LuCl3*6H2O. The stock solution for the denser bone compartments was prepared based on[2]. Here, a method was presented to determine the K2HPO4 concentration required for a stock solution of a given HU in a low-dose CT. The target HUs (spongiosa: 200, metastasis: 500) were obtained from the CT of a peritherapeutic SPECT/CT acquisition of the same patient after [177Lu]Lu-PSMA-I&T therapy. Both stock solutions were prepared by mixing K2HPO4 with H2O and adding a separately prepared solution of H2O, DTPA and 33kBq/ml (healthy spongiosa) or 0.95Mbq/ml (metastasis) of [177Lu]LuCl3. SPECT/CT imaging was performed with a clinical low-dose protocol (MELP, 20s-per-projection, 256x256 matrix, 1.95cm voxel-size, 130kVp, 20mAs). ***Results:*** Visually, the phantom CT exhibited a noticeably higher density than the surrounding water. The HU histogram showed three peaks, corresponding to the densities of the materials used. Cross-sections through the attenuation maps of patient and phantom showed comparable density profiles of water, cortical bone, spongiosa, and metastasis. Despite the similarities, the integral along a central line through the vertebra showed a higher attenuation in the phantom than in the patient. ***Conclusion:*** This study shows that realistic attenuation properties in bone sites can be achieved by a combination of denser 3D printing resins and stock solutions when measuring with hollow phantoms. This represents an important step towards the validation of quantitative SPECT/CT imaging in bone sites. ***References:*** [1] Kalidindi Y et al. Micromachines 14(10);2023:1928, [2] Pieper L et al. NuclearMedicine 2024;63(2):137.

EP-0674

Subdiaphragmatic artefacts in myocardial perfusionm scintigraphy

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Aim/Introduction: Myocaridal perfusion imaging aids in assessing coronary artery disease. During image acquisition, subdiaphragmatic artifacts may occur, hindering the accurate evaluation of the conducted study. Several methods exist to reduce the occurrence of these artifacts. The aim of this study was to evaluate the quantity of examinations repeated due to these artifacts at the Department of Nuclear Medicine, Medical University of Łódź. ***Materials and Methods:*** Study included 139 patients (67females, 72males) aged 35-91 years, BMI 18.8-48.8 [kg/m2]. 103 patients (74%) were classified as overweight (BMI ≥ 25). The analyzed studies were conducted between IX-XII 2022, encompassing a complete set of myocardial perfusion scans (rest (RS) and stress(SS): exercise - 86 patients or pharmacological tests - 53 patients). Studies were performed using GE Discovery 530c semiconductor gamma camera and GE Infinia Hawkeye 4 scintigraphic gamma camera. ***Results:*** Subdiaphragmatic artifacts occurred in 27/139 SS (19.4%) and 44/139 RS (31.7%). In 17 cases, they occurred in both SS and RS of the same patient (12.2%). Incidence of these artifacts was significantly lower in SS compared to RS (19.4% vs. 31.7%; $p = 0.009$). Among 53 patients who underwent pharmacological stress tests, artifacts occured in 15 cases (28.3%), while in 86 patients who underwent exercise tests

they occured in 12 cases (14%). Incidence of subdiaphragmatic artifacts after excercise stress tests was significantly lower than after pharmacological stress tests (14% vs. 28%; p = 0.038). No significant relation between age, sex and BMI of the patients and incidence of subdiaphragmatic artifacts was observed. ***Conclusion:*** Recommendation that patients walk moderately intensively (in the designated area of the Department) between radiopharmaceutical administration and image acquisition on a gamma camera may reduce the occurrence of subdiaphragmatic artifacts in rest studies and studies after pharmacological stress tests.

EP-47

e-Poster Area

D: Technical Studies -> D1 Instrumentation -> D12 PET/CT

EP-0675

The Role of Ga^{68}-PSMA PET/CT in Biochemical Recurrent Prostate Cancer

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Aim/Introduction: The aim of study was to investigate the the diagnostic performance of PSMA PET/CT performed for restaging in subjects with biochemical recurrent prostate carcinoma after curative treatment either with radical prostatectomy (RP) or Radiation Treatment (RT). ***Materials and Methods:*** 58 prostate cancer patients (Age 73±8) with biochemical recurrent prostate carcinoma after curative treatment who underwent Ga68-PSMA PET/CT between December 2015 and August 2022 were retrospectively analyzed.PSMA uptake levels were grouped as posivite or negative.Positive disease locations were classified as prostate/prostate bed,pelvic lymph node,abdominal lymph node,supradiaphragmatic lymph node,bone,visceral organ.SUVmax values were recorded for positive disease sites.According to PSMA PET/CT findings, the extent of disease was decided (pelvis limited and distant metastatic). Gleason score,ISUP grade (International Society of Urological Pathology)),PSA,PSAdt,PSAvelocity and pathological SUVmax values were recorded and compared in PET positive and negative subjects and also in RT and RP groups.Findings were correlated with histopathological results and/or radiological, clinical and laboratory findings. ***Results:*** PSMA PET/CT was positive in 33 patients,negative in 25 patients.The sensitivity,specificity,positive predictive value and negative predictive value of PSMA PET/CT were calculated as 73.2%,78.6%,90.9%,50%,respectively.Patient-based detection rate was found to be 57%.Detection rate was 24% when PSA level was <1 ng/ml,69% when PSA level was between 1-4 ng/ml and 81% when PSA level was above 4 ng/ml.A statistically significant correlation was found between PSMA PET/CT positivity and age,Gleason score,ISUP grade and PSA level.PSA value was found to be significantly higher in PET-positive patients. The threshold value in the ROC analysis for PSA was calculated as 1.0050 ng/ml,and was statistically significant (p= 0.06).In the presence of bone involvement,Gleason score average and PSA were found to be higher.A statistically significant relationship was found between visceral involvement,supradiaphragmatic LN involvement and bone involvement and ISUP Grade categories.A statistically significant strong positive correlation was observed between PSA and bone SUVmax.PSA value was observed to be significantly higher in patients with distant metastases.It was noted that the PSAdt value was shorter, especially in cases with extensive metatatic disease.The uptake in local recurrence site was higher in subjects who had RT than in subcets with RP.No difference was noted for both groups in other metastatic disase sites. ***Conclusion:*** Ga68-PSMA PET/CT has shown reliable performance in locating recurrence sites of prostate cancer.This performance is better when the PSA serum level is above 1 ng/mL.Ga68-PSMA PET/CT imaging should be considered and used as the first-line imaging modality for biochemical recurrence in prostate cancer patients who had curative treatment.

EP-0676

The impact of various patient hydration protocols on physiological $^{[18F]}$FDG uptake in the urinary bladder on PET/CT

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Aim/Introduction: To assess the impact of volume and route of hydration, forced diuresis (furosemide 10mg IV) and the time of diuretic administration, prehydration (before $^{[18F]}$FDG administration) on physiological $^{[18F]}$FDG uptake in the urinary bladder on PET/CT. ***Materials and Methods:*** Prospective single-center randomized trial included 140 patients who underwent $^{[18F]}$FDG PET/CT. Scans were performed according to the standard EANM proposed protocol, 60 minutes after the IV administration of $^{[18F]}$FDG. Patients were divided into 7 groups (n=20 for each group), based on the hydration protocol: (#1) 1000ml orally post $^{[18F]}$FDG injection (p/i); (#2) 1000ml orally p/i + furosemide 10mg IV (60 minutes before PET); (#3) 1000ml orally p/i + furosemide 10mg IV (30 minutes before PET); (#4) 500ml orally p/i + furosemide 10mg IV (30 minutes before PET); (#5) 1000ml IV p/i + furosemide 10mg IV (30 minutes before PET); (#6) 500ml IV p/i + furosemide 10mg IV (30 minutes before PET); (#7) 500ml IV before and 500ml IV within 30 minutes p/i + furosemide 10mg IV (30 minutes before PET). $^{[18F]}$FDG uptake in the urinary bladder was quantified using SUVmean (Mean Standardized Uptake value), measured within a spherical VOI with a fixed volume of 2.5cm3 delineating the bladder boundaries. Intergroup differences were assessed for statistical significance using the nonparametric Mann-Whitney U test. ***Results:*** The urinary bladder SUVmean for each group were as follows: (#1) - 15.4 [9.0;36.1]; (#2) - 5.4 [4.1;10.5]; (#3) - 2.8 [2.3;3.9]; (#4) - 5.0 [3.7;6.4]; (#5) - 3.1 [2.6;3.5]; (#6) - 4.8 [3.6;7.2]; (#7) - 3.3 [3.1;4.0]. Significantly lower SUVmean ($p<0.001$) were observed in the groups (#4) and (#6) compared to the groups (#3) and (#5), respectively. Patients in all other groups also exhibited significantly lower SUVmean compared to the group (#1) ($p<0.001$ for each group). Additionally, SUVmean was significantly lower ($p<0.0001$) in the group (#3) compared to the group (#2). No significant differences in SUVmean were found between the groups (#3) and (#5) ($p=0.46$), groups (#4) and (#6) ($p=0.98$), as well as between the groups (#5) and (#7) ($p=0.095$). ***Conclusion:*** A larger volume of hydration, forced diuresis and a 30-minutes time interval between furosemide administration and the start of PET acquisition significantly reduced both the level and variability of $^{[18F]}$FDG uptake in the urinary bladder. Prehydration and the route of hydration in the same volume did not affect $^{[18F]}$FDG uptake in the urinary bladder.

EP-0677

Phantom-based evaluation of yttrium-86 quantification using a conventional and a digital PET system: impact of prompt gamma coincidence correction

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Aim/Introduction: In theranostic approaches, the diagnostic and therapeutic radionuclide should ideally be the same element. For example, the beta-emitting yttrium-90 is often used for therapeutic applications; the corresponding diagnostic yttrium isotope is the positron-emitting yttrium-86. However, yttrium-86 has a complex decay scheme emitting a large amount of prompt gammas that impair PET image quantification. In this phantom study, the quantitative performance of yttrium-86 will be evaluated. Yttrium-86 images reconstructed with and without prompt gamma coincidence correction (PGC correction) are compared with reference level results of fluorine-18. ***Materials and Methods:*** A PET NEMA phantom (with a lung insert) was scanned using two PET/CT scanners, a conventional Biograph mCT and a digital Biograph Vision 600. A clinical relevant acquisition time of 240 s for yttrium-86 and 67 s for fluorine-18 (positron-branching ratio-adapted) were selected. Images were reconstructed with time-of-flight option, once with PSF and once without and with and without application of PGC correction. Four performance metrics were used: sphere signal recovery coefficient, sphere contrast recovery coefficient, background recovery coefficient, and residual lung bias. ***Results:*** For all metrics, images without PGC correction yielded inferior output, particularly unacceptable results for the conventional scanner. Applying the PGC correction improved considerably all metrics. Sphere signal and sphere contrast recovery coefficient values of yttrium-86 were underestimated (≤ 15%) compared to fluorine-18 reference levels. The images with PGC correction provided residual lung bias values comparable to those of fluorine-18. Nevertheless, images with PGC correction achieved a background recovery of 85%. ***Conclusion:*** This study reveals necessity of PGC correction in the image reconstruction of yttrium-86. Involving the PGC correction resulted in quantitative performance comparable across both PET/CT systems. Despite observed improvements, additional advancements of PGC correction are desirable.

EP-0678

Misregistration correction of 650 PET/CT scans with data-driven gated CT

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Aim/Introduction: Misregistration caused by irregular respiration can compromise the quantification and localization accuracy of PET/CT. Repeat PET/CT can be a solution, but it takes > 5 mins to repeat 1-bed position on a 25-cm axial field of view PET/CT. We have developed a data-driven gated (DDG) CT, whose CT radiation dose is 35% of a repeat PET/CT and whose scan time is < 1 min. We evaluated the efficacy of DDG CT for misregistration correction of 650 PET/CT scans. ***Materials and Methods:*** All PET/CT scans were reviewed for data integrity in the last bed position. When misregistration is identified, a low-dose cine CT scan over the misregistration area is initiated during the transition from PET to CT to patient release. The cine CT scan protocol is 120 kVp, 5-sec cine duration, 0.8-sec gantry rotation cycle time, noise index = 70, and 10 ≤ mA ≤ 20. The cine CT takes < 1 min and the radiation dose is 1.3 mSv, 35% of a repeat PET/CT. The overlap region of the misregistered CT with DDG CT is replaced with the DDG CT for attenuation correction of the PET data. The DDG CT was derived from the changes in the lung CT numbers and body outlines to respiration and was applied for misregistration correction of 650 PET/CT scans from January 1, 2023, to April 17, 2024. ***Results:*** The 650 scans constituted only 3% of the total PET/CT scans. Three cine CT scans (< 0.5%) failed due to patient motion or loss of landmark position between PET and cine CT. The remaining 647 scans (> 99.5%) were all improved with DDG CT for quantification and registration. Of the 650 scans, 49%, 30%, and 18% were 18F-FDG, 18F-PSMA-PYL, and 68Ga-Dotatate scans, respectively; and 308 scans (47%) had ≥ one lesion in the misregistration area and benefited from correction. Of these 308 scans which had ≥ one lesion in the misregistration area, 70%, 8% and 22% were 18F-FDG, 18F-PSMA-PYL, and 68Ga-Dotatate scans, respectively. There was no impact on patient throughput as the misregistration correction was applied during the acquisition of the next PET scan. ***Conclusion:*** The efficacy of DDG CT for misregistration correction has been demonstrated on 650 scans. The DDG CT was effective for misregistration correction, particularly for the 18F-FDG and 68Ga-Dotatate scans. Misregistration correction of the 18F-PSMA-PYL scans may not be necessary as there is usually no lung or liver lesion.

EP-0679

Additional value of the acquisition of PET with ^{18}F-FDG in inspiration to the conventional PET/CT protocol, in the metabolic assessment of lung nodules.

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Aim/Introduction: To determine the impact of the acquisition of PET in inspiration, in addition to the conventional ^{18}F-FDG PET/CT protocol, in the metabolic assessment of pulmonary nodules. ***Materials and Methods:*** We analyzed 53 patients (median 68 years; 24 Women and 29 Men) referred for evaluation of one or more lung nodules previously identified in previous radiological studies. The acquisition was performed with PET/CT (GE Discovery Gen 2 5-ring) on an empty stomach, for at least 4 hours, checking basal blood glucose, after administration of ^{18}F-FDG. Whole body and chest images were acquired on inspiration (both PET and CT) with multiparametric visual analysis, as well as quantitative analysis of the maximum standardized uptake index (SUVmax). ***Results:*** 85 nodular lesions (size 0.3-3cm) were analyzed. We performed a visual assessment of which 58 were suspicious of malignancy, 25 suspected of benignity and 2 undetermined. An SUVmax > 2.5 was also defined as a suspicious cut-off point, evaluating them both in the usual acquisition and in inspiration, 41 nodules evaluated with the usual acquisition obtained an SUVmax > 2.5, while those evaluated with PET in inspiration were 63 with a median increase in SUVmax of 0.59. Similarly, the SUVmax decreased in 22 nodules and increased in 58 nodules. ***Conclusion:*** The acquisition of PET/CT in inspiration is very useful to determine the malignancy of lung nodules, not only from a semi-quantitative point of view, but also significantly impacting the visual assessment. Therefore, the acquisition of PET in inspiration added to the usual protocol allows it to be a useful tool for correct assessment, staging

and, consequently, adequate medical-surgical management. ***References:*** 1. Lamare, F et al. "PET respiratory motion correction: quo vadis?." Physics in medicine and biology vol. 67,3. 1 Feb. 2022.2. Noto, Benjamin et al. "Respiratory motion correction in F^{18}-FDG PET/CT impacts lymph node assessment in lung cancer patients." EJNMMI research vol. 12,1 61. 15 Sep. 2022.3. Gratz, Marcel et al. "Impact of respiratory motion correction on lesion visibility and quantification in thoracic PET/MR imaging." PloS one vol. 15,6. 4 Jun. 2020.4. Walker, Matthew D et al. "Data-Driven Respiratory Motion Correction in Clinical PET - A Turning Point." Journal of nuclear medicine : official publication, SNM, jnumed.120.257022. 18 Dec. 2020.5. Ruan, Weiwei et al. "Evaluating two respiratory correction methods for abdominal PET/MRI imaging." EJNMMI physics vol. 9,1 5. 31 Jan. 2022.

EP-0680

Evaluation of the optimal imaging protocol for [18F] PSMA PET-CT to detect bone metastases in prostate cancer patients

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Aim/Introduction: PSMA-PET is a commonly used diagnostic tool for patients with prostate cancer (PC). However, it is important to consider the indications and acquisition time due to the limited availability of PET scanners and associated costs. The objective of this investigation was to determine if a PET scan from the head to the proximal femur is sufficient to detect the presence of relevant bone metastases. ***Materials and Methods:*** A retrospective analysis was carried out on 1050 consecutive [18F]PSMA-1007-PET-CT scans, acquired from the head to the proximal lower leg. PET scans were classified based on the presence and quantity of bone metastases: (1) 1-5, (2) 6-19 and (3) ≥20. The PET scans were also evaluated for the presence of bone metastases distal to the thigh. The imaging results were compared to patients PSA values. ***Results:*** Bone metastases were present in 391 PSMA-PET scans. In 37.3% (n=146) the PET scan also revealed distant bone metastases in the femur and/or proximal tibia. The majority of distant bone metastases was found in patients with more than five bone metastases (second and third subgroups). Only one patient with five metastases in total (subgroup one, 0.7%) presented with a distant bone metastases. No solitary distant metastasis was detected. PSA values increased significantly with a higher number of bone metastases (first vs third subgroup, $P < 0.001$). The ROC analysis indicated that a PSA value of 11.15 ng/mL is the most effective cut-off for detecting distal bone metastasis, with an AUC of 0.919 (95% CI: 0.892 - 0.945), sensitivity of 87%, and specificity of 86%. ***Conclusion:*** PSMA-PET acquisition protocols from the head to the proximal femur may be sufficient for accurate detection of bone metastatic disease in PC. PSA values can be used to support decision making regarding individual PET acquisition protocols.

EP-0681

When do Ki images benefit lesion detection by SUV images

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Aim/Introduction: To compare using Ki or SUV images. ***Materials and Methods:*** Patients with a histopathological diagnosis who received a weight-based 18F-FDG injection and underwent 60-min total-body PET/CT dynamic imaging were included in this retrospective study. SUV images were reconstructed using data collected from the last 10 minutes of the scans. Ki images were generated using the Patlak methods with data from minutes 12-60. The background SUVmax, SUVmean, SUVSD, Kimax, Kimean, and KiSD values were recorded. The signal-to-noise ratios of the SUV (SUVSNR) and Ki (KiSNR) images were calculated. The lesion detection rate and sensitivity of the SUV and Ki images were evaluated. ***Results:*** The study included 134 patients with 244 pathologically confirmed lesions (200 malignant and 44 benign). The lesion-detection rates were 97.7% (214/219) and 99.5% (218/219) for the SUV and Ki images, respectively ($p = .22$). Five false-negative lesions on the SUV images were true-positive on the Ki images. The sensitivity (94.0% vs. 96.0%, $p = .22$), specificity (41.9% vs. 41.9%, $p > .99$), accuracy (84.4% vs. 86.1%, $p = .61$), positive predictive value (87.9% vs. 88.1%, $p = .94$), negative predictive value (60.0% vs. 69.2%, $p = .47$), and the area under the curve [.68 (95% confidence interval, .61-.73) vs. .69 (95% confidence interval, .62-.74)] were similar in the SUV and Ki images (all $p \geq .10$). ***Conclusion:*** SUV images play an important role in lesion detection. Sometimes, particularly for lesions in organs with high radiotracer background, Ki images enhance the detection ability of the SUV images.

EP-0682

Brain-Only Imaging on Long Axial Field-of-View PET/CT

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Aim/Introduction: Brain-only PET/CT studies are crucial for diagnosing brain malignancies and Alzheimer's disease. They are typically performed over one bed position centred on the brain, with the CT providing attenuation correction (AC). The Royal Free Hospital recently received the UK's first long axial field-of-view (LAFOV) PET/CT system, boasting a 106 cm axial length and 20 times higher sensitivity than current-generation scanners. This system offers significantly improved image quality and contrast recovery. However, for single-organ studies like brain imaging, it poses the question of optimal patient positioning to balance sensitivity and CT dose. Should the brain be centred in the FOV for maximum sensitivity but higher CT dose, or positioned at the edge for lower dose but noisier images? This study seeks to optimize brain-only PET/CT scans by evaluating patient positioning, image quality, and CT dose. ***Materials and Methods:*** The need for CT attenuation correction was assessed to determine if it could be omitted from the imaging study. All initial brain imaging studies using the LAFOV system were retrospectively reconstructed with and without CT-based attenuation correction. Additionally, a reconstruction using the Chang filter was created. Two experienced nuclear medicine practitioners reviewed the images to assess whether CT attenuation correction was required. Phantom data were also acquired using a brain phantom placed at the centre and the edge of the FOV. CT scans were performed with varying quality reference mAs from 7 to 300 to optimize the CT dose while identifying the optimal patient position. ***Results:*** LAFOV non-attenuation-corrected (NAC) brain images were deemed acceptable if a recent high-quality brain CT or MRI was available. In this case, imaging the brain at the centre of the FOV was considered optimal. If no high-quality CT or MRI was available, imaging the brain near the edge of the FOV with a CTAC scan at 60 mAs provided a reduced dose while achieving a diagnostically

appropriate image. This mAs value was the lowest that could be used without photon starvation and still provided a suitable quantitative image. ***Conclusion:*** Brain-only imaging on a LAFOV PET/CT system is optimized by either centering the brain in the FOV with no attenuation correction if a high-quality CT/MRI is available or positioning the brain at the edge with a low-dose CTAC. This flexibility allows for a reduction in CT radiation burden while maintaining diagnostic image quality.

EP-0683

Impact of Different Coincidence Strategies on Image Quality in [18F]FDG PET: A Phantom Study

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Aim/Introduction: In PET/CT imaging, image quality is a critical factor for evaluating and optimizing scanning protocols, and it is directly influenced by count rate performance. Considering this relationship, we focuses on exploring whether applying different coincidence strategies to the same raw scan data affects image quality, as quantified by recovery coefficients (RC). Accurate RC values are essential for effective clinical diagnosis and scientific research. ***Materials and Methods:*** This study employed a fully digital clinical PET/CT system, which utilizes multi-voltage threshold (MVT) technology to directly digitize scintillation pulses, thereby facilitating post-acquisition coincidence sorting with various Coincidence Sorting Methods (CSMs) via software. We conducted four 10-minute scans of an Image Quality (IQ) phantom at hourly intervals, yielding 48 images utilizing 12 distinct coincidence strategies. The initial PET/CT scan of the phantom commenced with a background-to-lesion ratio of 1:10, where the lesion activity concentration was 19.13 kBq/ml. Each coincidence strategy was incorporated with a unique pairing policy dictating the management of coincident events within a 5 ns timing window. These policies (1), which ranged from the most restrictive ("killAll") to the least restrictive ("takeAllGoods"), were evaluated in both multi-window and single-window modes. All images were processed under identical reconstruction parameters (OSEM+PSF, 2 iterations, 12 subsets). Using ANOVA, we assessed the effects of different coincidence strategies on the mean and maximum recovery coefficients (RCmean and RCmax) for hot spheres varying from 10 mm to 37 mm in diameter, aiming to evaluate their potential impact on image quality. ***Results:*** The ANOVA results indicated no statistically significant differences in RCmean and RCmax across different coincidence strategies ($P > 0.9999$), suggesting that under the test conditions used, the choice of coincidence strategy does not significantly impact recovery coefficients. ***Conclusion:*** The findings demonstrate that different coincidence strategies do not significantly affect RCmean and RCmax when using the digitalized PET/CT system on an IQ phantom, thereby providing flexibility in clinical and research applications. Future research should explore the impact of varying reconstruction parameters and different imaging time intervals on quantitative image parameters to deepen understanding of the stability and reliability of quantification under different settings. ***References:*** (1) OpenGATE GATE user's guide version 9.4 openGATE. http://www.opengatecollaboration.org/.

EP-0684

Lesion conspicuity by size in [18F]FDG long-axial field-of-view PET/CT

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Aim/Introduction: To compare lesion quantification with [18F]FDG long-axial field-of-view (LAFOV) PET/CT to simulated short-axial field-of-view (sSAFOV) PET/CT. ***Materials and Methods:*** In this retrospective evaluation of 57 oncologic patients who underwent [18F]FDG LAFOV PET/CT, 160 malignant lesions (melanoma, lung cancer, lymphoma, breast cancer) were evaluated. Lesions were divided into different subgroups by their largest diameter based on the coregistered CT (<8mm: n=22, 8-10mm: n=32, 11-20mm: n=48, .20mm: n=58). LAFOV PET/CT was acquired in list-mode for 360s in maximum ring difference (MRD) 322. For sSAFOV PET, data were reconstructed in MRD 85 with 120s acquisition time. Image evaluation was performed by two nuclear medicine physicians. Image noise were characterized by liver's mean standardized uptake value (SUVmean) and signal-to-noise ratio (SNR). Tumor uptake was compared by using SUVmax/SUVpeak. Tumor-to-background ratio (TBR) was calculated by SUVmax/SUVpeak (TBRpeak). Image quality was assessed by SUVpeak tumor-to-noise ratio (TNRpeak) and a new independent image quality criterion (IQ: TBRpeak x TNRpeak). Paired t-test ($p<0.05$) was used to identify statistically significant differences between LAFOV and sSAFOV reconstructions. ***Results:*** Background noise level was impacted by LAFOV PET/CT reconstructions. While liver SUVmean did not change significantly between both analyzed reconstructions ($p=0.08$), SNR was significantly lower in sSAFOV compared to LAFOV PET (7.71±1.22 vs. 14.98±3.81). SUVmax was significantly higher for sSAFOV PET/CT in all lesion sizes compared to LAFOV PET/CT ($p<0.05$). TBR by SUVmax was significantly higher for sSAFOV to LAFOV PET/CT ($p<0.05$). However, TBR by SUVpeak was not significantly different between sSAFOV and LAFOV reconstructions. All LAFOV reconstructions showed increased image quality criteria compared to sSAFOV PET/CT. TNRpeak was significantly higher in all analyzed subgroups (<8mm: 8.12±3.79 vs. 16.22±9.74 $p<0.0001$; 8-10mm: 11.18±5.70 vs. 21.09±12.67 $p<0.0001$; 11-20mm: 17.92±13.68 vs. 35.02±28.63 $p<0.0001$ and >20mm: 31.85±21.26 vs. 63.78±45.01 $p<0.0001$). Subsequently, IQ was significantly higher in LAFOV PET compared to sSAFOV PET (<8mm: 10.44±11.80 vs. 22.00±29.13 $p<0.01$; 8-10mm: 18.07±18.31 vs. 34.89±39.51 $p=0.0001$; 11-20mm: 66.04±101.66 vs. 131.76±210.50 $p=0.0001$ and >20mm: 194.75±281.29 vs. 392.77±567.79 $p<0.0001$). ***Conclusion:*** Given the improved sensitivity and spatial resolution of next generation LAFOV PET/CT, here we present the first semi-quantitative data comparing LAFOV and sSAFOV PET/CT. LAFOV PET/CT showed not only increased tumor uptake values, but also superior image quality compared to sSAFOV PET/CT even in small size lesions (<8mm). This could be used to characterize early tumor stages or small metastases, not only morphologically by CT but also with reliable metabolic information by PET.

EP-0685

Performance Evaluation of a High-Sensitivity Preclinical PET/CT Scanner

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Aim/Introduction: The next generation preclinical PET/CT incorporates multi-voltage threshold (MVT) readout technology. This system is equipped with LYSO detector blocks, each comprising 1 × 4 detection heads. A light guide connects a 13 × 13 array of LYSO crystals coupling to a 6 × 6 SiPM array. The dimensions of each crystal are 13.0 mm in length and 1.89 × 1.89 mm^2 in cross-sectional area, with a 2.00-mm pitch in both axial and transaxial directions. The system includes 48 detector sectors arranged in two contiguous rings, offering transaxial field of view (FOV) of 160 mm and axial FOV of 200 mm, enableing the dynamic imaging of various organs in experimental animals. This study aims to assess the performance of the E180 system in accordance with the National Electrical Manufacturers Association (NEMA) NU4-2008 standard. ***Materials and Methods:*** Spatial resolution, sensitivity, image quality (IQ), and count rate performance were assessed in accordance with the NEMA standard. Spatial resolution was further evaluated using a Derenzo phantom. Finally, high-throughput performance was tested by simultaneously scanning 2-4 IQ phantoms and four mice. The resulting images were then compared with those from single phantom/mouse scans. ***Results:*** Employing 2D-filtered back projection (FBP) reconstruction, the system achieved full-width at half maximum (FWHM) values of 1.69 mm, 1.69 mm, and 1.46 mm in the radial, tangential, and axial directions, respectively, at the centre of FOV. Derenzo phantom imaging clearly resolved 1.2 mm-size features. The peak absolute sensitivity was 7.58% in a 350-650 keV energy window. Scatter fractions were 18%, 28%, and 47%, and peak noise-equivalent counting rates (NECRs) achieved 1340 kcps@129MBq, 727 kcps@94MBq, and 100 kcps@114MBq for mouse-, rat-, and monkey-like phantoms, respectively. In IQ phantom studies, recovery coefficients (RCs) for 1-5 mm rods ranged from 10.99% to 113.84%, with image uniformity at 7.0% and spill-over ratio (SOR) of 5.11% and 4.20% for the water- and air-filled regions, respectively. Dynamic scanning of a single mouse yielded images of excellent quality. Concurrent imaging of two and four IQ phantoms, alongside four mice, demonstrated the system's capability for multi-target imaging. ***Conclusion:*** The E180 preclinical PET/CT system exhibits superior count rate performance, high sensitivity, and the ability to capture high-quality images of multiple mice simultaneously. These features render it exceptionally suitable for high-throughput dynamic imaging of experimental animals in preclinical studies.

EP-0686

Is Breath-Hold PET/CT Comparable with Cutting-Edge Technology for Evaluation of Pulmonary Nodules?

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Aim/Introduction: FDG PET/CT is recommended for the evaluation of pulmonary nodules. However, blurring of the image due to respiratory movement may reduce the signal of the nodule and cause faulty interpretation. There are some software programmes which solve respiratory blurring problem but they are not available in every imaging center. The aim of our study is to reveal the role of breath-hold PET/CT imaging (BH) in the evaluation of pulmonary nodules. ***Materials and Methods:*** Patients aged 18-years and older with pulmonary nodules referred for FDG PET-CT scanning were included. All had undergone whole body imaging as well as BH and late free respiration imaging. In this retrospective single center study, the diagnostic performances of late imaging with free-respiration, immediate 30 second-BH, digital-motion-correction (MC) were analyzed. From OSEM and Bayesian Penalised Likelihood (BPL) images; SUVmax, SUVmean, Tumor-to-background ratio (TBR) as well as CT derived findings (nodule size, shortest distance from the lesion to nearest pleura, solid or subsolid nodules etc) were investigated. ***Results:*** Thirty-four patients (17 female) were included into the study. The mean age was 65.9 (±1.4) years. Imaging was performed 71.6 (±2) min post injection. Predominantly the nodules were solid (18) and were located in the upper lobes (53%) with a mean size of 19.3 (±1.1) mm. All nodules were FDG avid except 5 and all imaging parameters were concordant regarding FDG avidity. The median SUVmax of the nodules on standard, BH, late and MC were 1.99 (0-18), 2.45 (0-19.6), 1.94 (0-19.5) and 2.71 (0-18.8), respectively. Median TBR values for standard, BH and late imaging were 5.62 (1.65-57.3), 12 (1.8-92.7), 4.7 (1.7-71.9), respectively. TBR values were the highest in the BH group ($p<0.001$) which led improved confidence among the readers. Similarly, the proximity of the nodule to the pleura cause difficulty in interpretation on standart imaging which is accomplished by BH and MC images. The SUVmax values of BH images are strongly correlated with MC images (Spearman's correlation value: 0,968, $p<0.001$). ***Conclusion:*** Breath-hold images are comparable with motion correction algorithms and this may improve reader confidence independent from nodule localization, texture and distance from the pleura. Breath-hold PET-CT imaging can be a part of routine pulmonary nodule evaluation in daily settings.

EP-0687

PET Attenuation Map generation from Virtual monochromatic images obtained with Photon Counting CT scanners

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Aim/Introduction: We generate attenuation maps for positron emission tomography (PET). These more accurate attenuation maps will be applied to the BrainPET insert developed in-house for a human 7T MR scanner to improve PET quantitation accuracy for typical neuroscientific applications as activation studies and neuroreceptor imaging. ***Materials and Methods:*** Firstly, an accurate transformation from Hounsfield units (HU) to linear attenuation coefficients for 511 keV gamma photos is needed to provide accurate attenuation correction maps for quantitative PET. Spectral CT systems allow to reconstruct virtual monochromatic

images (VMI) from the inherently multiple polyenergetic data sets of CT. VMIs can be used to obtain virtual non-contrast (VNC) images and bone mineral density measurements. Currently, CT-derived PET attenuation maps are based on conversion schemes from conventional CT scanners with polyenergetic X-ray spectra and it is known that the conversion from polyenergetic spectra to the monoenergetic energy of 511 keV introduces systematic errors in the attenuation coefficients for PET. Inaccuracies in the transformation will also propagate into attenuation maps for hybrid MR-PET devices, if the attenuation correction is based on CT images, e.g., using template method. In our approach, we plan to use angiographic spectral CT scans with administration of iodinated contrast agents and to compute VNC images from the obtained dataset. For improving the measured bone mineralization accuracy, which is of high relevance for gamma attenuation, we combine the VNC images with bone mineral density measurements. So, we segmented all bone values from the bone mineralization image and replaced the corresponding image voxel values in the VNC image. ***Results:*** The resulting combined monochromatic CT image (at 67 keV) is converted to linear attenuation coefficients at 511 keV. The conversion scheme from monochromatic CT images to linear attenuation coefficients was obtained by acquiring spectral CT data for different tissue types using the electron density phantom developed for spectral CTs and a photon-counting CT scanner. We will present conversion schemes from HU to attenuation coefficients for different tube voltages (120 kV and 140 kV) virtual monochromatic energies (64, 67, 76, 80, and 100 keV). Further, we will evaluate the accuracy of the conversion scheme using previously acquired angiographic CTs. ***Conclusion:*** Spectral CT allows to minimize the systematic error when converting HU values to linear attenuation coefficients for 511 keV gamma rays using virtual monochromatic images. Further, VNC images allow to compute these attenuation coefficients from CT angiographic images after administration of iodinated contrast agents.

EP-0688

Low dose CT for attenuation correction of LAFOV PET body imaging

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Aim/Introduction: Adding additional filtration to the X-ray tube reduces the tube output whilst increasing the average energy of the X-ray beam. This may be desirable for low dose CT scanning, since a higher energy beam may better penetrate the patient and avoid artefacts even when the tube current is significantly reduced. Considerable dose reductions have been achieved by authors applying a tin filter for this purpose.[1,2] Low dose CT is particularly desirable in the context of LAFOV PET, where the whole of the PET field of view must undergo CT in order to produce an attenuation corrected PET reconstruction. Previous work has typically examined dose reductions possible for standard sized phantoms. In this study we sought to create a LDCT workflow that would produce adequate imaging for PET attenuation correction, including larger patients and those who must be scanned with their arms down. ***Materials and Methods:*** A NEMA image quality phantom was prepared with 7 and 36.7 kBq/ml 18F in the background and lung regions respectively. The lung insert additionally contained an iodinated contrast solution (23.6 mgI/ml) to approximate the Hounsfield units of bone. The phantom was imaged with and without additional scatter and attenuation material added to simulate a larger patient scanned with their arms down. The phantom was scanned using the manufacturer's low dose CT workflow, tin filter workflows using CarekV and a range of quality reference (QR)mAs settings, and our existing clinical PET/CT workflow. PET reconstructions were created using each CT scan, and volumes of interest were drawn on the lung insert and background regions. SUV deviation was assessed relative to the clinical scan. ***Results:*** Photon starvation artefacts were observed in the arms-down configuration, which became increasingly severe as the QRmAs were reduced. Both the manufacturers low dose workflow and the tin filter workflow with a QRmAs of 200 produce a PET reconstruction with <2 percentage points SUV difference in the background region to reference, whilst incurring CT doses of <20% of our current workflow. Larger SUV discrepancies were measured in the lung insert. Further dose reduction is possible, but only by accepting larger SUV discrepancies inside and in proximity to highly attenuating structures. ***Conclusion:*** The manufacturers default low dose CT workflow and the tin filter workflow using 200 QRmAs both achieve significant dose reductions whilst achieving adequate image quality, even when performing arms-down scanning of large patients. ***References:*** 1.Bebbington et.al, DOI:10.1186/s40658-023-00585-0 2.Mostafapour et.al, DOI:10.1002/mp.16862

EP-0689

PET Image Quality in a Weight-Based Activity Regime: A Prospective Study

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Aim/Introduction: Scaling PET radionuclide administered activity with patient weight is recommended in EANM-endorsed guidelines [1], and weight-based dose scaling is common clinical practice in the UK[2]. For fixed activity, PET image quality typically reduces among heavier patients, reducing the diagnostic power of images. Research informing the EANM guidelines is scanner-specific, and the literature largely does not originate from prospective studies, notably not with patients whose weights are high. EANM guidelines scale from 75 kg, a weight which is greatly exceeded by many patients in the clinic. A prospective study was performed on two lutetium-based scintillator PET-CT scanners to investigate the relationship between PET tracer activity and image quality in larger patients. It is expected that higher tracer activity improves image quality via higher signal to noise ratio. However, higher activity can result in image degradation due to dead time and randoms effects. Patients of weight well above 75 kg were injected with increased activity, and images were compared against patients of the same weight injected with standard, lower activity. ***Materials and Methods:*** 27 patients with unspecified indications weighing between 120 kg and 140 kg were injected and scanned with 510 ± 20 MBq 18F-FDG. 27 patients in the same weight range were scanned with 350 ± 50 MBq 18F-FDG. Qualitative and quantitative measurements were made to compare image quality between the two cohorts . Mean and standard deviation in standard uptake value (SUV) in the uniform liver was measured and compared for every patient. A subset of 9 weight-based activity patients were matched with a standard activity patient based on height, weight, and arm positioning for visual comparison by a PET-CT clinical consultant. ***Results:*** Patients scanned with higher activity exhibited a 22% reduction in mean noise in the uniform liver. The consultant rated weight-based images as much better than standard activity in 11% of pairs, slightly better in 56%, equivocal in 22%, slightly worse in

11%, and much worse in 0%. ***Conclusion:*** Increasing the tracer activity from 350 ± 50 MBq to 510 ± 20 MBq 18F-FDG produces less noisy images for patients weighing 120-140 kg scanned on a lutetium-based scintillator PET-CT scanner. Weight-based scaling of 18F-FDG for patients in this range is advisable, and the reduced noise brought about by the higher activity is not negated by dead time effects. ***References:*** [1] Eur J Nucl Med Mol Imaging (2015) 42:328-354; [2] Nuc Med Commun (2023) 44(6):p 518-56.

EP-0690

Assesment of the use of central venous catheter with out-injector for the administration of ^{18}FDG in PET-TC studies

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Aim/Introduction: Our Nuclear Medicine department performs an average of thirty PET-CT scans per day for oncological or inflammatory/infectious diagnoses. Since March 2023, the injection [18F]FDG is conducted using automatic injection system. Oncology patients often have difficult peripheral venous access, which with the rapid injection flow, leads to frequent extravasation of peripheral catheters, requiring re-cannulation, patient discomfort and occasionally loss of dose. These patients often have central venous catheters (CVC), which the management is undertaken by expert nursers. Despite the lack of evidence, the clinical guidelines do not support the use of CVC for [18F]FDG administration. The aim of this study was to describe the use of CVCs in the administration of [18F]FDG by auto-injector and to assess whether it has a negative influence on the quality of PET-CT. ***Materials and Methods:*** Descriptive study with prospective data collection of all PET-CT procedures in patients with CVC attended at the Nuclear Medicine Unit of a tertiary hospital of Madrid Health Service since January 1st 2024 (continued). Standard injection procedure consists of removal of the anti-reflux valve, permeability check, injection of [18F]FDG and flushing with 50 ml of saline with Intego-Bayer© injector at 0.5-1ml/s and subsequent sealing. Image acquisition is performed after 50-90min according to oncological or inflammatory indications. The equipment used is Siemens Biograph Vision Syngo VG80x PET/CT scanner. The studies are reviewed and reported by a specialist in Nuclear Medicine with more than 12 years of experience.Variables collected: patients (sex, age, diagnosis); CVC (type: PICC, Hickman, reservoir, central line; location; duration); procedure (indication); quality of the study (dependant variable). ***Results:*** Preliminary data up to April 2024 are presented. Forty-nine procedures were included in 48 patients (52.1% female), mean age 64.1; mean CVC duration 54 days (range 1-378); 68.8% PICC (n=33); diagnostic reason: oncological 60.4% vs. inflammatory 39.6%. Of all procedures, [18F]FDG uptake was observed in 57.1%. In 16,3% PET were considered as low quality and in one procedure (2%), the administration of [18F] FDG using CVC interfered with clinical interpretation, leading to a repeat study through peripheral access route. ***Conclusion:*** Despite the uptake on CVC caused by the administration of [18F]FDG on many cases, only a small faction are considered of low quality and may interfere with the clinical interpretation. However, given the possibility of uptake, further studies are needed to assess the impact of [18F]FDG administration by CVC. ***References:*** GELTAMO. Guía de PET-TC en Linfomas. [Online]. Available on: https://www.geltamo.com/descargas/documentos-publicos/115-guia-de-pet-tc-en-linfomas-de-geltamo/file.

EP-0691

^{18}F-FDG conventional digital PET/CT imaging: Does a higher dosage always entails superior image quality?

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Aim/Introduction: The EANM has established a minimum range of administered radioactivity, below which achieving the desired image quality would require extended acquisition time. However, the full clinical potential of the latest digital PET/CT scanners may not have been fully explored within that range. Therefore, our study aimed to investigate whether high-normal-dose 18F-FDG digital PET/CT imaging could yield superior image quality and improved lesion detectability compared to full-dose imaging. ***Materials and Methods:*** 37 patients who underwent a conventional digital PET/CT scan following a high-normal-dose 18F-FDG injection (5.5 MBq/kg) were included to assess the overall image quality, abbreviated as high-normal-dose IQ cohort. Among these, 32 patients with pathologically diagnosed malignant tumors formed another cohort, abbreviated as high-normal-dose LD cohort, to evaluate lesion detectability. In the subsequent matched-pair study, 37 patients (full-dose IQ cohort) who received a full-dose 18F-FDG injection (3.7 MBq/kg) were retrospectively selected from our database. These patients were well-matched in terms of age, gender, weight, height, BMI, blood glucose level and uptake time with the 37 subjects in high-normal-dose IQ cohort. Additionally, another 32 patients (full-dose LD cohort) were selected to match with the pathology features, including histological typing and grading, of those in high-normal-dose LD cohort. Objective image quality in IQ cohorts was evaluated using SUVmean, SUVSD and signal-to-noise ratio (SNR= SUVmean/SUVSD). Lesion detectability in LD cohorts was compared by calculation of SUVmax and tumour-to-background ratios(SUVmax of lesion/SUVmax of backgrounds). Liver, mediastinal blood pool and gluteus maximus muscle were utilized as backgrounds for the semi-quantitative analysis. ***Results:*** Both SUVmean and SUVSD of all backgrounds in high-normal-dose IQ cohort were lower than those in full-dose IQ cohort, with the corresponding SNR being slightly higher in the former. However, the differences in SUVSD and SNR between the two cohorts were not statistically significant. In contrast, SUVmax of the lesions and all backgrounds in high-normal-dose LD cohort were all lower than those in full-dose LD cohort. Significant differences in SUVmax were observed across all backgrounds between these two cohorts, while SUVmax of the lesions did not exhibit. Consequently, the tumor-to-background ratios were all higher in high-normal-dose LD cohort than those in full-dose LD cohort, with a significant difference observed across all backgrounds. ***Conclusion:*** In comparison to full-dose 18F-FDG digital PET/CT imaging, high-normal-dose 18F-FDG digital PET/CT imaging provides slightly improved SNR and significantly enhanced tumor-to-background ratio, which can be utilized when striving for higher image quality and improved lesion detection rate.

EP-0692

Pathologic Response Prediction Value of ^{18}F-FAPI PET/CT inEsophageal Squamous Cell CarcinomaTreated with Neoadjuvant Camrelizumab and Chemotherapy: A phase II clinical trial

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Aim/Introduction: The neoadjuvant chemotherapy and

immunotherapy have brought safer and more effective treatment for locally advanced esophageal squamous cell carcinomas (LA-ESCC) patients, but there are still 55% to 83% of patients with poor curative effect. This study was a single-center, single-arm, phase II trial (ChiCTR2100050057), evaluating the predict value of 18F-FAPI PET/CT in camrelizumab plus chemotherapy in the neoadjuvant treatment for LA-ESCC patients. ***Materials and Methods:*** This study included thirty-two patients with newly diagnosed LA-ESCC who underwent 18F-FAPI PET/CT at baseline and after 2 cycles of neoadjuvant camrelizumab and chemotherapy (nCC). PET parameters including SUV, tumor-to-background ratio (TBR), metabolic tumor volume (MTV) and total lesion FAP expression (TLF), as well as the variables of SUV and TBR, were recorded. Patients were classified as major or minor pathologic responders (MPR or MiPR) according to postoperative pathology findings. We compared the PET parameters between the 2 pathologic response groups and analyzed their predictive performance for tumor pathologic response. ***Results:*** 50.0% (16/32) achieved an MPR, and 50.0% (16/32) was MiPR. SUVs, including maximum, peak, mean and TBRs, decreased significantly after nCC, all P values <0.05. MPR found lower SUVs than MiPR, all P values <0.05, but TLF and MTV found no difference. For Patients with MPR, the variables of SUVs were also significantly higher than those in MiPR, all P values <0.05, but variables of TLF and MTV found no difference. Maximum (AUC, 0.87; P=0.0026), peak (AUC, 0.89; P=0.0017), mean (AUC, 0.88; P=0.0021), TBRmax (AUC, 0.86; P=0.0031) and TBRmean (AUC, 0.88; P=0.0021) after nCC were significantly parameters for prediction of pathologic response to nCC, and the predictive sensitivity and specificity were 63.64% and 100%, 81.82% and 83.33%, 81.82% and 83.33%, 81.82% and 91.67%, 81.82% and 91.67%, respectively. Variables of maximum (AUC, 0.81; P=0.0116), peak (AUC, 0.82; P=0.0097), mean (AUC, 0.81; P=0.0116) and TBRmean (AUC, 0.74; P=0.0489) were significantly parameters for prediction of pathologic response to nCC, and the predictive sensitivity and specificity were 81.82% and 83.33%, 72.73% and 83.33%, 81.82% and 75.0%, 63.64% and 91.67%, respectively. ***Conclusion:*** In this study, SUVs after and variables of nCC in patients with LA-ESCC may be better predictors to nCC.

EP-0693

Fabrication of Zirconium-89 solid phantoms for PET using 3D Printing

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Aim/Introduction: In immuno-PET, radiolabelling with 89Zr (t1/2=78.4 h) allows non-invasive tracking of monoclonal antibodies as well as longitudinal studies, and enables theranostic approaches for cancer treatment. Dedicated characterization, evaluation and quality assurance (QA) of 89Zr-PET conventionally requires scanning 89Zr-filled phantoms. However, the metallic nature of 89Zr makes it adhere to the phantom walls, resulting in non-uniform distributions unsuitable for QA and performance studies. By direct 3D-printing of 89Zr mixed with resin, we have previously shown1 that this problem can be avoided. Here we investigate the suitability of two 89Zr 3D-printed phantoms for high-resolution small-animal PET. ***Materials and Methods:*** We modified our method for 18F-FDG2 to produce a full-size micro-PET image quality (IQ) phantom3 (0.20 MBq/ml) and its 50%-scaled-down replica (0.21 MBq/ml). The original resin tank and the print bed of an Anycubic-Mono SLA 3D-printer were replaced by smaller ones to achieve a high activity concentration. After printing, the phantoms were washed and cured for 5 min under UV light. The full-size phantom was measured in a MEDISO nanoScan PET/CT for 20 min. For reference, a standard IQ phantom filled with 89Zr (0.18 MBq/ml) was scanned using the same acquisition parameters. The scaled-down phantom was scanned for 40 min. Evaluation was done following the NEMA protocol3. ***Results:*** Neither observable printing defects nor large air bubbles affected the 3D-printed phantoms. The image of the printed IQ phantom showed 5.4% higher mean contrast recovery values compared to the filled one. In both images, 4 out of 5 rods were clearly visible. The relative standard deviation in the uniform region were approx. 16% (filled) and 17% (printed). The downscaled phantom also showed a homogeneous distribution of 13%. ***Conclusion:*** 3D-printing of 89Zr mixed with resin is a flexible alternative to filled phantoms enabling longitudinal performance and QA studies. The method was suitable to 3D-print customized shapes as well as radioactive submillimetre structures with homogeneous activity distributions. The procedure will be applied to enhance performance evaluation studies of high-resolution scanners for 89Zr-immuno-PET. ***References:*** 1Elmoujarkach et al., Trans. AMMM Supplement, 2023, DOI: 10.18416/AMMM.2023.2309833.2Elmoujarkach et al., 2022 IEEE NSS/MIC. doi:10.1109/NSS/MIC44845.2022.10399242.3NEMA NU 4-2008: Performance measurements of small animal positron emission tomographs, NEMA, 2008.

EP-0694

Evaluation of F^{18} FDG PET/CT According to Mandard Classification in Locally Advanced Rectal Cancer Patients Receiving Neoadjuvant Chemotherapy

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Aim/Introduction: In this study, the relationship between PET/CT with ^{18}F-FDG parameters and Mandard's tumor regression grade (TRG) used in the evaluation of response to treatment in Locally Advanced Rectal Cancer Patients Receiving Neoadjuvant Chemotherapy was evaluated. ***Materials and Methods:*** Our study is a retrospective study. The study included patients diagnosed with locally advanced rectal cancer, receiving neoadjuvant chemotherapy, operated after neoadjuvant chemotherapy, and those who received a complete response (TRG1) and did not receive a complete response (TRG2-5) according to the pathological preparation examination according to the Mandard Classification, F18 FDG PET/CT scans before treatment. Patients with socio-demographic findings, tumor characteristics and post-operative data of the patients were compared. ***Results:*** 151 patients were included in the study. The median age of the patients was 62 (28-85). The groups were similar in terms of age and gender (p>0.05). There was a statistically significant difference between TRG1 and TRG2-5 in terms of family history (p=0.034). There was a statistically significant difference between TRG1 and

TRG2-5 in terms of carsinoembryonic antigen (CEA) tested at diagnosis, Ca19-9 checked after radiotherapy, and the presence of concurrent chemotherapy (CT) (p=0.002, p=0.045, p=0.004, respectively). There was a statistically significant difference between TRG1 and TRG2-5 in terms of perforation, lymphovascular invasion (LVI), perineural invasion (PNI), and post-op CEA during and after surgery (p=0.045, p=0.023, p=0.031, p=0.001, respectively). There was no significant difference between the groups in terms of maximal standardized uptake value (SUVmax), total lesion glycolysis (TLG), and metabolic tumour volume (MTV) (p>0.05). While 86.3% of the patients in the TRG1 group were alive, 47.6% of the patients in the TRG2-5 group were alive. There was a statistically significant difference between TRG1 and TRG2-5 in terms of survival status, disease-free survival time, and overall survival time (p=0.001, p=0.001, p=0.001, respectively). The risk factors were found to be significantly associated with complete response (TRG1) in the logistic regression analysis included family history, post-RT CEA, post-op CEA, perforation, LVI, and PNI (p<0.05). The risk factors were found to be significantly associated with survival in the logistic regression analysis included Mandard (TRG1), histopathological diagnosis, and perforation (p<0.05). ***Conclusion:*** Our results showed that there was no correlation between initial [18F] FDG-PET parameters and Mandard's tumor regression grade. However, family history, Post-RT CEA, Post-op CEA, perforation, LVI, and PNI variables predicted TRG1. Additionally, TRG1 histopathological diagnosis and perforation predicted survival.

EP-0695

PSMA PET vs. Pelvic MRI in Localized Biochemically Recurrent Prostate Cancer

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Aim/Introduction: After primary definitive therapy of localized prostate cancer with either radical prostatectomy or radiation therapy, up to 50% of patients will experience biochemical recurrence (BCR) of disease. Both PSMA PET/CT and pelvic MRI can provide useful information about the location of disease, which can guide more tailored management of these patients. The objective of this descriptive, retrospective analysis is to compare the performance of PSMA PET/CT and pelvic MRI in BCR and investigate the added value of their combined use in this patient population. ***Materials and Methods:*** Patients with localized BCR who underwent PSMA PET/CT and pelvic MRI within three months of each other at the University of California, Los Angeles with available imaging and follow-up data were included in our retrospective analysis. Two board-certified nuclear medicine physicians blinded to clinical information interpreted the PSMA PET/CT scans independently and described up to three positive findings. A third nuclear medicine physician resolved any disagreements (2:1 majority rule). In a similar framework, two radiologists interpreted the pelvic MRIs with a third radiologist serving as a tiebreaker. Data on disagreements between clinical PSMA PET/CT and pelvic MRI reads, disagreements between blinded and clinical PSMA PET/CT and pelvic MRI reads, and subsequent management based on findings from clinical PSMA PET/CT and pelvic MRI were collected. ***Results:*** 10/84 (12%) patients had a negative clinical pelvic MRI and positive PSMA PET/CT, with 33% of these lesions noted to be in the lymph nodes, while 8/84 (10%) patients had a negative clinical PSMA PET/CT and positive pelvic MRI, with 100% of these lesions noted to be in the prostate or prostate bed. In 10/84 (12%) patients, the blinded PSMA PET/CT reads were negative while the clinical PSMA PET/CT reads were positive, and in 7/84 (8%) patients, the blinded pelvic MRI reads were negative while the clinical pelvic MRI reads were positive. 51% of patients underwent radiation as a next step in management, 26% underwent biopsy, 17% underwent follow-up imaging, and 6% underwent other focal or systemic therapy. ***Conclusion:*** In this retrospective, descriptive analysis of 84 patients with localized BCR, there was good agreement between PSMA PET/CT and pelvic MRI, although pelvic MRI may overcall lesions in the prostate and prostate bed and miss nodal metastases. Most patients with localized BCR underwent radiation therapy or biopsy following PSMA PET/CT and pelvic MRI, with a minority of patients undergoing follow-up imaging, systemic therapy, or focal therapy.

EP-0696

CT recon optimisation on Long Axial Field-of-View PET/CT scanner

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Aim/Introduction: The Nuclear Medicine department of the Royal Free Hospital has recently installed a long axial field-of-view (LAFOV) PET/CT scanner. As expected, a significant image quality improvement has been noticed when comparing images from previous standard PET/CT system. Given the different CT system in use, work was done to optimise CT images. ***Materials and Methods:*** A cohort of 30 patients that underwent a ^{18}F-FDG PET/CT scan using the new LAFOV PET/CT scanner were selected randomly, making sure a wide range of BMI was captured. Thus, only scans performed with patients' arms elevated and without any detectable motion artefact were included, or any other type of artefact that could potentially affect image quality. CT images were reconstructed using different recon kernels, slice reconstruction thickness and different SAFIRE strength levels. The baseline CT reconstruction parameters chosen were selected to provide an image quality similar to the one provided by the previous conventional PET/CT system. A proforma was distributed to 3 Nuclear Medicine consultants to compare the different reconstructions parameters. Reporters were also enquired if further reconstructions were desired (e.g. bone window). ***Results:*** The three consultants have preferred sharper images compared with baseline reconstructions, obtained by the use of recon kernels between Br34 and Br38. Preference was given to 2 mm slice thickness, even though 1 mm was also deemed with good image quality by one of the consultants. Images with 1 mm slice thickness were considered noisier despite being sharper. Although there was no significant difference between SAFIRE strength levels, agreement was reached to a value of 3. ***Conclusion:*** Despite not agreeing completely with all the reconstruction parameters, Nuclear Medicine consultants have preferred sharper CT reconstruction compared to baseline ones. Despite a dedicated reconstruction for a bone window was considered as potentially useful, this was deemed as not needed. ***References:*** Comparison

of image noise and image quality between full-dose abdominal computed tomography scans reconstructed with weighted filtered back projection and half-dose scans reconstructed with improved sinogram-affirmed iterative reconstruction (SAFIRE*), S Choy et al, Abdominal Radiology, Volume 44 (355-361).

EP-0697

Performance of PET-choline in the pre-surgical localization of benign parathyroid pathology (adenoma/hyperplasia) in patients with clinical primary hyperparathyroidism and previous negative 99mTc-MIBI scintigraphy

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Aim/Introduction: To evaluate the importance of performing ^{18}F Choline in patients exhibiting a high clinical suspicion of benign parathyroid pathology (adenoma/hyperplasia) as the underlying cause of primary hyperparathyroidism, particularly those with prior negative findings on 99mTc-MIBI scintigraphy. ***Materials and Methods:*** 51 patients with negative 99mTc-MIBI scintigraphy. who underwent surgery between January 2020 and March 2024 due to suspicion of pathological parathyroid gland, either based on positive ^{18}F Choline PET (group A, 26 cases) or positive ultrasound, CT, or MRI (group B, 25 cases), were included. The data were compared with respect to the pathological anatomy results after surgery. ***Results:*** In group A, pathological parathyroid tissue was confirmed in 20/26 patients (76%): 2/25 (7%) had hyperplasia and 18/26 (69%) had adenoma. In 5/26 patients (19%), the parathyroid tissue was reported as normal, while in 1 case parathyroid tissue was not found. In group B, pathology was confirmed in 17/25 cases (68%), 15/25 (60%) had parathyroid adenoma, 2/25 (8%) had other lesions with pathological reports of thyroid cancer in one case and Whartin's tumor in another. In 8/25 cases (32%), pathological anatomy indicated normal parathyroid tissue. ***Conclusion:*** In patients with primary hyperparathyroidism and surgical criteria, including PET ^{18}F Choline as a complementary test after a negative 99mTc-MIBI gammagraphy increases the probability of locating the responsible pathological parathyroid gland. Compared to other imaging localization techniques, PET ^{18}F Choline was superior in the successful treatment of primary hyperparathyroidism.

EP-0698

Optimizing Malignant Lung Lesion Detection: A Comprehensive Evaluation of PET Reconstruction Methods

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Aim/Introduction: The maximum standardized uptake value (SUVmax) is the most common parameter used to quantify tumor metabolic uptake in F^{18}-fluorodeoxyglucose positron emission tomography/computed tomography (FDG-PET/CT), but it is largely influenced by image reconstruction and its different methods. The aim of this study was to analyze the association of SUVmax deviations related to point spread function (PSF) and time-of-flight (TOF) reconstruction with tumor-to-background ratios (TBR) in pulmonary metastatic nodules. ***Materials and Methods:*** Thirty pulmonary metastatic nodules from different malignant tumors were included retrospectively. FDG-PET/CT imaging was performed on a Siemens Biograph mCT 64 followed by image reconstruction using 3D-ordered subset expectation maximization (3D-OSEM) or 3D-OSEM with PSF modeling both with (UltraHD) and without TOF information. Image quality was evaluated by the mean of coefficient of variance (CV) calculated by divising liver standard deviation by SUVmean of the liver. Tumor to ratio background (TBR) was obtained by devising nodule's SUVmax by background's SUVmean. Different TBR and CV values were compared and analyzed using the Friedman test and Wilcoxon test for paired non-parametric data. ***Results:*** The TBR median was highest with UltraHD reconstruction (20,25), followed by TOF (16,63) then by PSF only (14,45). The lowest TBR median value was seen with 3D-OSEM. There was a significant difference between the median TBR obtained with UltraHD and all the other methods, between the median TBR obtained with 3D-OSEM and all the other methods (p=0,0001), but no significant difference found in TBR values with PSF and TOF (p=0,861). As for quality of image, the lowest median value of CV, meaning the best quality, was seen in images reconstructed with PSF (7,81), followed by UltraHD (10,68) and 3D-OSEM (13,3). The highest was obtained by using TOF alone (14,54), with significant difference between all these methods (p 0,0001). ***Conclusion:*** Our results suggest that the different reconstruction methods cause significant alteration of pulmonary nodules's SUVmax. UltraHD provided the highest SUVmax increase with better TBR without altering image quality. ***References:*** ADDIN ZOTERO_BIBL {"uncited":[],"omitted":[],"custom":[]} CSL_BIBLIOGRAPHY 1. Rogasch JM, Steffen IG, Hofheinz F, Großer OS, Furth C, Mohnike K, et al. The association of tumor-to-background ratios and SUVmax deviations related to point spread function and time-of-flight F^{18}-FDG-PET/CT reconstruction in colorectal liver metastases. EJNMMI Res. déc 2015;5(1):31. <![endif]-->

EP-0699

Primary hyperparathyroidism: ^{18}F-fluorocholine PET/CT and related semiquantitative parameters.

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Aim/Introduction: This retrospective study aimed to explore the utility of ^{18}F-fluorocholine (FCH) positron emission tomography/computed tomography (PET/CT) as a tool for localizing parathyroid adenoma (PTA) in patients with biochemical primary hyperparathyroidism and analyze the potential role of semiquantitative PET parameters to aid in the interpretation of scans. ***Materials and Methods:*** Thirteen patients (24-75 years old, mean: 57) with biochemical primary hyperparathyroidism (PTH mean 120 pg/ml, Calcium mean 11.2 mg/dl) who underwent FCH PET/CT, US and dual-phase ^{99}mTc-MIBI imaging were evaluated. Only patients treated with surgery were included. FCH PET/CT were performed one hour after injection of radiopharmaceutical (from 100 to 300 MBq), according to EANM guidelines. After a visual interpretation of images, lesion SUVMax was measured by assigning a spheric VOI to the suspect area of uptake. Thyroid SUVMean was assessed by placing a spheric VOI inside the contralateral thyroid lobe and SUVratio (SUVr) was calculated using lesion SUVmax and this background region. Also, metabolic tumor volume (MTV) was evaluated. The relationship between biochemical parameters and semiquantitative parameters and consequently its impact on management was evaluated. The Sensitivity (SE), positive predictive value (PPV) and accuracy of

each method were calculated. Finally, the percentage difference of biochemical parameters before and after surgery was computed. ***Results:*** 12 parathyroid lesions were histologically confirmed as adenoma and among them, 10 PTA with chief cells, 1 oxyphil cell PTA and 1 atypical PTA were detected. One histopathological evaluation proven hyperplastic glands. FCH PET/CT showed significantly higher sensitivity than ^{99}mTc-MIBI scintigraphy and US in detection of PTA. SE, PPV and accuracy of FCH PET/CT were 100%, 92% and 92%. The corresponding values for MIBI were 50%, 100% and 54% and for US were 86%, 86% and 50%. The mean value of SUVmax, SUVmean, SUVr and MTV in PTA was 7.1, 4.3, 3.9 and 1.3 . The mean value of Thyroid SUVMean was 1.9. Pearson's test showed a significant correlation between PTH values and SUVmax and SUVmean ($p<0.05$, $r= 0.58$ and $r=0.62$ respectively). No significant correlation with SUVr was found. After parathyroidectomy, biochemical parameters showed reduction of 60% for PTH values and of 14% for Calcium. ***Conclusion:*** F^{18} fluorocholine PET/CT shows superior accuracy over the conventional imaging modalities in patients with primary hyperparathyroidism. Semi-quantitative PET parameters closely correlate with PTH, highlighting their potential role in the characterization of parathyroid adenoma.

EP-0700

Evaluation of a 24 cm-axial field of view PET/CT system using ^{18}F/^{68}Ga NEMA phantoms emulating different patient BMI

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Aim/Introduction: Image quality and activity quantification depend on used radiopharmaceutical, reconstruction algorithm and patient body mass index (BMI). This work aims to assess the optimal parameters for four combinations of reconstruction algorithms and post-processing filters available for a 24 cm long field of view PET/CT recently installed in our centre, according to radionuclide and patient BMI. ***Materials and Methods:*** Two NEMA Image Quality phantoms were filled with 18F and 68Ga, respectively, with 8:1 spheres-to-background activity ratio. Five-minute acquisitions were collected in list mode, and reconstructed at 1, 1.5, 2, 3, 5 minutes, and 2, 3 and 5 minutes, for 18F and 68Ga, respectively. Phantoms images were acquired using the standard setup, and with one or two in-house-built water belt rings, to mimic patients with three BMIs (19, 36 and 46 kg/m2, respectively). Investigated algorithms included: iterative (alg1), iterative with noise suppression (alg2) for 18F and 68Ga, the deep process iterative method (alg3) and iterative with deep learning-based noise post-processing correction (alg4) for 18F. (SUVbw)maxbg, i.e., the maximum SUVbw (SUV body weight) over the average background SUVbw, and (SUVbw)maxth, i.e., the mean SUVbw over the theoretical SUVbw were calculated for each sphere to assess the percentage deviation of resulting values compared to the expected ones. ***Results:*** Our analysis revealed that 0.4 and 0.85 are optimal reconstruction parameters for alg2, for 18F and 68Ga respectively, independently of BMI-mimicking phantoms and that this algorithm outperforms the alg1. For 18F phantoms, the disagreement of median (SUVbw) maxbg values increase with BMI, within 20% for all the algorithms and configurations. The (SUVbw)maxbg disagreement, according to sphere dimensions tends to slightly be reduced moving from alg1 to alg3 (i.e. from 55% to 40%) among all phantoms and considering reconstruction time from 1 to 5 minutes. For 68Ga phantoms, the disagreement of median (SUVbw)maxbg values decrease with BMI, being within 10% for all the algorithms, with improved accuracy for larger BMI-mimicking phantoms. The (SUVbw)maxbg disagreement, according to sphere dimensions tends to stay about equal, as in the 18F acquisitions (i.e., from 42% to 57%). ***Conclusion:*** Performance evaluation is mandatory as a new PET/CT scanner become available for clinical practice. BMI variability does impact PET/CT image quantification. This should be considered, during harmonization and standardization procedure for its potential impact in clinical practice.

EP-0701

Impact of image reconstruction algorithm and acquisition time for ^{90}Y NEMA phantom acquisitions for radioembolization treatment on a 24 cm-axial field of view PET/CT

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Aim/Introduction: After 90Y radio-embolization, PET/CT acquisitions allow verification of the distribution of 90Y resin or glass micro-sphere as a tool for post-treatment internal dosimetry. This work investigates the optimal parameters of three image reconstruction algorithms available for a 24 cm field of view PET/CT recently installed in our centre and not yet reported in literature. ***Materials and Methods:*** A NEMA Image Quality phantom was filled with 90Y chloride (90YCl3), with 8:1 spheres-to-background activity ratio [1], and a concentration of 900 kBq/ml in hot spheres, for a total activity of 1.2 GBq. Phantoms images were acquired using the standard setup and with one or two in-house-built water belt rings to mimic patients with three BMIs (19, 36 and 46 kg/m2, respectively). Thirty-minute acquisitions were collected in list mode, and reconstructed at 5, 8, 10, 15, 20 and 30 minutes. Investigated algorithms included iterative with a Gaussian filter of 3-mm FWHM (alg1), with a Gaussian filter of 8-mm FWHM (alg2) applied during the image post-processing, and iterative with three levels of noise suppression (alg3). For a total of eighty-one reconstructions, the contrast recovery (CR) background variability (BV) (CRBV) index, simultaneously considering contrast recovery and background variability as CR * (1 - BV) [2], was calculated. ***Results:*** Alg3, with the highest level of noise suppression (1.0), performed better than alg1 and alg2, considering a minimum reconstruction time of 10 minutes. The CRBV metric was analysed using the same reconstruction algorithm (alg3) and varying the reconstruction time. In this case, among all sphere sizes for NEMA standard setup, CRBV ranged from 0.29 to 0.67, and from 0.26 to 0.69, for 10- and 30-minute reconstruction, respectively. Images of phantoms mimicking overweight patients showed a significantly increased noise level and lower CRBV values, i.e. with a maximum CRBV ranging from 0.2 to 0.3. ***Conclusion:*** Our phantom study indicates that, for the investigated PET/CT system, alg3 with the highest level of noise suppression and a minimum reconstruction time of 10 minutes are necessary to enable post-treatment 90Y dosimetry. Longer acquisition times are necessary for overweight patients. ***References:*** [1] D'Arienzo M. et al., "Phantom validation of quantitative Y-90 PET/CT-based dosimetry in liver radioembolization". EJNMMI Res. 2017; 7(1):94. doi: 10.1186/s13550-017-0341-9. [2] Santoro M. et al., "A novel

figure of merit to investigate 68Ga PET/CT image quality based on patient weight and lesion size using Q.Clear reconstruction algorithm: A phantom study", Physica Medica, 106, 2023, 102523, ISSN 1120-1797, https://doi.org/10.1016/j.ejmp.2022.102523.

EP-0702

The evaluation of image quality of Four-ring Discovery DMI vs. Discovery 710 PET/CT using F^{18} and Ga68

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Aim/Introduction: Positron Emission Tomography/Computed Tomography (PET/CT) is a sensitive, accurate, non-invasive diagnostic tool that remarkably evaluates physiological and pathological processes. PET modality has been increasing in detecting tumours, infections, or inflammation. The appropriate PET system and radioisotope choice for certain investigations has to be based on deep knowledge to obtain the desirable diagnostic outcome. This study compares PET/CT systems (DMI & D710), and radionuclides (F^{18} and Ga68, the most prominent pharmaceuticals currently used for imaging and differentiating lesions), in terms of image quality and the ability to detect the most minor lesions. ***Materials and Methods:*** Jaszczak Deluxe Flangeless phantom was filled F^{18} and Ga68 with different sphere-to-background ratios 4:1 and 8:1 of 7.2kBq/mL and 14.2kBkq/mL, respectively. PET/CT scans were performed using Digital DMI and Discovery D710 PET/CT. Five minutes of acquisition time were acquired and used to get partial data of different times (4,3,2.5, 2,1.5, 1,0.5). Images were reconstructed using OSEM + TOF + PSF. SUV max contrast, Spatial resolution, COV, and NECR were investigated. The Q.clear + TOF parameter was used for DMI, with different β values, ensuring a comprehensive approach. The statistical analysis was conducted with the utmost rigour, employing Mann-Whitney U, Wilcoxon Signed-Rank, and Kruskal-Wallis tests to provide a robust validation of the findings. ***Results:*** The most minor detected lesion in 4:1 DMI and D710 images for F18 was 12mm and 16mm, respectively, at 1.5 min/bed position and was 16mm for both systems at 2 min/bed position for Ga68. The spatial resolution at 2min/bed images in DMI and D710 for F18 was 6.4 mm and 7.9mm, respectively, and for Ga68 was 7.9mm and 9.5mm, respectively. Overall, no significant changes have been shown regarding SUVmax at different times/beds in both systems. The COV on both systems was ≤ 20%, with DMI having significantly lower COV and noise than D710 ($p < 0.05$). The NECR at 14.2kBq/mL for F18 was 108.1 kcps and 84.7 kcps in DMI and D710, respectively and was 98.3kcps and 69.7kcps for Ga68, respectively. Q.Clear images showed improved image quality using β=600 for both radionuclides with an SNR gain of 1.3. ***Conclusion:*** This study has demonstrated that the new-generation Digital MI PET/CT system has improved the detectability of small lesions at different times per bed. F18 offers better image quality and spatial resolution with different activity concentration ratios than Ga68.

EP-48

e-Poster Area

D: Technical Studies -> D1 Instrumentation -> D13 PET/MR

EP-0703

Dynamic profiles of early biological responses to predict the treatment efficacy of proton therapy in liver cancer assessing with in vivo PET/MRI

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Aim/Introduction: Proton beam therapy (PBT) is an advanced treatment for patients with unresectable hepatocellular carcinoma (HCC). However, evaluating the response to treatment based on tumor size alone may not be sufficient. Hence, this study used dynamic $^{[18F]}$FDG PET and diffusion-weighted MR imaging (DWI) to monitor the biological response to PBT in HCC mice, to assess treatment efficacy. ***Materials and Methods:*** Mice with orthotopic HCC received 20 Gy of PBT with a FOV of 15 mm2. The dynamic $^{[18F]}$-FDG PET was performed with a two-compartment kinetic model and T2/DWI at baseline and post-PBT days 1, 3, 7, and/or 10. The tissue histopathological and in vitro $^{[18F]}$-FDG cellular uptake studies were conducted for validation. ***Results:*** The study found that tumors with PBT within 7 days had constant relative SUVs (0.80 ± 0.16, 0.92 ± 0.20 and 0.76 ± 0.29 for post-PBT day 1, day 3 and day 7) and increased trend in K1 values (1.23 ± 0.38, 1.60 ± 0.70 and 1.70 ± 0.38 for post-PBT day 1, day 3 and day 7) compared to those who did not receive PBT. This is in line with an increased CD 31 expression on PBT day 7. Meanwhile, the tumor's relative ADC values significantly increased post-PBT days 3 (1.2 ± 0.11) and 7 (1.19 ± 0.10). Significantly decreased proliferation rate and cellular density on day 1 and/or day 3 and rebound on day 7 corresponding with increased vessel expression and inflammation by ex vivo IHC were consistent with the imaging parameters. However, no significant changes in tumor size were found between the PBT and non-PBT groups on post-treatment until day 7. ***Conclusion:*** Dynamic $^{[18F]}$-FDG PET/DW-MRI techniques are feasible and promising approaches for assessing tumor response in the early stages of PBT treatment and for predicting the treatment response.

EP-0704

The MERMAID Project : Pioneering PET Imaging for Small Aquatics Animals

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Aim/Introduction: Zebrafish and other small aquatic animals have become important model organisms in biomedical research. However, there is currently no dedicated PET system for such animals. Our Multi-Emission Radioisotopes - Marine Animal Imaging Device (MERMAID) aims to bridge this gap by providing dedicated solutions for imaging, animal handling and tracer application. The PET device has been now upgraded with an improved data acquisition software, a dedicated image reconstruction framework, and has been characterised using various point sources and phantoms. ***Materials and Methods:*** The improved prototype comprises two detector heads, with two

detector modules per head. Within each module, a LYSO crystal matrix (16x8) is directly coupled to two silicon photomultiplier arrays (SiPMs). The heads rotate around the object with a variable number of steps (typically 3 steps, diameter 33 mm). For an accurate energy calibration, we modelled the SiPM behaviour1 using data from 133Ba, 22Na, and 137Cs point sources. Coincidences were sorted based on a 2-ns time window and an energy window of 450-550 keV. The reconstruction relies on a dedicated list-mode implementation of penalized maximum likelihood. For characterization, we employed point sources and 3D printed radioactive phantoms. Towards future PET of living fish, preliminary animal trials were conducted with focus on handling, fixation in a water-filled chamber, and tracer application (e.g., radiolabelling of fish food with 18F-FDG). ***Results:*** Due to the limited pixel count per detector channel, the SiPMs response saturated at high photon energies. The mean energy resolution was 21,6% for 18F-FDG data. The reconstructed images of the point sources and phantoms show a high spatial resolution, reaching approximately 0.74 mm along the x-axes for a 22Na point source. A noticeable shrinkage (about 9%) affected the reconstructed sizes of extended objects, probably due to an insufficient compensation of parallax effects through the system model used in the reconstruction algorithm or number of rotation steps. The animal studies showed that MERMAID's imaging chamber provides efficient immobilization of anesthetized zebrafish for extended periods—up to 40 minutes—with a continuous supply of fresh water. Radiolabelling of fish food promised better performance as radiotracer delivery via surrounding water. ***Conclusion:*** Efforts will be devoted to improve radiotracer administration and compensation of parallax errors. By combining high-resolution PET with efficient immobilization and anaesthesia methods for in-vivo imaging, MERMAID opens up new possibilities for biomedical research. ***References:*** 1S. Gundacker et al., Phys.Med.Biol. 5, 17TR01, 2020.

EP-0705

Design and Construction of a Head Phantom with Internal Carotid Flow for Image-Derived Input Function with 7T MR-BrainPET Studies

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Aim/Introduction: Quantitative brain studies with positron emission tomography (PET) often require an arterial input function (AIF), which can be derived from the radiotracer transition through the internal carotid arteries (ICAs). However, PET data obtained from regions of interest over the ICAs often suffer from partial volume effects (PVE). This effect can be corrected using magnetic resonance imaging (MRI) to show the structure of the ICA. The described combination of PET and MRI data is optimal in combined PET/MR scanners, such as a 7T MR-Brain PET. To achieve accurate AIFs, the Iida head phantom [1], containing grey matter (GM), white matter (WM) and skull structures, was used as a starting point for the design and construction of a realistic head imaging phantom that incorporates ICA structures and allows dynamic flow simulation through the phantom. Here, we report on the present state of this project. ***Materials and Methods:*** The initial phantom model was generated using a set of CT/MR images acquired from the Iida head phantom [1]. The images were processed using PMOD v4.3. Segmentation of GM, WM, and skull structures was performed using 3D Slicer v5.4.0 with a combination of manual and semiautomatic thresholding techniques. Additionally, 3D Slicer v5.4.0 was utilized to extract the anatomical structure of the ICA from an MR angiography of a healthy volunteer. This extraction process involved applying specific threshold values to isolate the ICA from the surrounding structures. The segmented data were then exported to 3D computer-aided design (CAD) software for further editing. The GM, WM, and ICA compartments were designed to contain radioactive solutions. ***Results:*** The GM and WM are clearly demarcated by a distinct boundary, while the bone component is crafted from a solid material to replicate bone attenuation properties accurately. The Standard Triangle Language (STL) file will be utilized in the next step to obtain a first prototype using 3D printing technology. ***Conclusion:*** This work is currently in the development phase, and further optimization of materials for 3D printing is required to mimic realistic head properties. Furthermore, the new dynamic 3D phantom requires validation to confirm that it accurately reflects images from PET acquisitions with ICA flow. ***References:*** [1] Iida, H., et al 2013. Ann Nucl Med 27, 25-36.

EP-0706

Diagnostic value of PET/MR biomarkers in patients with gynaecological malignancies

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Aim/Introduction: PET/MRI has a capability to provide the molecular and metabolic information using PET biomarkers along with anatomical and functional information using MRI biomarkers [1]. The purpose of this study is to evaluate the correlation between PET/MRI biomarkers and histopathology in patients with gynecological malignancies and further evaluate its importance. ***Materials and Methods:*** This is a retrospective study and a total of 25 patients diagnosed with gynaecological malignancies including cervical, endometrial, vulvar and uterine cancer were studied. All the patients included in this study were referred for diagnosis and staging and underwent regional [18F]FDG PET/MR scan on 3T MRI scanner (uPMR790, United Imaging Healthcare, Shanghai, China) at Omega hospital, Hyderabad. The operable cases underwent hysterectomy, and the histopathology reports were collected. Inoperable cases underwent radiotherapy. 148-185 MBq of radiotracer was administered and the scanning was done 60 minutes after the injection and with an empty bladder. A precise MR scan was conducted for patient comfort with 15 min scan time and the protocol including following sequences: Dixon, T2-weighted, T2-FatSat, DWI. PET/MRI biomarkers that were measured include the ADCmin, ADCmean and ADCmax calculated from DWI images, SUVmax, TLG and MTV and correlated with the histopathology. ***Results:*** Tumours were segregated in squamous cell carcinoma (SCC), adenocarcinoma (AdC), endometrial carcinoma (ECa) and leiomyosarcoma (LMS). In more aggressive SCC (poorly differentiated SCC), SUVmax was high (18.6-23.9), whereas, for less aggressive SCC (SCC-in-situ), the SUVmax was as low as 3.9 showing a direct correlation between SUVmax and the tumor grade. Further, ADC values are lower in poorly differentiated SCC and higher in SCC-in-situ. Leimyosacroma also demonstrates the same pattern as SCC-in-situ and has low SUVmax values and high ADC values. There is also a significant inverse correlation between SUVmax and ADCmean values (r=-0.53). TLG and MTV values demonstrate a direct correlation with the tumor grade

only for endometrial carcinoma. ***Conclusion:*** This study shows that simultaneous PET/MRI biomarkers can provide an alternative to histopathological findings in gynaecological malignancies and demonstrates the importance of PET/MR in gynaecological cases. ***References:*** 1. Shih IL, Yen RF, Chen CA, Cheng WF, Chen BB, Chang YH, Cheng MF, Shih TT. PET/MRI in Cervical Cancer: Associations Between Imaging Biomarkers and Tumor Stage, Disease Progression, and Overall Survival. J Magn Reson Imaging. 2021 Jan;53(1):305-318. doi: 10.1002/jmri.27311. Epub 2020 Aug 14. PMID: 32798280.

EP-0707

Discrepanciesand calibrationof Aβ protein threshold in ^{18}F-florbetaben PET imaging acrossdifferent scanners

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Aim/Introduction: Standardization methods like standardized uptake value ratio (SUVR) and the centiloid scale are crucial for analyzing amyloid beta (Aβ) positron emission tomography (PET) images. However, variations in scanners, such as PET/CT and PET/MRI, can affect Aβ thresholds. This study aims to investigate the differences in Aβ threshold on 18F-florbetaben (18F-FBB) PET imaging between PET/CT and PET/MRI scanners, and propose a correction method. ***Materials and Methods:*** A total of 137 subjects with Alzheimer's disease, mild cognitive impairment, dementia with Lewy bodies, posterior cortical atrophy, multiple system atrophy, Parkinsonism syndrome, or subjective cognitive impairment underwent 18F-florbetaben PET/CT (N=48) or PET/MRI (N=79, huashan hospital, Shanghai, China; N=10, xuanwu hospital, Beijing, China) imaging. SUVR values were transformed into Centiloid units. Receiver operating characteristics analysis established cutoff values and sensitivity/specificity for amyloid PET imaging. Correction for scanner differences was performed using data from the Global Alzheimer's Association Interactive Network (GAAIN) website. The calibration method for scanner differences was verified in the PET/MRI data of Xuanwu Hospital. ***Results:*** PET/CT and PET/MRI (Huashan hospital) scanners revealed SUVRs of 1.032±0.109 and 1.489±0.200 for negative Aβ, and 1.186±0.176 and 1.736±0.271 for positive Aβ in the global cortical target (CTX), respectively. The SUVR thresholds for 18F-FBB PET/CT and PET/MRI (Huashan hospital) were 1.140 and 1.401, respectively, resulting in sensitivities/specificities of 96.30%/85.71% and 92.86%/89.47%, respectively. The threshold of 18F-FBB on PET/CT in our cohort aligned with the standard threshold observed on the GAAIN website, whereas the threshold of 18F-FBB on PET/MRI was notably higher than that on PET/CT. After calibrating the whole cerebellum (calWC) reference using the formula calWC = 1.365 × WCsuv - 260.5 with standard data from the GAAIN website, the PET/MRI threshold was adjusted to 1.132, yielding a sensitivity/specificity of 92.86%/89.19%. Following the calibrating formula of calWC, the PET/MRI (xuanwu hospital) received SUVRs of 0.91±0.109 for negative Aβ, and 1.186±0.176 for positive Aβ in the global cortical target (CTX), respectively. ***Conclusion:*** Variations in Aβ thresholds between 18F-FBB PET/CT and PET/MRI scanners may be due to differences in whole cerebellum attenuation. Correction using whole cerebellum reference improved consistency across scanners, allowing SUVR values on PET/MRI to be converted into CL units using a standard equation. Further research is needed to validate these findings and establish standardized protocols for amyloid PET imaging.

EP-0708

Evaluation of dose reduction for [^{11}C]PHNO: how does it affect the binding potential non-displaceable (BP_{ND})?

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Aim/Introduction: [^{11}C]PHNO has been used in psychiatric studies investigating disease aetiology and drug development, due to its binding to D2 and D3 brain receptors. This radiopharmaceutical has the potential to be used in prospective studies investigating the hypothesis of a genetic neurodevelopmental continuum between childhood neurodevelopmental disorders and psychiatric conditions. This project aims to evaluate dose reduction for [^{11}C]PHNO Positron Emission Tomography (PET)-Magnetic Resonance (MR) imaging, to reduce the radiation burden for future research participants. ***Materials and Methods:*** Ten in vivo datasets, belonging to ten healthy volunteers who received 134.2±20.3 MBq of [^{11}C]PHNO and were scanned on a General Electric SIGNA PET-MR, were reconstructed once with the full administered dose and 7 times with different simulated low doses. The low dose simulations were obtained by undersampling the time frames and represented 1⁄2, 1⁄3, 1⁄4, 1⁄5, 1⁄6, 1⁄10,1⁄15 of the full dose. An OSEM algorithm with time-of-flight was used with 6 iterations, 16 subsets, a 5mm filter (xy-axis). Regions of interest were drawn in the accumbens, substantia nigra, caudate, globus pallidus, putamen, striatum and thalamus. A simplified reference tissue model was used to investigate the binding potential non-displaceable (BPND) for each structure, per reconstruction. Coefficient of variation (CV) and bias were investigated. The two-way ANOVA and Kruskal-Wallis tests were used for group comparisons between the low dose and the full dose datasets. ***Results:*** The substantia nigra (20.55%) and thalamus (39.90%) presented the highest CV, for the full dose datasets. When comparing the full dose CV and the highest CV from the low dose datasets, differences ranged between 0.67%-4.36% for the accumbens, caudate, globus pallidus, putamen, striatum and thalamus. For the substantia nigra, the difference was 22.92%. The 1⁄2 and 1⁄3 low dose datasets produced the lowest bias for all structures except, the putamen and striatum. The 1⁄10 and 1⁄15 low dose datasets produced the highest bias, for all structures. Apart from the putamen and striatum, no significant differences were found between the 1⁄2, 1⁄3, 1⁄4, 1⁄5, 1⁄6 low dose and full dose datasets. The putamen and striatum showed significant differences between the 1⁄2, 1⁄10, 1⁄15 low dose and the full dose datasets however, visual assessments of the time-activity curves indicate there may be an image artefact/bias in the 1⁄2 low dose dataset. ***Conclusion:*** Whilst the data indicates that reducing the [^{11}C]PHNO may be possible, current statistical differences suggest further work is needed before low dose is a suitable approach.

EP-0709

Impact of surface coil interposition on attenuation correction in preclinical^{18}F-fluorodeoxyglucose (FDG) positron emission tomography-magnetic resonance imaging (PET/MRI): a phantom study

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Aim/Introduction: 23Na MR imaging has lower signal strength due to a lower gyromagnetic ratio and tissue abundance of 23Na. In PET/MRI imaging, resonators enhance proton imaging, while surface coils increase 23Na sensitivity. However, using a surface coil can disrupt the PET signal. In this study, we compared the PET images acquired using a resonator or a surface coil. ***Materials and Methods:*** To evaluate the impact of a surface coil interposition on attenuation correction in a 7T preclinical PET/MRI (Bruker BioSpin), we developed a dedicated cradle (DC) incorporating a surface coil, and then we integrated the attenuation map into the PET reconstruction process. To validate this attenuation correction, we compared it to that obtained using a conventional cradle (CC) and a resonator. A NEMA (National Electrical Manufacturers Association) NU-4 2008 phantom, a homogeneous phantom, and a resolution phantom filled with 18F fluorodeoxyglucose (FDG) (3.7 MBq) with the two cradles were used. Various image quality metrics (recovery coefficients (RC), non-uniformity (%STD), spillover ratio (SOR)) were calculated for NEMA phantoms according to the NEMA standards. The images were reconstructed using Maximum A Posteriori algorithm. ***Results:*** The RC calculated for rods of 1, 2, 3, 4 and 5 mm diameters were respectively 0.12, 0.43, 0.78, 0.94 and 0.92 for CC and 0.08, 0.50, 0.86, 0.89 and 1.03 for DC. The RC values using the DC was slightly higher than that of the CC. The %STD increased with the number of iterations until it converged, starting with 15 iterations. However, the %STD was lower with the CC (3.29 ± 0.53) vs. the DC (5.07±0.18, p=0.0023). The SOR was consistent between the two cradles for both air and water. The number of iterations also affected the Contrast-to-Noise Ratio (CNR) values, a convergence occurring after 20 iterations. There was no effect of scatter correction, but there was an increase in RC when using partial volume correction and the point spread function for both cradles. The CC - CD image subtraction demonstrated an overestimation of the PET signal on the surface coil side and an underestimation on the opposite side. The spatial resolution value was similar with the two cradles. ***Conclusion:*** The dedicated cradle with a surface coil increased the RC but also the non-uniformity compared to a conventional cradle with a resonator coil. This could impact quantitative PET imaging when using a surface coil in PET/MRI with 23Na imaging.

EP-0710

Time resolution and sensitivity including triple coincidences of a UHF-MRI compatible BrainPET insert

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Aim/Introduction: The BrainPET-7T is a new high-performance PET insert for brain imaging combined with Ultra-High-Field MRI [1]. With its state-of-the-art detector technologies and enhanced data processing methods, it is expected to achieve good timing resolution and high sensitivity. For this system, the standard processing of coincidence events is extended for triple coincidences to increase the sensitivity with reduced loss of accuracy. Additionally, the identification of triple coincidences when using isotopes that emit additional prompt gammas after the positron emission could be used for dual-isotope [2] and positronium lifetime imaging [3]. ***Materials and Methods:*** The scintillator blocks of the BrainPET-7T consist of LSO scintillator arrays in three staggered layers with a readout by 12x12 digital Silicon photomultipliers (operating temperature 18°C, second photon trigger) providing high-resolution time stamps [4]. The skews between timer components and scintillation location are calibrated systemwide on block and die level and considering depth of interaction [5]. We determine the timing resolution of the system after skew correction and investigate the noise level and the sensitivity for double coincidences and triple coincidences of prompt gamma emitters with the simulator PeneloPET [6] as well as with measurements using 124I, 22Na and 68Ge sources. ***Results:*** Preliminarily, a timing resolution <850ps was achieved. The sensitivity at the iso-center in comparable simulations using point-sources was 17% for double coincidences of 18F and 2.3% for triple coincidences of 22Na. The measured peak sensitivity of the BrainPET-7T for double prompt coincidences including those caused by triple coincidences for a 18F line-source at the iso-center was ≈12% leading to an expected triples sensitivity of ≈1.6% for 22Na. ***Conclusion:*** The simulated sensitivity for double coincidences from 18F was 7.4 times larger than the sensitivity for triple coincidences from 22Na. Reliable identification of true and random triple coincidences of different nuclides could be shown allowing for a more accurate quantification for pure positron and prompt gamma emitters. ***References:*** [1] C. Lerche et al., "First Performance Results of a UHF-MRI Compatible BrainPET Insert for Neuroscience.",2023 IEEE NSS MIC RTSD, 2023 [2] E. C. Pratt et al., Nat. Biomed. Eng, 7 (2023) 8, pp. 1028-1039 [3] P. Moskal et al., Nat. Rev. Phys., 1 (2019) 9, pp. 527-529[4] Y. Haemisch et al., Physics Procedia, 37 (2012), pp. 1546-1560[5] S. Naunheim et al., Phys. Med. Biol., 68 (2023) 2, p. 025013 [6] S. España et al., Phys. Med. Biol., 54 (2009) 6, pp. 1723-1742.

EP-0711

Generating synthetic CT volumes for PET/MR attenuation correction using machine learning

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Aim/Introduction: Achieving accurate quantitative PET images in neurological studies requires proper attenuation correction. PET/MR systems pose a challenge in this regard due to the dependence of MR signals on proton density and tissue relaxation times rather than electron density. In this study, we proposed a novel machine learning-based approach to generating synthetic CT volumes with continuous HU values. This method can quickly generate synthetic CT volumes to create accurate attenuation correction maps for brain PET data. ***Materials and Methods:*** We acquired MR images from ten healthy volunteers using

IR-PETRA and VIBE-DIXON techniques with a 3T MR scanner and a 20-channel head/neck coil after providing their written consent. Following the bias magnetic field correction and MR-CT registration, we extracted 3D voxel-based radiomics feature maps from these MR volumes using the Pyradiomics library. After scaling the features and performing feature selection, we employed LightGBM, an advanced gradient-boosting framework, to predict synthetic CT volumes from unseen folds. Furthermore, the LightGBM Hyperparameters were optimized using the Optuna library. Lastly, we assessed the ten synthetic CT volumes against the Ultra-low dose CT volumes as reference images using various voxel-wise and volume-wise evaluation metrics. ***Results:*** Based on our experimentation, we found that training the LightGBM model using a 9-fold train dataset on a system equipped with a Core i7 CPU and 16 GB RAM took approximately 60 minutes. Also, generating a synthetic CT volume with continuous HU values from the test fold took less than 1 minute. To ensure accuracy, we used a 10-fold leave-one-out cross-validation technique, which allowed us to generate ten synthetic CT volumes from MR volumes. After comparing these volumes with reference ultra-low dose CT volumes, the findings revealed an average mean absolute error of 60.75±8.8 HU, an average structural similarity index of 88±2%, and an average Pearson correlation coefficient of 95±1%. These results are comparable to those reported in the literature. Further histogram-wise and slice-wise evaluations also revealed high correlation and similarity between synthetic and reference CT volumes. ***Conclusion:*** Significant differences were discovered between CT and synthetic CT images in the ear regions and the patients' head surfaces, possibly due to ear positioning variations during different scans or MR-CT registration errors. Quantitative assessments indicated promising correlations and similarities between Reference CT and LightGBM-generated CT images. Furthermore, the cross-validation results demonstrated the possibility of generating accurate synthetic CT volumes for PET/MR attenuation correction with lower computational time using CPU-based processors.

EP-0712

^{18}F-FDG PET/MRI Imaging in the Differential Diagnosis Between Progressive Recurrence and Radionecrosis in the Ccontext of Ccerebral Metastatic Lesions

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Aim/Introduction: Brain metastases are the most common intracranial tumours, and their incidence is increasing. While the improved overall survival of oncology patients contributes to this rise, it does not fully explain the trend. Radiotherapy is a frequently used treatment for brain metastases. However, during post-treatment follow-up, it is often difficult to distinguish between radionecrosis and tumour recurrence. Radionecrosis lacks specific imaging features on MRI sequences. The combination of anatomical and functional (PET/MRI) imaging can help overcome this diagnostic challenge and enhance the ability to differentiate between radionecrosis and tumour progression. The aim of our study was to assess the contribution of ^{18}F-FDG PET/MRI in differentiating between radionecrosis and recurrence of brain metastases in patients who had undergone brain radiotherapy. ***Materials and Methods:*** : We analysed 72 patients with the input from five doctors, including three nuclear physicians and two radiologists. The results were subsequently compared with clinical and radiological findings. ***Results:*** The diagnostic performance of ^{18}F-FDG PET, MRI, and PET/MRI was evaluated separately. The sensitivity was 97.9%, specificity was 100%, and the NPV was 98.9% for ^{18}F-FDG PET combined with a T1 MRI sequence in distinguishing recurrence from radionecrosis. PET/MRI resolved misclassifications in 17% of patients initially misclassified by PET/MRI alone. Late acquisition allowed for the calculation of a retention index at 4 hours, which enhanced the diagnostic performance of PET. ***Conclusion:*** Combining PET with brain MRI remains crucial for detecting new lesions, especially micro-lesions, and demonstrating lepto-meningeal dissemination. Technological advancements, such as PET/MRI, allow for the integration of the strengths of both techniques while improving patient comfort. Simultaneous PET/MRI acquisition provides compelling and clinically relevant additive diagnostic value for the most complex cases, that necessitate precise alignment of morphological and functional information.

EP-49

e-Poster Area

D: Technical Studies -> D1 Instrumentation -> D14 Imaging Guided Surgery and Other Instruments

EP-0713

Fully integrated handheld gamma camera compared to conventional gamma camera for detection and localisation of sentinel lymph nodes in breast cancer

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Aim/Introduction: Preoperative lymphoscintigraphy is the gold standard for sentinel lymph node biopsy (SLNB) in breast cancer (BC) patients. However, conventional gamma camera imaging is prone to operator variability and time consuming in the nuclear medicine department workflow. This study aims to validate the performance of the Pocket Gamma CAM (PGC), a handheld gamma camera, in detecting and locating sentinel lymph nodes (SLNs) during the preoperative and intraoperative phases in BC patients compared to conventional gamma camera imaging. In addition, we evaluated the manoeuvrability and intrinsic instrument sensitivity of both devices. ***Materials and Methods:*** Adult female patients with histologically confirmed BC candidates for surgery and SLNB were enrolled in this prospective open-label clinical trial. All patients underwent pre- and intra-operative assessment using both the PGC and conventional lymphoscintigraphy. The performance of the two devices was compared using the Poisson regression model for incidence rate ratios (IRRs). The intrinsic sensitivity of the devices was compared using the Wilcoxon Ranked Sign Test. The manoeuvrability of the devices was defined as low-moderate-high. ***Results:*** Sixty-eight patients (median age 50 years, BMI 21.4) were enrolled, including one patient with bilateral breast cancer who underwent two SLNBs. The PGC demonstrated superior preoperative lymph node detection (IRR 8.01, 95% CI 6.11-10.50; p<0.0001) and intrinsic device sensitivity (299 versus 56.5 counts per second; p=0.0003) compared to the

conventional gamma camera. Intra-operative assessment with PGC was performed in 64 patients and no additional lymph nodes were visualised. However, the conventional gamma camera demonstrated superior manoeuvrability ($p<0.0001$). ***Conclusion:*** The PGC handheld gamma camera has potential for preoperative sentinel lymph node assessment in patients with BC. Its limited manoeuvrability may hypothetically increase inter- and intra-operator variability. However, appropriate training and frequent use of nuclear medicine and surgical equipment could overcome this limitation.

EP-0714

PET/MRI Mixed Reality for Intraoperative Localization of Sentinel Lymph Nodes in Head and Neck Melanoma

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Aim/Introduction: Patients with malignant melanoma undergo surgical sentinel lymph node (SLN) resection to determine stage of disease. Pre-surgical SLN single-photon emission computed tomography (SPECT)/computed tomography (CT) is currently used to visualize the first draining lymph node with subsequent use of the neoprobe to detect the node intraoperatively. As the neoprobe registers the amount of radiation, it can only give an estimate to where the SLN is located in tissue. In this study, we evaluated whether mixed reality (MR) that projects pre-surgical SLN imaging onto the patient can aid the surgeon localize and extract the SLN. ***Materials and Methods:*** Molecular sieves with a diameter of 3 mm were incubated with fluorine-18 (18F) in order to simulate lymph nodes and were implanted in fresh cadavers. Imaging with positron emission tomography (PET)/magnetic resonance imaging (MRI) was performed instead of SPECT/CT. Virtual renderings of the PET/MRI scans were generated and projected onto the cadaver using a commercially available MR headset (HoloLens 2). Standard surgery was performed on one side of the neck while on the contralateral side, surgery with the MR headset was performed. Surgeons received a questionnaire asking about their overall experience. ***Results:*** Six cadavers were scanned with 4 implanted SLN per side, respectively. All surgeons (n=11) reported that AR has helped determining where to set the first incision for retrieving the SLN. However, the AR depth perception was limited and was therefore not helpful in guiding how deep the lymph node is located in tissue. The surgeons found that wearing the AR headset was comfortable and not distracting; they believed unisono that AR has added value for the intraoperative detection of the SLN. The alignment of the hologram onto the cadaver was time intense, however with the introduction of new QR code based fiducial markers, this might improve in the near future. ***Conclusion:*** MR visualization of PET/MRI data in 3D improved the surgeons' confidence in where to set the first incision for removing the SLN and might be able to reduce overall time spent in the operating room.

EP-0715

SFoV Imaging Using a Hybrid Optical-Gamma Camera (HGC): Specifications and First Clinical Result

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Aim/Introduction: A portable small field of view (SFoV) high resolution gamma camera designed for small organ has been developed. Four integrated pinhole collimators (1, 2, 3 and 5 mm diameter) can be software selected in seconds to optimise image resolution and acquisition speed. A microcolumnar CsI(Tl) crystal scintillator converts gamma to optical photons for detection by a semi-conductor. An in-built optical camera with the same field of view, allows real-time display of gamma image acquisition streaming mapped to surface anatomy. ***Materials and Methods:*** Following characterisation and performance measurements, pilot studies were undertaken in the clinical setting as part of research ethics committee (REC) approved clinical studies. Imaging was undertaken in patients undergoing standard of care imaging and the investigational images compared with the standard gamma camera images. ***Results:*** Characterisation results indicate that spatial resolution, spatial linearity, and uniformity values exceed those of large field of view (LFoV) gamma cameras. Sensitivity and count rate capability were comparably lower, due to the smaller size of the device. This is partially compensated by the ability to position the small camera head (< 15 cm diameter) very close to the region of interest. A range of patients have been studied and images from the first clinical investigations will be presented. The compact nature of the camera allows use with the patient in a small-sized room. A 60° field of view allows the operator to assess larger or smaller regions by altering the camera distance from the region of interest. Automated pinhole collimator change allows rapid change between 'higher sensitivity' and 'higher resolution' settings. These studies demonstrated that the camera is highly suited to SFoV imaging applications such as thyroid and parathyroid using Tc-99m and I-131, sentinel node localisation studies and bone spot views. However there is a learning curve for the operator to establish the optimum combination of camera positioning and collimator selection for each case. Investigation of further clinical applications using different radionuclides are underway to determine how the fusion of the gamma and visible images can be used to best effect. ***Conclusion:*** Use of a hybrid SFoV camera complements the LFoV imaging and in some applications may provide a solution for small organ imaging without the use of the larger, more expensive systems. The portability of the device offers the potential to integrate scintigraphy within clinical pathways outside of the nuclear medicine department such as surgical and intensive care settings.

EP-50

e-Poster Area

D: Technical Studies -> D1 Instrumentation -> D15 Quality Control, Performance and Standardization

EP-0716

Verification of pharmacopoeia TLC procedure of method C used for separation between medronate and oxidronate. Technetium (^{99m}Tc) medronate injection (01/2016:0641)

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Aim/Introduction: Technetium (99mTc) medronate injection produced under GMP requirements must assure quality based on

the European Pharmacopeia (Ph.Eur.) monograph 0641.The direct implementation of the pharmacopoeial method C (thin-layer chromatography) for medronate identification was associated with several inconveniences that had to be eliminated, including the lack of visible spots for sodium oxidronate, the long drying time of the developed plate (at least 14 h) and the multiple application of samples for analysis. Based on the recommendations in Ph. Eur. chapter 5.26 Implementation of pharmacopoeial procedures, we verified method C and obtained reliable and reproducible results for the test product. ***Materials and Methods:*** The following parameters of the method C were modified: the concentration of reference solution (a) of sodium oxidronate increased by 15 times, and the concentration of reference solution (b) and test solution of medronic acid increased by five times. The sample application was changed from 5 µL in 1 µL portions to 1 or 2 µL in one portion. The drying in-air procedure has been drastically reduced from 14 hours to at least 20 minutes. Other method parameters, such as mobile phase, development and detection, remained unchanged. The method was investigated using three types of plates with cellulose for chromatography as the coating substance: 5552 MERCK (aluminium-backed), 1.05730 MERCK (glass-backed), and 1.05577.0001 MERCK (plastic-backed). ***Results:*** We successfully verified the pharmacopoeial TLC method by increasing the concentration of the reference and test solutions and applying them once. These modifications showed clearly visible spots due to the test solution and the reference sodium oxydronate sample developed using glass and plastic-backed chromatographic plates. At the same time, we demonstrated that shortening the drying time of the plates after development does not affect the final result. ***Conclusion:*** Implementing changes to the Ph. Eur. method allowed to obtain reliable results under our laboratory conditions. Furthermore, we have shown that reducing the plate drying time to 20 minutes allows the entire analysis (identity) to be completed in up to 4 hours. The implementation of the verified analytical method for identification of the medronate will allow the biodistribution test to be removed from the specification, which is in line with the 3Rs principle. ***References:*** 1. Ph.Eur. monograph 06412. Ph.Eur. General text 5.26. Implementation of pharmacopoeial procedures.

EP-0717

Artificial high- and low-density materials in bone mineral densitometry using dual-energy X-ray absorptiometry: A GATE Monte Carlo simulation of "Black-hole" artifact

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Aim/Introduction: To evaluate the effect artificial high- and low-density materials on BMD scans in dual-energy X-ray absorptiometry (DXA) method and emergence of so-called black-hole artifact through GATE Monte Carlo simulation. ***Materials and Methods:*** A GATE Monte Carlo code is utilized to simulate the artifact encountered in clinical scans acquired by HOLOGIC® bone densitometer. Two simplified phantoms are designed. The first one is a rectangular box with 6 smaller cubes inside and second one is body torso. Materials of cubes are spine bone, PMMA, barium sulfate suspension in water, stainless steel, titanium alloy and gold. Torso phantom contains objects of 5 vertebrae, bowel and 3 small spherical objects near the surface of torso as piercing objects on the abdominal wall, each overlying the vertebrae. Using 100 and 140 kVp, spectral X-rays are generated to simulate DXA. For both phantoms, two simulations are conducted. The pair of projections acquired for each phantom are then subtracted and analyzed by curve plotting. ***Results:*** Except for spine bone, in which radio-opacity decreases with increasing spectral X-ray energy (from 100 to 140 kVp), other squares exhibit little changes over different energies. PMMA shows consistently very low radio-opacity. For four other materials (barium sulfate in water, stainless steel alloy, titanium alloy and gold), all attenuate the X-ray photons substantially. Except for spine bone, and other materials are barely noticeable in pairwise subtracted images. In torso phantom, piercing objects are visualized as "holes" in vertebrae. ***Conclusion:*** Both artificial high- and low-density materials, compared to bone, are eliminated during subtraction of dual-energy X-ray profiles and therefore, can create black-hole artifact.

EP-0718

Optimizing PET dose in adult imaging: striking a balance between patient safety and optimal image quality. From our daily clinical experience to the existing literature.

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Aim/Introduction: Since the development of hybrid scanners combining a Positron emission tomography (PET) and an X-ray computed tomography (CT), the use of PET/CT has rapidly increased worldwide. However, radiation exposure can be a thoughtful concern. A proper PET/CT procedure should achieve the clinical purpose, without compromising the objective evaluation of the PET/CT study, while maintaining radiation dose "as low as reasonably achievable" (ALARA principle). In fact, PET/CT results in considerable medical radiation exposure (up to 25 mSv in older systems, and approximately 7-10 mSv at modern state-of-the-art CT), which is somewhat higher than in multidetector contrast material-enhanced CT (depending on the examination protocol). Thus, especially for young patients who potentially require repeated follow-up studies, the imaging modality with the lowest possible absorbed radiation dose per examination is desired.Aim of our study is to collect all the adopted measures in our clinical daily practice to reduce the patient dose at different steps (injected activity, CT protocol, reconstruction methods, etc.) and to compare them to the current evidence in literature. ***Materials and Methods:*** A comprehensive search of relevant articles was conducted in medical databases (i.e. Embase, Scopus, Web of Science and Medline), using the keywords: dose optimization, computed tomography, PET, radiopharmaceutical, PET/CT, PET/MRI, DRL. Only English and full-text articles were included, without limitations on the publication year. After the screening, 58 articles were selected considered eligible for the analysis. ***Results:*** The methods used for dose optimization include: improving reconstruction algorithms; reducing the injected radiotracer activity but increasing the acquisition times, especially in new digital PET scanner; using long-axial field of view (LAFOV) PET/CT tomographs; and modulating CT radiation dose

by using artificial intelligence tools. All these approaches are in line with those implemented in our departments. Furthermore, the future trend is prioritizing data collection, in accordance with international guidelines, to better understand PET/CT dose discrepancies while also striving to optimize radiation doses without compromising the quality of PET images. ***Conclusion:*** Several optimization methods have been developed and implemented to reduce the dose delivered to the patients who undergo PET/CT or PET/MRI examination; in recent years, the advent of digital PET and LAFOV scanners represent an important step in the evolution of molecular imaging and dose optimization and are also experiencing an increasingly widespread adoption in clinical practice. ***References:*** Al-Fatlawi M et al. Optimization of the Acquisition Time and Injected Dose of ^{18}F-Fluorodeoxyglucose Based on Patient Specifications for High-Sensitive PET/CT. WJNM.2023;22(3):196-202.

EP-0719

Introducing Risk Management into the IAEA Quality Management Program

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Aim/Introduction: Risk management strategies aim to effectively identify and prevent risks and mitigate their possible effects. The expected outcomes for a medical organization include an improved capacity for achieving the desired level of quality and safety in care and creating a safer work environment for staff. The overall goal of a new IAEA project is to help Nuclear Medicine departments in Member States to develop a risk management culture where all staff members and stakeholders are aware of the importance of prospectively evaluating and then monitoring and managing risk. ***Materials and Methods:*** A committee of NM professionals with experience in QM, auditing, and risk assessment, discussed strategies to promote and support risk management as a tool in Nuclear Medicine departments. The group reviewed literature and experience in various fields within Nuclear Medicine to establish the range of aspects in which risk management should be implemented. Failure Modes and Effects Analysis (FMEA), was selected as a suitable tool applicable in our discipline. In FMEA, the level of risk R of an activity or operation is calculated semi-quantitatively based on the probability P of occurrence of a fault, the grade of severity S of the consequences and the detectability D of the specific fault. These variables are scored on a 5-level scale. A model Excel spreadsheet was used to capture the steps for each of a few example procedures and their possible failures, calculating the risk score for each step. Possible causes and preventive or corrective measures were provided in the spreadsheets. ***Results:*** Selected Nuclear Medicine procedures were used to prepare examples of implementing FMEA. Each procedure was broken down into a series of individual steps, for which possible failures were considered. An initial set of FMEA spreadsheets was prepared, covering situations such as injection of radiopharmaceuticals; thyroid cancer therapy with 131I; and labeling of kits with 68Ga. More examples are being developed. ***Conclusion:*** The IAEA promotes the practice of risk management in Nuclear Medicine. The adoption of FMEA as a prospective method will facilitate setting up more robust SOPs, and a system of checks, graduated according to the risk and tailored to the needs. Tools, like an FMEA spreadsheet, that can be easily adapted according to local needs, and a library of examples will shortly be available on the IAEA's Human Health Campus. This further extension of the QUANUM portfolio will help improve quality and safety in patient care.

EP-0720

Can IRT replace ^{18}F-FDG PET/CT scan in the assessment of Brown Adipose Tissue activation?

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Aim/Introduction: Brown Adipose Tissue (BAT) has the potential to combat obesity and metabolic diseases. Hence, it has been a field of abundant research since the confirmation of BAT presence in adult humans by PET/CT. PET/CT has since been considered as the gold-standard for BAT assessment (1). PET/CT scans are relatively expensive and expose research participants to ionising radiation. In contrast, infrared thermal imaging (IRT) is an inexpensive, easy, and non-invasive alternative method that has the potential to assess BAT activity without radiation exposure. In BAT research, IRT measures the skin temperature in the supraclavicular region, where the largest, superficial depot of BAT in humans typically is located. IRT measures a direct outcome for BAT activity, as the main function of BAT is thermogenesis. Studies have observed an overlap of the region with maximal temperature on IRT with the area of maximal fluorodeoxyglucose (18F-FDG) uptake on PET/CT. However, only few studies validate IRT compared PET/CT scans or similar imaging techniques. In studies that have measured BAT activity with PET/CT and IRT, there is discrepancy in the correlation of FDG-uptake and the supraclavicular temperature. We aim to validate IRT for BAT assessment by standardized methods. We examine the correlation between supraclavicular temperature measured with IRT and BAT activity quantified by different PET-parameters in the supraclavicular region. ***Materials and Methods:*** Recommendations for standardised BAT assessment and analysis are followed (1,2). PET/CT scans are performed on 20 healthy participants at two separate visits: A cooling visit and control visit. To activate BAT, participants are exposed to an individualised 2-hour cold exposure with cooling blankets. 18F-FDG will be injected after the first hour of cooling. PET/CT scans will be performed after 2 hours cooling. During the cold exposure, IRT images are obtained from the beginning and every 15 minutes until the PET/CT scan is performed after 120 minutes. We assess the relationship of BAT activity and volume by measuring the correlation of outcome from the two methods: the maximal supraclavicular temperature from IRT and different PET-parameters in the supraclavicular region including maximal standardized uptake volume adjusted for lean body mass (SULmax), BAT metabolic volume (BMV) and total BAT glycolysis (TBG). ***Results:*** Data will be ready for presentation at the conference. ***Conclusion:*** Awaiting data analyses. ***References:*** 1. Chen KY et al. Cell Metabolism. Cell Press; 2016 2. Kim K et al. Journal of Visualized Experiments; 2019.

EP-0721

Impact of ^{18}F standard PET EARL-harmonization on functional volume measurement: a pilot single-center phantom study

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Aim/Introduction: To assess the impact of 18F-based PET EARL-harmonization on the variability of functional volume measurements (FVM). ***Materials and Methods:*** A 5 rings BGO PET/CT system certified according 18F standard 2 EARL accreditation program and NEMA IEC Body Phantom Set NU2-2018 were used in the study. The volume of the each sphere of the phantom was previously measured. The phantom filling and scanning procedure was performed in accordance with the recommendations of EARL 18F standards [1]. The study included 40 image reconstructions: 20 EARL2-harmonized (EARL2) (10 - 3D OSEM+PSF, 10 - BSREM) and 20 non-harmonized (10 - 3D OSEM+PSF, 10 - BSREM), as control group. The volume of the each sphere on PET were measured using two segmentation tools: a 41% of the maximum voxel value 3D isocontour (41%ISO) and the adaptive iterative algorithm (AIA). For each of six spheres the volume recovery (VR) value was calculated, which corresponds to the ratio of measured PET volume to the true volume, similar to EARL's recovery coefficient [2]. Mean VR (MVR) value was calculated for each reconstruction, then coefficients of variation (CoV) of MVRs were calculated across EARL2 and control group (6 CoVs for each group) depending on reconstructive algorithm (3D OSEM+PSF or BSREM) and segmentation tool. ***Results:*** CoVs of EARL2 were lower in comparison to control group independently of the reconstruction algorithms and the segmentation approaches used: for the AIA tool 6.7% vs 20.4% in the total, 6.9% vs 15.1% for 3D OSEM+PSF, 6.0% vs 21.9% for BSREM; for the 41%ISO tool 4.4% vs 11.5% in the total, 4.0% vs 14.5% for 3D OSEM+PSF, 0.7% vs 4.7% for BSREM. The CoVs were lower when using EARL2 BSREM in comparison to 3D OSEM+PSF independently of the segmentation tool, the lowest one (0.7%) was achieved among the EARL2 for BSREM algorithm using 41%ISO tool. 41%ISO tool consistently yielded lower CoVs irrespective of harmonization status or the reconstructive algorithm. ***Conclusion:*** Preliminary results suggest that EARL harmonization, alongside reducing interscanner SUV variability, may also contribute to decreased interscanner FVM variability in 18F-based PET, utilizing widely available segmentation tools. It is necessary to conduct a multicenter study to verify obtained results on different PET-systems. ***References:***

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2. Feasibility of state of the art PET/CT systems performance harmonisation. A. Kaalep et al. Eur J Nucl Med Mol Imaging. 2018; 45(8): 1344-1361. doi: 10.1007/s00259-018-3977-4.

EP-0722

The Color of Radiation: Evaluating and Advocating for Improved Colormaps in Nuclear Medicine

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Aim/Introduction: Strict quality guidelines for monitors and room classes are in place to ensure high-quality image analysis. Frequent sources of artifacts such as the human eye and Colormaps (CMAP) are often overlooked. A translation table comprises guidelines for image generation by transforming a sequence of numbers into respective pixels, with each numeral in the sequence being converted into a pixel of a distinct color. An optimal translation table allows for the undistorted visual representation of measurements and would e.g. aid in the detection of perfusion abnormalities and reduce the likelihood of mistakenly classifying artifacts as pathological findings in myocardial perfusion SPECT. Societies like ASNC and EANM recommend linear and thus perceptionally uniform CMAPs to prevent effects like pseudo-contouring. However, an equidistant color spacing has not yet been considered, which significantly affects the undistorted representation of measurements. Furthermore, dichromacy, led by deuteranomaly (5% of the male population), is a common condition that can lead to misinterpretations with some CMAPs. ***Materials and Methods:*** The common 16 CMAPs of the Cedars Cardiac Suite QPS/QGS were examined for a linear luminance curve in the CIE L*a*b* color space, which is device-independent and perception-based, thus perceived independently of the origin or reproduction technique under standard lighting conditions. Furthermore, the CMAPs were examined for equidistant color spacing. ΔE00, as defined by the standard CIEDE2000 (ISO/CIE 11664-6), serves as a metric for the visual distance between two colors. Based on the CIE L*a*b* color model, it considers differences in luminance (L*) as well as variations in the chroma components a* and b*. With simulated deuteranomaly, protanomaly, and tritanomaly through the Matpack C++ Numerics and Graphics Library, we checked whether transitions between colors are still noticeable. ***Results:*** Only 1/16 CMAP (thermal) had a nearly linear luminance curve in the CIE L*a*b* color space. The remaining 15 are thus susceptible to erroneous evaluations due to pseudo-contouring. None of the CMAPs have a uniform equidistant color spacing, thus distorting the representation of the measurements. With deuteranomaly, 13/16 color transitions are difficult to differentiate, with protanomaly 13/16, and with tritanomaly 5/16. ***Conclusion:*** None of the tested CMAPs met the societies' recommendations regarding perceptional uniformity. Additionally, equidistance should be considered. Further, Common CMAPs and current recommendations do not account for individuals with dichromacy and can therefore lead to misinterpretations. Since ensuring image quality requires considerable effort, including financially, CMAPs should be included in quality assurance and take dichromacies into account.

EP-0723

Multi-site comparison of imaging protocols for quantitative 99mTc SPECT-CT

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Aim/Introduction: Quantitative SPECT-CT is available from several Gamma Camera vendors, as well as vendor neutral applications. Implementation in clinical practice remains piecemeal and inconsistent, though recent EANM guidelines attempt to address this[1]. There are a range of SPECT-CT systems across six hospitals in NHS Greater Glasgow and Clyde and some variation remains in clinical adoption of quantification. This work aims to investigate variations in [99mTc] quantification between SPECT-CT systems with a view to establishing harmonised quantification protocols. ***Materials and Methods:*** Calibrations of seven SPECT-CT systems were performed for [99mTc] using a uniform SPECT phantom and resulting calibration factors were compared. A NEMA-IEC-2012 phantom was adapted to include

a 60mm diameter sphere, filled to give a sphere-to-background ratio of 5:1 and imaged on each system. Standardised set-up instructions, acquisition protocols and vendor neutral reconstruction protocols were developed and applied to ensure cross-site consistency. Background recovery, based on 60mm diameter spherical VOIs, was assessed. Recovery Coefficient (RC) curves (derived from Max, Mean and Peak measurements in hot spheres) were analysed visually and compared numerically using Mean Contrast Recovery (MCR). Multiple NEMA phantom acquisitions were performed on one system to assess repeatability and reproducibility. This variation was consistent with a ±10% range, hereafter used as an acceptable benchmark for cross-system consistency. ***Results:*** Calibration factors ranged from 78.9-96.2 cps/MBq over the seven systems assessed. Background recovery matched the expected activity concentration to within 6% and was comparable between systems with a maximum difference of 7% (range 0.94-1.01). The RC curves approached maximal recovery with the addition of the 60mm sphere, demonstrating minimisation of partial volume effect with this larger sphere size and reducing uncertainty for RC curve fitting [2]. RC curves from all seven systems fell within the acceptable range derived from the single system repeatability and reproducibility measurements; demonstrating cross-system consistency for standardised acquisition and reconstruction protocols. MCR averages and ranges were found to be comparable between systems [MCRMax: 0.785(0.737-0.815), MCRMean: 0.540(0.507-0.562) and MCRPeak: 0.733(0.646-0.916)]. ***Conclusion:*** RC curves for standardised [99mTc] acquisition and reconstruction protocols demonstrated acceptable cross-system consistency. The addition of a 60mm diameter sphere improved RC curve fit and minimised partial volume effects. Ongoing work will assess city-wide consistency using clinical protocols, including vendor specific reconstructions. ***References:*** [1]Dickson.JC; Armstrong.IS; Gabiña. PM; Denis-Bacelar.AM; Krizsan.AK; Gear.JM; Vanden-Wyngaert.T; de-Geus-Oei.LF; Herrmann.K, EANM practice guideline for quantitative SPECT-CT. EurJNuclMedMolImaging(2022) doi:10.1007/s00259-022-06028-9 [2]Ryu.H; Meikle.SR; Willowson.KP; Eslick.EM; Bailey.DL; Performance evaluation of quantitative SPECT/CT using NEMA-NU 2 PET methodology. PhysMedBiol(2019) 64:doi:10.1088/1361-6560/ab2a22.

EP-0724

Development of Harmonised Quantitative Imaging as a First Step to a Pan-Scotland Dosimetry Service for ^{177}Lu

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Aim/Introduction: The Scottish national service for [177Lu] Oxodotreotide therapies is provided at Gartnavel General Hospital (GGH), delivered as a fixed protocol of four 7.4 GBq fractions. Post-therapy imaging acquired each fraction 24 hours post-administration assesses radiopharmaceutical distribution within the patient. Personal dosimetry has the potential to improve patient outcomes, but is not currently performed at GGH due to the requirements of the fixed protocol. The multi-timepoint quantitative imaging required for optimal personalised dosimetry is not currently practical for patients outwith Glasgow: we aim to set up a pan-Scotland dosimetry service, by imaging patients at more practical local Nuclear Medicine sites. Factors involved in identifying suitable sites include location, camera capabilities, legislative requirements and staffing levels. ***Materials and Methods:*** Three gamma cameras at GGH, Aberdeen Royal Infirmary (ARI) and New Victoria Hospital (NVH) were chosen as pilot sites and calibrated for 177Lu. Prior to phantom preparation, radionuclide calibrator calibration factors at each site were determined for 177Lu using sources traceable to the National Physical Laboratory via the secondary standard radionuclide calibrator at GGH. Locally optimised clinical acquisition parameters were used as standard across all sites. SPECT-CT data were reconstructed using a standardised reconstruction on vendor neutral software. Planar sensitivity factors were determined using a small flat-bottomed flask. SPECT-CT sensitivity factors were determined using a cylindrical uniformity phantom. An image quality phantom adapted to include spheres of diameter 10 to 60 ml, to allow full contrast recovery to be approached, was filled with a 177Lu solution to give a sphere-to-background ratio of 5:1. Mean Recovery coefficient (RC) curves were characterised using Mean Contrast Recovery (MCR), curvature and absolute error, as suggested by Kaalep et al[1]. ***Results:*** Planar calibration factors ranged from 16.3-17.6 cps/MBq. SPECT-CT calibration factors ranged from 20.4-21.4 cps/MBq. Visual appearance of the mean RC curves were similar. Percentage range of MCR, curvature and absolute error of the mean RC curves were 23.3%, 33% and 22.3%, respectively. ***Conclusion:*** Planar and SPECT-CT calibration factors for all cameras were comparable. RC curve analysis has demonstrated similar gamma camera performance. The foundations for harmonised quantitative imaging as part of a pan-Scotland 177Lu dosimetry service have been established; further work using this standardised calibration and imaging protocol will establish calibration factors for gamma cameras at additional sites and trial multi-timepoint imaging and dosimetry of patients. ***References:*** Kaalep.A; Sera.T; Rijnsdorp.S. et al. Feasibility of state of the art PET/CT systems performance harmonisation. EurJNuclMedMolImaging(2018). https://doi.org/10.1007/s00259-018-3977-4.

EP-0725

^{99m}Tc-efficacy of a well-counter - evaluation of different approaches

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Aim/Introduction: The efficacy of a well counter is defined as the ratio of the actual activity in kBq and the measured count rate in cpm of a radioactive sample. The biannual verification of the 99mTc-efficiacy is a regulatory requirement in Germany. Aim of this investigation was to compare different approaches to calculate the 99mTc-efficacy regarding accuracy, managability and radiation protection. ***Materials and Methods:*** Three different approaches (10 series of measurements respectively) were evaluated: 1. a dilution series of 1:1000 in 1 ml H2O in three steps; 2. Dilution of 1:1000 by addition of a volume of 1 ml 99mTc to 999 ml H2O and 3. Preparation of an appropriate 1 ml 99mTc-sample by decay. In each approach, a concentration of 5 kBq/ml (2% deadtime of the well-counter) was aimed for. A well-counter with connected multi-channal-analyser (Dr. Westmeier GmbH) and a dose-meter (ISOMED 2020; MED) were used. Measuring time was 60s in each case. 99mTc efficacy was calculated as the ratio of background corrected count rate (energy window 140 keV ± 20%) and decay corrected 99mTc activity. Results were statistically compared by calculating mean and standard deviation within the three measurement series.

Results: The first method showed a mean 99mTc-efficacy of 48,302 cpm/kBq ± 6.6%. Mean 99mTc-efficacy of the second method was 47,220 cpm/kBq ± 1.9% and the third method showed a mean 99mTc-efficacy of 46,696 cpm/kBq ± 1.1%. Maximum deviation of the three approaches were 13% (1. Approach), 2.4 % (2. Approach) and 2.1 % (3. Approach). ***Conclusion:*** Due to its easiest practical implementation, the lowest risk of contamination and the highest accuracy, method 3 should be favored over the other two methods. In addition, the preparation and implementation is quicker compared to the other methods. Method 2 has the highest potential for contamination and is inferior in terms of handling and preparation time. Method 1 is the most error prone.

EP-0726

The impact of the operator and the software in gated equilibrium radionuclide angiography processing.

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Aim/Introduction: Gated Equilibrium Radionuclide Angiography (ERNA) allows for optimal measurement of ventricular volumes and the evaluation of left ventricle ejection fraction (LVEF) during the course of chemotherapy with potential cardiotoxicity. An accurate LVEF quantification is essential, since a significant serial decrease may dictate the interruption of ongoing chemotherapy. This study aims to evaluate the impact of intraoperator, interoperator and intersoftware variability in LVEF estimation. ***Materials and Methods:*** Retrospective study including all ERNA performed between September 2023 and February 2024 in a tertiary referral hospital. All ERNA with non-standard technical imaging parameters were excluded. Each ERNA was semi-automatically processed three times by 3 independent operators (OP), using two different softwares (FUGA Gated Heart Analysis v6 [Hermes] e MUGA syngo MI Applications VA46C [Siemens]). Statistical Package for the Social Sciences (SPSS) v27 was used for statistical purposes. ***Results:*** One hundred and twenty-six ERNA were included in the final sample and 28 ERNA were excluded. The final sample comprised an oncological population with 94 females (75%) with a mean age of 59 years. The most common cancer was breast cancer (63%), followed by leiomyosarcoma (n=7). Intraoperator measurements were consistent between themselves (ICC > 0,90).Hermes and Siemens ICC were 0.962 (95%CI 0,949-0,972) and 0.983 (95%CI 0,978-0,988), respectively, revealing excellent reproducibility. However, both softwares revealed significant differences between operators, which were higher in the Hermes group: there were significant LVEF differences between OP1-OP3 (mean difference -1,728%) and OP2-OP3 (mean difference +2,071%). In the Siemens group, there were LVEF differences between OP1-OP3 (mean difference +0,738%). The average LVEF estimated by Siemens was significantly higher than the one calculated by Hermes (61,59±8,77 vs. 60,41±8.86%; p-value 0,015). ***Conclusion:*** Although having excellent interoperator repeatability and interoperator reproducibility, there seems to exist some degree of operador-dependency. The higher differences between operators using Hermes software may be explained by higher erroneous region-of-interest (ROI) segmentations than in the Siemens group, inducing more operator-dependent ROI marginalization. The LVEF differences between softwares may be explained by different processing algorithms applied in both softwares. Different algorithms may contribute to unequal ROI segmentations used for LVEF estimation - left ventricle end-systolic and end-diastolic ROI and the background ROI. Therefore, it seems reasonable to include the software used for ERNA processing in medical reports. The current study also highlights the importance of uniformizing the algorithms applied in the different ERNA processing software, in order to make the LVEF a reliable value, operator- and, possibly, software-independent.

EP-0727

Implementation of EARL ^{177}Lu Quantitative SPECT Accreditation on 360° CZT SPECT-CT Camera

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Aim/Introduction: The aim was to apply the SPECT-CT 177Lu accreditation protocol to our new-generation 360° CZT camera, which is not included in the EARL recommendations, in comparison with our standard NaI two-head gamma camera. ***Materials and Methods:*** Radionuclide calibrator was calibrated by a metrology laboratory. The gamma cameras were calibrated for 177Lu, in accordance with the manufacturers' recommendations. The first fantom was a cylinder filled with 400MBq of 177Lu, in order to measure quantitative accuracy for large volumes. The second was an IEC Body NEMA, without the lung insert, whose spheres contained a concentration of 2MBq/mL of 177Lu, in order to measure the spatial resolution, and whose volumes are: Sphere1=27.36cm3, Sphere2=11.24cm3, Sphere3=5.52cm3, Sphere4=2.41cm3, Sphere5=1.20cm3.Acquisitions were carried out on the 2 gamma cameras according to the protocol recommendations: 7 million counts for the 1st phantom, 3 million counts for the second. The reconstructions on the standard gamma camera followed the recommendations of the protocol (CT Attenuation Correction (CTAC), Resolution Modelling (RM), TEW Scatter Correction (TEWSC), 25iterations 2subset (25it2s) and no filtering). For the CZT gamma camera, several parameters were tested in order to obtain results close to that of the NaI camera: Clinical reconstruction: CTAC, 4it8s, convolution filter 0.125mm and High Peak Correction (HPC) 0.2 EARL reconstruction: CTAC, 25it2s, convolution filter 0.125mm. ***Results:*** Quantitative accuracy, measured with a circular volume of interest (VOI) with a diameter equal to 85% of the diameter of the activity distribution in the cylinder gave SUVs at 1.04 for standard camera and 1.05 for CZT camera, with the same phantom filled with 393 MBq of 177Lu. Spatial resolution was assessed by the recovery coefficient (RC) of each sphere. The same phantom, with 2MBq/mL in each sphere, was used.For the standard camera, the RC were 0.97 (sphere1), 0.97 (sphere2), 0.93 (sphere3), 0.93 (sphere4) and 0.59 (sphere5). For CZT camera:Clinical reconstruction: 0.99 (sphere1), 0.85 (sphere2), 0.81 (sphere3), 0.72 (sphere4) and 0.35 (sphere5) EARL reconstruction: 1.01 (sphere1), 0.89 (sphere2), 0.87 (sphere3), 0.82 (sphere4) and 0.39 (sphere5). ***Conclusion:*** The EARL protocol was successfully applied on a CZT 360° gamma-camera with comparable results to a NaI gamma-camera. The same protocol will be tested with the 6 cm sphere replacing the smallest sphere as recommended by EARL.

EP-0728

Evaluation of surface activity detection efficiency for different contamination meters, decay modes and sizes of contaminated area

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Aim/Introduction: Use of open sources in nuclear medicine facilities demand for reliable contamination measurements.

General threshold values for contaminated areas are set to very low surface activity (SA), i.e. from 0.4Bq/cm2 up to 40Bq/cm2. Our aim was to measure and evaluate the sensitivity of two different contamination meters to detect such threshold values with radionuclides with different decay modes. In addition, effect of contaminated area size to sensitivity and quantitative accuracy (Bq/cm2) was evaluated. ***Materials and Methods:*** Two types of contamination meters were measured using four radionuclides with different decay modes: 223Ra, 177Lu, 99mTc and 18F. All the measurements were done for two different distances (2cm and 10cm) and surface areas (1cm2 and 16cm2). Average values over approximately 5s measurement time were used. Accurate SA values were determined based on known activity concentration measured in standard vial geometry using metrologically traceable Secondary Standard Calibrator and prepared with known volumes measured with high accuracy pipettes. Quantitative accuracy was calculated as a difference between measured and known SA values. ***Results:*** Only preliminary results are presented. For 2 cm distance and surface area of 16cm2, lowest detectable SA of 5Bq/cm2 were observed with alpha and beta decay modes, whereas only 1kB/cm2 SA was detected with 99mTc. With 18F, corresponding lowest SA was 12.5Bq/cm2. Quantitative accuracy was the highest for 177Lu with SA between 5-12.5Bq/cm2, ranging from 1.1% to 20.9%. Interestingly, for all radionuclides (99mTc excluded) the most accurate quantitative values were observed with SA of 12.5Bq/cm2.On the other hand, with surface area of 1cm2, the detectable SA was substantially higher (1MBq/cm2) with 99mTc whereas only the highest threshold value of 40Bq/cm2 was detected with 223Ra, 177Lu and 18F. ***Conclusion:*** Sensitivity and accuracy of the contamination measurements are highly dependent on decay mode of radionuclide as well as size of the contaminated area. In practice, small, concentrated contaminations (e.g. 1cm2) can be detected but only with higher SA, whereas lower SA can be detected only in larger contaminated areas. Importantly, optimal performance of contamination meters was observed with alpha and beta emitters, which are the most important decay modes in terms of contamination risks. Use of alpha channel in contamination meters provided only information about the presence of alpha radiation. With positron emitters, the performance of contamination meters was sufficient for clinical settings whereas the detection of low SA was challenging for gamma emitters.

EP-0729

Achieving EARL Accreditation on a Long Axial Field-of-View (LAFOV) PET/CT System

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Aim/Introduction: European Association of Research in Nuclear Medicine (EARL) guidelines aim to standardise PET imaging, particularly in clinical research, but were developed primarily for conventional PET/CT systems. Recent studies at the University Medical Centre Groningen explored a method to adapt EARL standards for long axial field-of-view (LAFOV) systems using high sensitivity (HS) static mode. This study extends the scope by examining ultra-high sensitivity (UHS) configurations and continuous bed motion (CBM) to determine EARL compliance. ***Materials and Methods:*** The NEMA IEC image quality phantom was filled with ^{18}F-fluorodeoxyglucose at a 10:1 spheres: background ratio. The phantom was scanned at five locations along the 106cm LAFOV PET/CT system: at 1/4, 1/3, 1/2, 2/3, and 3/4 of the axial length. Images were acquired in static mode for 5 minutes and with CBM at 2.2 mm/sec, simulating a 5-minute static acquisition. Reconstructions were performed in HS and UHS modes using 3D ordered subset expectation maximization (OSEM) with 4 iterations and 5 subsets, with time-of-flight (TOF) and point spread function (PSF) corrections. Matrix sizes were 220×220 with Gaussian filtering of 4, 5, 6, and 7mm, and 128×128 with filtering of 3, 4, 5 and 6mm. The contrast recovery curves for each sphere were compared against the EARL standards. ***Results:*** Images met EARL standard specifications in both HS and UHS static modes, as well as UHS with CBM. Optimal reconstructions used 3D TOF OSEM with 4 iterations, 5 subsets. For EARL 1, HS static, UHS static and UHS with CBM required matrix sizes and Gaussian filtering of 220×220 and 7mm, 128×128 and 2mm and 128× 128 with 6mm respectively. For EARL 2 UHS static and CBM matrix and Gaussian filters were 220×200 with 4mm and 128×128 with 3mm respectively. Additionally, the improved performance of the LAFOV system meant that the recovery profiles were flat making EARL2 complicated to achieve without significantly reducing image quality. ***Conclusion:*** The study demonstrates that both EARL 1 2 standards are achievable with a LAFOV PET/CT system. This compliance allows these systems to participate in clinical trials that require harmonization with conventional PET/CT cameras, enhancing flexibility in research and clinical practices. ***References:*** Van Sluis J, Van Snick JH, Brouwers AH, Noordzij W, Dierckx RAJO, Borra RJH, Slart RHJA, Lammertsma AA, Glaudemans AWJM, Boellaard R, Tsoumpas C. EARL compliance and imaging optimisation on the Biograph Vision Quadra PET/CT using phantom and clinical data. Eur J Nucl Med Mol Imaging. 2022 Nov;49(13):4652-4660. doi: 10.1007/s00259-022-05919-1.

EP-0730

Dynamic Imaging and Accuracy of Kinetic Analysis on a Long Axial Field-of-View PET/CT System

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Aim/Introduction: Dynamic PET/CT imaging and kinetic analysis hold promise for enhancing patient diagnosis, staging, and treatment planning. However, these techniques have yet to be widely adopted in clinical settings due to extended acquisition times, suboptimal image quality from shorter scans, and the requirement for specialized expertise. New long axial field-of-view (LAFOV) PET/CT systems with sensitivity 20 times higher than conventional scanners, coupled with integrated kinetic analysis software and AI-derived input functions, could reduce acquisition times and bring dynamic imaging and kinetic analysis into mainstream clinical practice. This study explores the image quality of dynamic images using a parsley plant and evaluates the accuracy of kinetic analysis with a phantom. ***Materials and Methods:*** Freshly cut parsley was placed in a cup of water containing 12 MBq of ^{18}F-FDG. A dynamic PET acquisition was performed over 8 hours, and reconstructed using 8-minute time intervals, with an additional reconstruction using 24×5-second frames at 6h to evaluate image quality for shorter scans. Images were analysed qualitatively to assess the uptake pattern and plant movement. For the kinetic analysis, a 500 mL saline bag was placed at the centre of the field of view on the bed and connected to a syringe with 13 MBq of ^{18}F-FDG in 30 mL. An infusion pump delivered the tracer at a rate of 100 mL/hr. Dynamic images were acquired every 30 seconds for 20 minutes. Kinetic analysis was performed using a 1-tissue irreversible compartment model to estimate K1, representing the infusion rate into the bag. Patlak analysis was

also used to confirm the accuracy of the kinetic analysis. ***Results:*** Dynamic images from the parsley plant demonstrated uptake in the stems and leaves over the entire acquisition. In 5-second reconstructions, uptake and movement were clearly observed, demonstrating the high sensitivity of the LAFOV system and potential for accurate kinetic analysis. The kinetic analysis, using both proprietary software and user-defined calculations, accurately estimated the rate of change in activity, confirming the system's reliability for these measurements. ***Conclusion:*** LAFOV dynamic imaging provides exceptional image quality due to its 20-fold sensitivity increase. This study introduces a straightforward method to test proprietary kinetic analysis software before patient use. The potential for these systems to support more accurate and shorter dynamic PET/CT studies in clinical settings is indicated. This improved capability could facilitate broader adoption of dynamic imaging and kinetic analysis in nuclear medicine.

EP-0731

Optimisation of Ga-68 DOTATATE Imaging on a Long Axial Field-of-View PET/CT

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Aim/Introduction: Ga-68 DOTATATE is a radiopharmaceutical used in PET/CT imaging to detect and localise neuroendocrine tumours (NETs) and other tumours expressing somatostatin receptors. Patients are typically injected with 100-200 MBq of Ga-68 DOTATATE and imaged at 3 minutes per bed position on a standard PET/CT system. Due to the technical expertise and time required to produce Ga-68 DOTATATE, and associated costs, the supply of this essential radiotracer is limited, leading to high demand and long waiting lists. Long axial field-of-view (LAFOV) PET/CT scanners, with 20 times the sensitivity of conventional scanners, offer the opportunity to reduce injected activity and acquisition times, increasing throughput, reducing waiting times, and improving patient outcomes. This study aims to optimise the imaging regime to keep injected activity low while maintaining minimal acquisition times. ***Materials and Methods:*** Images of 25 patients undergoing Ga-68 DOTATATE studies on the LAFOV PET/CT as part of standard care were analysed. Patients received 100-200 MBq of Ga-68 DOTATATE and were imaged in static mode, acquired in ultra high sensitivity (UHS) configuration. To explore reduced activity, shorter image acquisition times were tested. Images were reconstructed with 10-minute acquisition (no filter), 5-minute acquisition (no filter), 5-minute acquisition with a 2mm Gaussian filter, and 5-minute acquisition with a 5mm Gaussian filter. All reconstructions utilised OSEM with 4 iterations, 5 subsets, a 440x440x708mm matrix, point spread function (PSF), and time-of-flight (TOF) corrections. Experienced nuclear medicine radiologists evaluated the images based on the number of lesions seen, number of liver lesions, overall diagnostic quality, and liver diagnostic quality using a 5-point scale: seriously inadequate, inadequate, marginally adequate, definitely adequate, and more than adequate. Quantitative noise measurements were taken from the liver. ***Results:*** Images acquired with a 5-minute acquisition and no filter were diagnostic but noisier compared to the 10-minute acquisition. The addition of a Gaussian filter reduced noise, with the 2mm filter considered optimal to avoid over-smoothing. Quantitative noise measurements indicated that the 5-minute acquisition with a 2mm Gaussian filter had equivalent noise to the 10-minute acquisition. These findings suggest that reducing injected activity by up to 50% while maintaining a 10-minute scan duration can yield diagnostic-quality images, allowing patient throughput to double. ***Conclusion:*** Ga-68 DOTATATE throughput can be doubled by reducing injected activity by half and imaging for 10 minutes on a LAFOV PET/CT scanner. This optimisation provides a significant opportunity to reduce waiting times and increase efficiency while maintaining diagnostic image quality.

EP-0732

Acceptance Testing of a Long Axial Field-of-View PET/CT Scanner

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Aim/Introduction: The Royal Free Hospital has acquired the UK's first Long Axial Field-of-View (LAFOV) PET/CT scanner, providing greater sensitivity and broader coverage (106cm axial FOV) compared to standard PET/CT scanners. This study aims to characterise the performance of this scanner, including new modes of acquisition such as ultra-high sensitivity (UHS) with a maximum ring distance (MRD) of 322 and continuous bed motion (CBM), alongside traditional high-sensitivity (HS) mode with an MRD of 85. ***Materials and Methods:*** Standard performance testing was conducted according to the National Electrical Manufacturers Association (NEMA) NU2-2018 guidelines and compared to manufacturer specifications. Additional tests were performed to characterise performance across the entire FOV, including extended sensitivity measurements and NEMA scatter and accuracy with lengths greater than the axial FOV. Spatial resolution tests, image quality assessments using the NEMA IEC phantom, and SUV validation measurements were performed at ¼, 1/3, ½, 2/3 and ¾ of the FOV with both static and CBM acquisitions to identify any variations. ***Results:*** Performance metrics were evaluated for HS and UHS modes, as well as for static and CBM . In UHS mode, sensitivity measurements showed a 20-fold increase over standard PET/CT scanners, and contrast resolution improved by 30% on average across the FOV. Spatial resolution also improved, with no significant differences observed between static and CBM modes in UHS configuration. Noise equivalent count rate (NECR) increased by 15 times compared to standard scanners. Variations in contrast recovery were noted between static and CBM in HS mode, while UHS mode displayed consistent results across both acquisition methods. ***Conclusion:*** The adaptation of current NEMA testing protocols to evaluate LAFOV PET/CT scanners presents challenges, but the results indicate substantial benefits in terms of sensitivity, contrast resolution, and spatial resolution. The consistency in spatial resolution between static and CBM modes in UHS configuration suggests versatility for clinical applications. The findings underscore the robust and adaptable performance of the LAFOV PET/CT scanner, offering a reliable solution for clinical imaging with expanded coverage and increased sensitivity. ***References:*** Prenosil et. al,. Performance characteristics of the Biograph Vision Quadra PET/CT system with a long axial field of view using the NEMA NU 2-2018 standard. Journal of Nuclear Medicine, 63(3), 476-484. https://doi.org/10.2967/jnumed.121.261972Spencer, et. al, (2021). Performance evaluation of the uEXPLORER total-body PET/CT scanner based on NEMA NU 2-2018 with additional tests to characterize PET scanners with a long axial field of view. Journal of Nuclear Medicine, 62(6), 861-870. https://doi.org/10.2967/jnumed.120.250597.

EP-0733

Artifacts caused be the spillover effect in dynamic SPECT studies - prevalence and preliminary assessment of possible methods of elimination

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Aim/Introduction: Calculation of myocardial blood flow (MBF) and myocardial flow reserve (MFR) in dynamic PET and SPECT studies requires applying certain corrections taking into account such factors as partial volume effect and spillover effect. Two models used in such calculations - net retention (RET) and one compartment (1CM), apply these corrections in different ways. RET applies constant correction for the whole myocardium, while 1CM relies on more detailed corrections calculated for each segment separately. During assessment of dynamic SPECT studies in 1CM model, in certain patients we observed spots of abnormally high activity on high resolution blood flow polar maps (reaching max level on the default color scale), that clearly stood out from activity in adjacent segments and ware not visible in RET model. These spots are most likely artifacts caused by the spillover effect and can potentially affect MBF and MFR values, so assessing their prevalence was considered necessary. ***Materials and Methods:*** High resolution blood flow polar maps generated by Corridor 4DM software (v2024) from dynamic SPECT studies of 107 patients with coronary artery disease were analyzed retrospectively. ***Results:*** Spots of abnormally high activity were found in approximately half of the assessed patients (52/107), most often in the vicinity of the apical part of the inferior wall and basal part of the septum. These areas are mostly assigned to the RCA vascular territory. In G-SPECT studies, these areas often appeared in the vicinity of myocardial segments with poor contractility and/or thickening, like membranous part of the septum or post-infarction scars. Methods of eliminating or minimizing these artifacts are the subject of an ongoing research, but our preliminary findings indicate that they can be reduced by correcting heart motion and improving the fit of activity in left ventricle cavity to the edges of its contour. Also, influence of manual heart motion correction on the extent of these artifacts may be one of the factors causing lower interobserver repeatability of MBF and MFR values in 1CM model, that we observed in our studies (especially in RCA territory). ***Conclusion:*** Artifacts caused by spillover effect can be observed on high resolution blood flow polar maps in 1CM model. This may be a useful information for study quality control, as our preliminary observations suggest that manual heart motion correction can reduce their extent. Influence of these artifacts on MBF and MFR values and potential methods of their elimination will be further investigated.

EP-0734

Evaluation of NEMA performance of two 3D ring-design digital SPECT/CT systems

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Aim/Introduction: Recently, ring-design general-purpose whole-body CZT digital SPECT/CT systems have been developed for clinical use. The systems consist of 12 narrow digital detectors arranged in a 3D ring geometry. They could potentially be an alternative for conventional dual-head analog SPECT/CT systems. In this study, the performance of two 3D digital SPECT/CT systems from different vendors were evaluated in accordance with vendors' NEMA instructions and NEMA NU 1-2018 publication. ***Materials and Methods:*** Both systems contain tungsten parallel-hole collimators registered with the CZT detector pixels of 2.46 mm. The systems have axial field-of-views (FOV) of 27.5 and 31.4 cm and sweeping/swiveling motion of detector heads enables the coverage of entire transaxial FOV. In addition, detector and collimator design between the systems includes differences. Our NEMA tests focus on the SPECT imaging performance of the systems. The following tests were carried out; energy resolution, flood field uniformity, count rate performance in air, SPECT reconstructed spatial resolution without and with scatter, system volume sensitivity (SVS), and tomographic contrast and absolute quantification accuracy. The tests were performed using 99mTc nuclide and the stopping conditions, energy window settings, detector motion settings, test equipment and source activities were attempted to be standardized between the two systems in all the tests. SPECT data were reconstructed in both systems using a basic iterative OSEM algorithm with 10 iterations, 15-16 subsets and CT-attenuation correction. Data were analysed according to NEMA instructions using a same vendor-neutral software for both systems, except vendor provided code for energy resolution. ***Results:*** According to the preliminary analysis, mean energy resolution for 99mTc over all 12 detectors was 5.1 and 5.4% for the different systems. The count rate in air decreased highly linearly with the decreasing activity, showing no dead-time in the digital CZT detectors. SPECT reconstructed spatial resolutions without scatter ranged between 2.7-3.9 mm and 2.9-5.3 mm for the different systems. Corresponding results with scatter ranged between 3.5-5.1 mm and 3.1-5.2 mm. Calculated SVS was 523.7 kcps/(MBq/cm3) and 798.0 kcps/(MBq/cm3) for the two systems. ***Conclusion:*** Other system showed a better performance in energy resolution. There were some small differences in reconstructed spatial resolution between the systems. However, both systems showed slightly lower spatial resolution values than previously reported maybe due to differences in the reconstruction parameters. SVS was higher in the other system. These performance differences may be caused by differences in detector and collimator design.

EP-0735

Benefits of Digital SiPM PET/CT Technology in Nuclear Medicine Clinical Practice: a Systematic Review by the Italian Association of Nuclear Medicine (AIMN) HTA Working Group

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Aim/Introduction: Fully digital PET (dPET) systems with solid state detectors have several technical advantages over analog PET (aPET) systems with photomultiplier tubes, holding potential for more accurate quantification and earlier disease localization. This review aimed to summarize the current literature evidence about the clinical advantages offered by dPET technology. ***Materials and Methods:*** The PubMed/MEDLINE and Embase databases were sistematically searched according to PRISMA guidelines. The methodological quality of full-text articles was independently assessed by four authors using the Critical-Appraisal-Skills-Programme (CASP) Diagnostic Study checklist. ***Results:*** 81 articles on both oncological (n=42) and benign diseases (n=39) were included. In early-recurrent prostate cancer (PCa) (PSA range <0.5 and 0.5-2.0 ng/ml), PSMA dPET has shown a significantly higher detection rate compared to aPET especially in smaller lesions, with excellent interrater reliability. These results mirror the experience from an Italian center on 440 Pca patients, with higher dPET detection rate for both PSA 0.2-0.5 ng/ml (39.0% vs 25.2%) and 0.5-1.0 ng/ml (63.2% vs 40.8%). dPET higher image quality and lesion detectability was also confirmed in other mixed-cohorts oncological FDG studies, where metabolic TNM upstaging occurred in up to 32% of cases compared to aPET. Improvements thanks to dPET technology were also reported in the localization of in-transit metastases in melanoma, the staging of oral squamous cell carcinoma, 68Ga-DOTA-TATE imaging in NET patients and 124I imaging in differentiated thyroid carcinoma recurrence. The enhanced sensitivity of dPET can however increase the risk of false positive findings (e.g., unspecific bone uptake in PSMA-1007 imaging) and the variability of SUVmax and radiomic features in multi-scanner studies. In non-oncological diseases, dPET achieved a significantly higher positivity rate in localizing hyperfunctioning parathyroid glands (91% vs 69%), especially subcentimetric. dPET was also shown to improve the sensitivity of semiquantitative analysis in neurodegenerative diseases, as well as the accuracy of 82Rb myocardial blood-flow quantification thus further advancing the diagnostic and prognostic role of molecular imaging in coronary artery disease. Finally, dPET allowed the optimization of imaging protocols by reducing administered activities and/or scan times. A 3/3.5-fold reduced scan time was proven feasible in FDG/DOTA/PSMA imaging, thus allowing to limit radiation exposure (especially in younger patients), lower imaging costs and increase patient throughput. ***Conclusion:*** dPET has shown a diagnostic advantage over aPET in a variety of oncological and benign settings, where the earlier and more accurate disease localization and characterization could have relevant implications for optimal patient management.

P-0736

Validation under simulated analytical conditions of PETKinetiX, software for 4D PET voxelwise kinetic modeling at the whole FOV level

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Aim/Introduction: The performance of a new academic software for fast parametric 4D-PET imaging, called PETKinetiX (1), is validated under simulated analytical conditions on a digital phantom. ***Materials and Methods:*** 4D-PET thoracic data were simulated from a reference digital phantom (XCAT) and realistic time-activity curves (TACs). These TACs, of whom the parameters K1, k2, k3 and Vb are known (groundtruth), were extracted from real-life practice 18F-FDG 4D-PET data (SAFOV PET/MR device). A total of 100 analytical simulations have been reconstructed using CASToR, an open-source software for tomographic reconstruction : without noise and with noise fulfilling the clinical characteristics of two available SAFOV and LAFOV PET systems. All these data were processed with PETKinetiX (IDIF approach) to generate kinetic parametric maps of 18F-FDG according to the simplified Patlak model (Ki and Vb) and the irreversible two-compartment model (2TCM: k1, k2, k3, Vb and Ki= k1 *k3/(k2+k3)). For each simulation, regions of interest were drawn within several organs of interest and the mean bias of PETKinetiX was computed as follows : Bias (%) = |(PETKinetiX – Ground truth) / Ground truth|×100. For data simulated with clinical noise, biases were compared to those observed in corresponding SUV data. ***Results:*** When applied to noise-free data, PETKinetiX provided kinetic parametric maps with biases less than 4% for all estimated kinetic parameters (Patlak and 2TCM). On the noisy data, the biases observed on the parametric maps generated with PETKinetiX diverged by 4 to 26% compared to the intrinsic variability observed in corresponding SUV data. This level of bias was at least two-times lower for LAFOV images than for SAFOV images, depending on the organ, and similarly impacted PETKinetiX parametric maps and SUV data. ***Conclusion:*** PETKinetiX generates robust kinetic modeling parametric maps, validating its performance under controlled noise-free and noisy simulated conditions. The magnitude of biases is similar to these observed with standard SUV data. ***References:*** (1) PET KinetiX-A Software Solution for PET Parametric Imaging at the Whole Field of View Level. J Imaging Inform Med. 2024 Apr;37(2):842-850. doi: 10.1007/s10278-023-00965-z. Epub 2024 Jan 10.

EP-0737

STANDARDIZATION IN PRE-IMAGING PROTOCOLS IN FOLLOW UP ^{18}FDG PET/CT STUDIES IN LYMPHOMA PATIENTS; REASONS BEYOND BENCHMARK

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Aim/Introduction: The standardization is necessary for the utilization of quantitative ^{18}FDG PET/CT as an imaging biomarker. Routine assessment by regular clinical audits of facilities performing ^{18}FDG PET/CT are crucial for ensuring compliance with standardized pre-imaging protocols and minimizing deviations from established benchmarks. Objectives: Determine the compliance with standardized pre-imaging protocols for follow-up ^{18}FDG-PET/CT studies in lymphoma patients and to determine the deviation(s) beyond established benchmarks. ***Materials and Methods:*** This is a retrospective study that was conducted at PET/CT section of Radiology department of Aga Khan University (AKU) and duly exempted from review by the ethical review committee in February-2023. The 52 lymphoma patients had undergone baseline and interim ^{18}FDG PET/CT from timeframe of 2021-2022 were included. The demographics and pre-imaging protocols,

including the ^{18}FDG dose, hepatic SUVmean (Standardized uptake value) and uptake time were retrieved. The compliance of standardized imaging protocol in the follow-up ^{18}FDG PET/CT was calculated against 85% benchmark as one of the key performance indicators (KPIs) in the department of set for JCIA (Joint Commission International Accreditation) standards. Any significant deviations in compliance from KPI were analyzed. ***Results:*** In follow-up ^{18}FDG-PET/CT studies, no significant differences were observed in demographic and pre-imaging parameters. The compliance rates for ^{18}FDG dose and hepatic SUVmean were 86%, surpassing the 85% benchmark as per institutional KPI. Conversely, there was a deficiency in adherence to the institutional benchmark for uptake time, with a compliance of 80% compared to the required 85%. ***Conclusion:*** The study findings indicate commendable adherence to standardization in pre-imaging protocols of ^{18}FDG dose and hepatic SUVmean for serial ^{18}FDG PET/CT examinations in accordance with international and institutional benchmarks. However, sub-standardization in compliance was observed in uptake time between ^{18}FDG injection and scanning beyond institutional KPI, especially delays associated with the positioning of bed-bound and unplanned prolonged radiation planning patients.

EP-0738

Performance evaluation of a high-resolution, dual-head animal SPECT system (HiReSPECT II) based on the NEMA NU1-2018 standard

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Aim/Introduction: Animal SPECT imaging is crucial in developing radiopharmaceuticals and researching disease treatments in the preclinical phase. For this purpose, the "HiReSPECT II" was developed in our center based on pixelated crystal and SiPM. ***Materials and Methods:*** The "HiReSPECT II" has two detectors, each detector consisting of a 95.2*95.2*5 mm3 pixelated CsI (Na) crystal (consisting of a 68*68 array with a pixel size of 1.4*1.4 mm2) with a 3mm light guide glass coupled to four SiPM modules with dimensions of 50.4*50.4 mm2 (each SiPM includes 12*12 photodiodes with dimensions of 3 mm and 4.2 mm pitch). Since HiReSPECT II is designed for SPECT imaging of small animals, it benefits from a suitable field of view (FOV) for imaging both mice and rats. Due to the use of SiPM photodiodes, the system is provided with higher resolution compared to similar systems with PSPMTs. Considering that no standard has been provided to measure the performance of the animal SPECT device, a series of protocols were designed based on the modified NEMA NU1-2018 clinical standard and have been used to measure the system's parameters. All of the physical parameters mentioned in NEMA were assessed with custom-made phantoms to match the detector's small dimensions. For example, the planar performance of the system was investigated by different phantoms such as a special lead mask to evaluate the intrinsic special linearity, and a point source to assess the intrinsic energy resolution. The system's sensitivity was evaluated employing a cylindrical phantom and the system's spatial resolution was measured by a capillary tube respectively, in terms of different distances. ***Results:*** The results show that the intrinsic absolute linearity is about 0.04 mm and the intrinsic differential linearity is 0.2 mm. The integral uniformity after correction is 2.9% in UFOV and 2.8% in CFOV. The differential uniformity after correction is 2.3. System sensitivity was 1.2 cps/μCi. Tomographic spatial resolution is ~4 mm in 30mm ROR. Note that the data shown here comes from a LEAP collimator, with ongoing measurements being conducted for the LEHR collimator. ***Conclusion:*** This study presents a modified protocol based on NEMA for performance evaluation of pixelated gamma cameras. Our pixelated animal SPECT tested with recent protocol and realized that the camera is suitable for preclinical research. ***References:*** NEMA NU 1-2018 Performance Measurements of Gamma Camera. Rosslyn, VA: National Electrical Manufacturers Association.

EP-0739

Y-90 quantification in PET-CT: mini-phantom experiment with induced respiratory motion

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Aim/Introduction: Yttrium-90 is used in molecular radiotherapy, and it is notoriously difficult to measure. Post-therapy imaging for dosimetric quantification is often performed with PET-CT. In this work, we aimed to study partial volume effect (PVE) in small volumes of interest (VOI; V<20 ml) using activity concentrations (~1 MBq/ml) encountered in patient treatments. PVE rises from the finite resolution of the imaging system, but post-processing factors may contribute as well; also, patient-related matters such as respiratory motion may add to it. ***Materials and Methods:*** We 3D-printed three spherical mini-phantoms (MP) and filled them with Y-90 chloride solution: MP1 inner diameter d=15 mm and activity A=1.7 MBq, MP2 d=20 mm and A=3.4 MBq, and MP3 d=30 mm and A=10.2 MBq. Activity was determined using precision scale and double-checked using radionuclide calibrator. The MPs were placed inside a liver insert of a dynamic anthropomorphic phantom with surrogate breathing platform. The images of the phantom were then acquired with PET-CT using patient protocol for Y-90 post-therapy imaging: first without motion, and secondly with breathing-like motion: with optical respiratory gating technique and without it. The images were reconstructed and analyzed to determine the activities in the MPs. ***Results:*** Firstly, we determined the activity in a large VOI (1500 cm3) drawn around the whole liver insert on the static image: 15.1 MBq, matching very closely (-2%) to the sum of the activities in the MPs. When VOIs were drawn to contain the liquid volume in each MP, the results were: MP1 0.49 MBq (-71%), MP2 1.5 MBq (-55%), and MP3 6.3 MBq (-39%), matching recovery coefficient curves in literature [1]. For breathing-like motion (sequence: cos6θ, amplitude 10 mm, period 5 s), the activities appeared MP1 0.30 MBq (-82%), MP2 0.95 MBq (-72%), and MP3 5.3 MBq (-47%). When respiratory gating was applied, MP1 0.49 MBq (-71%; -1% difference compared to the static case), MP2 1.5 MBq (-56%; -5%), and MP3 6.8 MBq (-33%; +9%). We plan to present more measurement data using different breathing patterns, and to perform imaging with PET-MRI and Bremsstrahlung-SPECT-CT for comparison. ***Conclusion:*** Breathing adds up to the already high-level partial volume effect in PET-CT Y-90 imaging. In this work, we studied how well resolution can be recovered using optical respiratory gating technique: the results were within ±10%. To assess the level of reliability, more data is needed. ***References:*** 1. Van, B.J., Dewaraja, Y.K., Sangogo, M.L. et al. EJNMMI Phys 8, 45 (2021).

EP-0740

Verification of quantitative performance of a preclinical PET-CT system for ^{89}Zr.

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Aim/Introduction: Pre-clinical imaging of various 89Zr labelled mAbs in animals has been particularly widespread in recent years [1]. Many of the studies have highlighted the advantages of 89Zr over shorter lived radiometals such as 68Ga or 18F [2]. It allows the tracking of mAbs over extended periods of time, and thus the development of a better understanding of uptake and long-term residency times. This study investigated the quantitative accuracy of a preclinical PET-CT camera for 18F and 89Zr using readily available calibration objects. ***Materials and Methods:*** The system was initially calibrated following the manufacturer's recommended protocol using traceable solutions of 18F. Verification measurements using traceably filled syringes and quality control phantoms with both 18F and 89Zr were made. Measurements were made over several half lives to test system stability and establish accuracy over a range of activities. Daily QC measurements were preformed to monitor system stability over the measurement period. ***Results:*** The system was found to have a stability of 1.2 %. The system was able to resolve the activity in an 18F syringe to within 0.1 % of the calibrated activity with results for 89Zr showing a 4 % positive bias. An estimate of the overall uncertainty on the activity in the recovered images was 5.3 %. Recovery coefficient curves were generated for both radionuclides and showed good comparisons to other published works[3]. ***Conclusion:*** The study demonstrated that activity recovery for two radionuclides was accurate to within 4 % for measurements between 10 MBq and 5 kBq (total object activity). A detailed study into activity recovery for lower activities gave quantifiable limits of detection for objects below certain size. An uncertainty assessment was made and some critical components were assessed, however further work is required in this area to build a more robust uncertainty assessment for reconstructed PET images. ***References:*** 1. Deri MA, Zeglis BM, Francesconi LC, Lewis JS. PET imaging with 89Zr: From radiochemistry to the clinic. Nuclear Medicine and Biology. 2013;40:3-14. 2. Baur B, Andreolli E, Al-Momani E, Malik N, Machulla H-J, Reske SN, et al. Synthesis and labelling of Df-DUPA-Pep with gallium-68 and zirconium-89 as new PSMA ligands. Journal of Radioanalytical and Nuclear Chemistry. 2014;299:1715-21. 3. Bradshaw TJ, Voorbach MJ, Reuter DR, Giamis AM, Mudd SR, Beaver JD. Image quality of Zr-89 PET imaging in the Siemens microPET Focus 220 preclinical scanner. Mol Imaging Biol. 2016;18:377-85.

EP-0741

Me, Myself and My calibrator: An update to the NPL good practice guide for calibrator operation and quality assurance

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Aim/Introduction: Radionuclide Calibrators are the backbone of any nuclear medicine department, providing accurate activity measurements for virtually all procedures in the department. Their maintenance and quality assurance should be a high priority for any nuclear medicine team to ensure patient safety and diagnostic or therapeutic accuracy. From trainee to consultant level, everyone should take a vested interest in the maintenance of these devices and thankfully it does not need to be an onerous task! ***Materials and Methods:*** The UKs National Physical Laboratory (NPL) has recently revitalised its good practice guide (known as GPG93) which provides a protocol for establishing and maintaining the calibration of medical radionuclide calibrators and their quality control. ***Results:*** The guide includes comprehensive descriptions of how a calibrator operates and covers the daily use and maintenance of radionuclide calibrators. The guide also includes extensive information relating to acceptance testing, daily and annual quality tests and special measurement processes such as the appropriate use of copper filters. ***Conclusion:*** The guide is available now and is accompanied by an online training course and both can be used as training materials for new (or experienced) staff. Both the guide and online course are free to download and have already been used by more than 500 students globally. ***References:*** 1. Parkin A, Sephton JP, Aird EGA, Hannan J, Simpson AE, Woods MJ. IPSM Report 65: Protocol for Establishing and Maintaining the Calibration of Medical Radionuclide Calibrators and their Quality Control. Proceedings of the joint IPSM/BIR Meeting on Quality Standards in Nuclear Medicine. London: IPSM; 1992. 2. Establishing and maintaining the calibration of medical radionuclide calibrators GPG93 [Internet]. NPLWebsite. [cited 2024 May 2]. Available from: https://www.npl.co.uk/gpgs/maintaining-the-calibration-medical-radionuclide

EP-51

e-Poster Area

D: Technical Studies -> D2 Data Analysis -> D21 Data Analysis in Neuro and Cardio

EP-0742

Value of single-harmonic Fourier curve fitting analysis on myocardial wall thickening signal for extraction of phase and amplitude of myocardial wall contraction during synchrony assessment by myocardial perfusion imaging

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Aim/Introduction: To evaluate the effect of single- or first-harmonic Fourier curve fitting in the enhancement of temporal resolution and consequently estimation of phase and amplitude of myocardial wall thickening curve for different levels of frame rate and phase shift. ***Materials and Methods:*** A typical signal of myocardial wall thickening spanning between two consecutive R waves or one cardiac cycle is generated. The original reference signal is shifted circularly to various amounts in time (0°, 2.8125°, 5.625°, 11.25°, 22.5°, and 45.0° from a 360-degree cardiac cycle). The non-shifted and shifted signals are resampled in 8, 16, 32, 64, and 128 intervals. In addition to raw noisy data, smoothed data are also created. The raw noisy and smoothed data are fitted to a first- or single-harmonic Fourier curve-fitting model and amplitude and phase of each one are calculated. ***Results:*** The estimated values of amplitude based on noisy raw data are relatively the same for all amounts of shift (0° to 45°) in all frame rates. Conversely, based on temporally-smoothed data, the amplitude is remarkably underestimated in 8-frame sampling in all amounts of shift and gradually approaches the true value

of amplitude. Likewise, the estimation of phase closely depends on frame rate. As the frame rate increases from 8 to 128, the curve approaches the actual value of shift. This pattern is almost consistent for all amounts of shift. The highest amount of error is for frame rate of 8. The value of amplitude is properly estimated for noisy raw data for all frame rates but is slightly underestimated in temporally-smoothed data, more prominently in frame rate of 8. The estimated value of phase, in 8-frame sampling, is highly variable. However, in frame rates of 16 or higher, the estimation shows a consistent pattern from no shift to 45° shift. ***Conclusion:*** The lowest accuracy in the estimation of phase was for frame rate of 8 and then 16. Smoothing of data profoundly worsens the estimates and is discouraged. In estimation of amplitude, for all frame rates, a good level of accuracy is observed. For frame rate of 16, using this method enhances the estimation of phase to a resolution, on average, of frame rate 1/32. For frame rate 32, good agreement is present between estimated and actual phases and thus is the preferable option in phase analysis if feasible for local SPECT facility.

EP-0743

Image quality evaluation in brain study when varyingreconstruction parameters by using a Digital PET/CT in Costa Rica

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Aim/Introduction: The the first digital PET/CT has been installed in Central America, at the University of Costa Rica. Then, it's fundamental to understand its capabilities for different studies by using ^{18}F-FDG. In Costa Rica this device is used for oncologic diagnosis, but there is an increase motivation from different neurology departments that this equipment can also be used for brain studies. Brain images can be affected by noise when different reconstruction parameters are employed. Then, depending on reconstruction method applied the signal-to-noise ratio (SNR), contrast-to-noise ratio (CNR), background variability (%BV) and image roughness (%IR) are degraded. ***Materials and Methods:*** One brain protocol from the Biograph Vision 450 PET/CT was selected. The Striatal RSD phantom is used where the putamen and left caudate nucleus function as high uptake regions and the brain shell as a background region. One bed acquisition with times 1, 2, 3, 4, 5 min were employed. For all case one bed image was employed. Reconstruction method is performed in combination with the following parameters: iterations of 1,4,6,10,20,30,40, 5 subsets, gaussian filters of 3mm,5mm,10mm and all pass filter, matrix size 880 x 880. SNR, CNR, %BV, %IR are evaluated by creating several regions of interest from the generated images. Fiji software was employed to study those images. ***Results:*** SNR increases as the number of iterations increases. SNR decrease when increasing the gaussian filters. When Gaussian filter of 10 mm is used, SNR does not change from 10 iterations onwards. SNR is not affected by acquisition time. CNR decrease as the number of iterations increases. The highest CNR occurs for the highest gaussian filter. CNR increases when acquisition time increases.%IR increases as the number of iterations increases. %IR decreases as the Gaussian filter increases. If all pass filter is used, %IR increases importantly. %IR decreases as the acquisition time increases.%BV increases as the number of iterations increases. %BV decreases as the gaussian filter increases. If all pass filter is used, %BV increases importantly. %BV decreases as the acquisition time increases. ***Conclusion:*** An initial evaluation of the effect of reconstruction parameters in brain studies protocols using a digital PET/CT was carried out. Further studies will occur with to assess the "best imaged quality" according to reconstruction parameters employed and also by using the Hoffman Brain Phantom. ***References:*** Tong, S., Alessio, A., & Kinahan, P. (2010). Noise and signal properties in PSF-based fully 3D PET image reconstruction: an experimental evaluation. doi.org/10.1088/0031-9155/55/5/013.

EP-0744

A novel two-step unsupervised machine learning clustering strategy for the identification of PET/MR-based biomarkers in arrhythmogenic cardiomyopathy. Preliminary study

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Aim/Introduction: Tissue characterization by magnetic resonance (MR) late-gadolinium enhancement (LGE) is a major diagnostic criterion in arrythmogenic cardiomyopathy (AC), assessing myocardial fibrosis, but it suffers from the inherent limitation of being only qualitative. Studies have shown the complementary value of PET in identifying markers of myocardial inflammation which is a prevalent aspect in patients with AC and a poor prognostic marker in cardiomyopathy. This preliminary study aims to demonstrate the potential of simultaneous PET/MR and inter-patient data linkage in the discovery of novel regional markers of AC, overcoming the inherent limitations of qualitative sequences. ***Materials and Methods:*** Two-step clustering was applied to T1 and T2 maps, LGE and 18F-FDG-PET images of 14 patients genetically diagnosed with AC pathogenic variants. Left ventricular (LV) myocardial segmentation was performed semi-automatically on the LGE images. Images were z-scored, summed and clustered into supervoxels using SLIC, a k-means based algorithm, independently for each patient. Abnormal supervoxels with extreme relaxation times were excluded. Data from all patients within the LV were then pooled and Box-Cox transformed. Twenty-five inter-patient groups of supervoxels were obtained by spectral clustering. The ratios of each cluster per patient were then used to hierarchically group patients into different profiles. Additionally, an "abnormality" score was assigned to each cluster for each modality, calculated as a distance from its median compared to a "healthy" reference cluster. These scores were then used to visualize the abnormal, likely diseased areas on each patient's imaging data, and to generate health reports for each patient, which were compared with the physicians' reports using balanced accuracy (BA). ***Results:*** The reports generated by clustering allowed for an accurate representation of the proportions of hyper-signal combinations per patient, while identifying most of the cardiac imagers observations (BA=0.65). Furthermore, the identified abnormal clusters closely matched their visual observations, facilitating the identification of varying degrees of fibrosis or inflammation intensity on the images. ***Conclusion:*** This framework provides a new approach to visualizing and quantifying diseased areas within the LV of AC patients. Through its inter-patient nature, this method overcomes the non-quantitative aspects of LGE, bringing new perspectives to the analysis of PET/MR images in AC. It then provides an encouraging first step towards identifying clusters of prognostic value through supervised clustering and the identification of specific patient profiles. Future plans include evaluating the approach in a larger cohort. ***References:*** Hansen et al. EXPERT SYST APPL (2021). Protonotarios, Wicks, Int. J. Cardiol. (2023).

EP-0745

Clinical Impact of a Data-Driven Motion-Compensated PET Brain Image Reconstruction Algorithm

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Aim/Introduction: Patients with dementia symptoms struggle to remain still during PET examinations, necessitating motion compensation in brain PET imaging to ensure the high image quality needed for diagnostic accuracy. This study validates a novel data-driven motion-compensated (MoCo) PET brain image reconstruction algorithm that corrects head motion by integrating the detected motion frames and their associated rigid body transformations into the iterative image reconstruction. Validation was conducted using phantom scans, healthy volunteers, and clinical patients. ***Materials and Methods:*** We conducted a technical validation of the method with Hoffman brain phantom filled with $^{[18F]}$FDG and scanned on a PET/CT scanner (26.3cm FOV, 214ps TOF) during a series of controlled movements. Then, we did two blinded reader studies assessing image quality between standard uncorrected images and MoCo images in 38 clinical patients undergoing dementia scans with $^{[18F]}$FDG, $^{[18F]}$N-(3-iodopro-2E-enyl)-2beta-carbomethoxy-3beta-(4'-methylphenyl)-nortropane, or $^{[18F]}$flutemetamol, and a group of 25 elderly subjects scanned with $^{[18F]}$fluoroethoxybenzovesamicol for a research project. ***Results:*** The technical validation showed that the algorithm detected and corrected for even minimal movements, 1-mm translations and 1^0 rotations, applied to the phantom. In the clinical cohort whose standard images were deemed to be of suboptimal or non-diagnostic quality, all MoCo images were classified as having acceptable diagnostic quality. In the research cohort, MoCo images consistently matched or surpassed the image quality of standard images even in cases with minimal head movement, and the MoCo algorithm never led to degraded image quality. ***Conclusion:*** The PET brain MoCo reconstruction algorithm was robust and worked well for four different tracers with markedly different uptake patterns. Moco Images enhanced diagnostic accuracy for patients who were unable to lie still during a PET examination and obviated the need for repeat scans. Thus, the method was clinically feasible to use and had a clear clinical impact.

EP-0746

^{11}C-CFT PET brain imaging in Parkinson's Disease using a total-body PET/CT scanner

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Aim/Introduction: This study aimed to evaluate the feasibility of and explore the optimal scan duration to guide the clinical practice. ***Materials and Methods:*** Thirty-two patients with Parkinson's disease (PD) performing 11C-CFT PET/CT brain imaging using a total-body PET/CT scanner were retrospectively enrolled. The PET data acquired over a period of 900 s were reconstructed into groups of different durations: 900-s, 720-s, 600-s, 480-s, 300-s, 180-s, 120-s, 60-s, and 30-s (G900 to G30). The subjective image quality analysis was performed using 5-point scales. Semi-quantitative measurements were analyzed by SUVmean and dopamine transporter (DAT) binding of key brain regions implicated in PD, including the caudate nucleus and putamen. The full-time images (G900) were served as reference. ***Results:*** The overall G900, G720, and G600 image quality scores were 5.0±0.0, 5.0±0.0, and 4.9±0.3 points, respectively, and there was no significant difference among these groups (P>0.05). A significant decrease in these scores at durations shorter than 600 s was observed when compared to G900 images (P<0.05). However, all G300 image quality was clinically acceptable (≥3 points). As the scan duration reduced, the SUVmean and DAT binding of caudate nucleus and putamen decreased progressively, while there were no statistically significant variations in the SUVmean of the background among the different groups. Moreover, the changes in the lesion DAT binding (ΔDAT-binding) between the full-time reference G900 image and other reconstructed group G720 to G30 images generally increased along with the reduced scan time. ***Conclusion:*** Sufficient image quality and lesion conspicuity could be achieved at 600-s scan duration for 11C-CFT PET brain imaging in PD assessment using a total-body PET/CT scanner, while the image quality of G300 was acceptable to meet clinical diagnosis, contributing to improve patient compliance and throughput of PET brain imaging.

EP-0747

Impact of Partial Volume Correction on Dopaminergic Network Parameters

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Aim/Introduction: In positron emission tomography (PET) studies, partial volume effects lead to a biased signal. This affects outcome parameters such as the binding potential (BPND) of high-affinity D2-like radioligands (Smith et al., 2019) and consequently further analyses, such as network analyses of brain connectivity. The Müller-Gärtner algorithm (Müller-Gärtner et al., 1992) for partial volume correction (PVC) involves mathematical convolution and deconvolution to correct for white matter spill-in and grey matter spill-out. The goal of this study was to investigate the effect of PVC on global and local parameters of the dopaminergic network. ***Materials and Methods:*** In a $^{[18F]}$fallypride PET study, 19 subjects (age: 30 ± 7.2 years) were examined with 175 ± 12 MBq and magnetic resonance imaging. After pre-processing of the data (motion correction, spatial normalisation and PVC), regions of the dopaminergic network were defined and time-activity curves extracted. Using the simplified reference tissue model 2 (reference region: cerebellum), the BPND was calculated without and with prior PVC. For both methods, graph theory was used to compare the topological organisation of the dopaminergic network based on the similarity of the regional binding across participants. The networks were computed in a density range of 0.3-0.9 in 0.01 steps. ***Results:*** PVC increased BPND values within the dopaminergic network compared with those calculated from uncorrected $^{[18F]}$fallypride uptake. Differences between methods (without and with PVC) were found for network measures of integration, segregation, centrality and

others. With PVC, global efficiency decreased ($p < 0.0001$), while the network was strengthened in terms of modularity ($p < 0.025$), betweenness centrality ($p < 0.0001$) and small world ($p < 0.0001$). In addition, regional betweenness centrality changed for several brain regions. ***Conclusion:*** Correction for partial volume effects should be performed to account for age- or neurodegeneration-related effects in PET studies with [18F]fallypride. Further analysis needs to consider the effect of PVC on network parameters. PVC has been shown to improve the stability of dopaminergic network analysis and increase the robustness of network parameter analysis. ***References:*** Smith CT et al. Partial-volume correction increases estimated dopamine D2-like receptor binding potential and reduces adult age differences. J Cereb Blood Flow Metab. 2019 May;39(5):822-833. Müller-Gärtner HW et al. Measurement of radiotracer concentration in brain gray matter using positron emission tomography: MRI-based correction for partial volume effects. J Cereb Blood Flow Metab. 1992 Jul;12(4):571-83.

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PET-only method for quantification of [18F]florbetaben scans and its relationship with histopathology, visual assessment, and longitudinal clinical progression from Mild Cognitive Impairment to Alzheimer's disease

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Aim/Introduction: The quantification of amyloid brain Positron Emission Tomography (PET) scans has recently increased in importance on research, clinical trials of Alzheimer's disease (AD) modifying drugs, and clinical routine as adjunct to visual read (VR) of PET images. Given differences in image processing pipelines1, there's the need to compare quantitative results of every available software with histopathology and clinical assessment. Therefore, in the present work, quantitative results from a PET-only pipeline have been compared with brain Aβ histopathology, visual interpretation from five independent readers, and longitudinal clinical status from Mild Cognitive Impairment (MCI) to AD in a span of four years. ***Materials and Methods:*** A total of 673 amyloid PET scans acquired with [18F]florbetaben were quantified with Centiloid (CL) values using BTXBrain2 (Brightonix Imaging Inc) with the whole cerebellum as reference region and a composite region as target. 91 scans correspond to brains which had post-mortem histopathology confirmation of presence or absence of Aβ in the brain and were used as standard of truth for the definition of a positive Aβ quantitative cut-off. To define a cut-off indicating absence of Aβ, 122 scans of healthy volunteers with a consensus negative VR were assessed. Furthermore, the agreement between VR and quantification was established with an independent set of 386 scans assessed visually by five readers. At last, a 4-year clinical follow-up was carried out in 45 MCI patients to evaluate the relationship between their clinical status progression and baseline CL value. ***Results:*** There was a strong agreement between quantification and histopathology with a sensitivity and specificity of 0.93[0.82-0.98] and 1.00[0.90-1.00], respectively, with a cut-off point of CL = 41.5 for Aβ positivity. This cut-off also had a 93.8% (362/386) agreement with the majority VR in an independent set of images. A cut-off of CL = 25.6 defined the absence of Aβ at the 95% quantile of the CL distribution from healthy controls with negative VR. In the 4-year longitudinal assessment, no individual with CL<41.5 progressed to AD while 87.5% (21/24) of individuals with quantitative Aβ positivity did progress to AD. ***Conclusion:*** Centiloid quantification of [18F] florbetaben PET scans with the BTXBrain PET-only pipeline can provide reliable and valuable results for adjunct assessment to VR of brain amyloid imaging. ***References:*** [1] Jovalekic, et al. EJNMMI 50.11 (2023); [2] Kang, et al. JNM 64.4 (2023).

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Diagnostic Performance Of Myocardial Perfusion SPECT/CT With Attenuation Correction

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Aim/Introduction: Myocardial perfusion single-photon emission computed tomography (SPECT) is one of the basic tools used for the purpose of diagnostic of coronary artery disease (CAD), prognosis of its unfavorable consequences,and evaluation of therapy effectiveness.However, its efficacy is compromised by a relatively low specificity of detection of perfusion defects, which is attributed to attenuation of gamma rays inside the patient's body, causing artefacts erroneously taken for perfusion defects.it is expected that attenuation correction (AC) could eliminate such artefacts.The aim of the present study was to evaluate whether computed tomography based-attenuation correction (CT-AC) provides any advantage over non -attenuation corrected(NAC) images for qualitative and quantitative analysis of SPECT myocardial perfusion imaging (MPI). ***Materials and Methods:*** We prospectively evaluated data of 85 patients who underwent stress rest MPI SPECT/CTas per standard protocol. Angiography done within +/- 3 months of MPI was taken as reference standard.two readers independently evaluated CT-AC and NAC images.Receiver operating characteristics curve analysis was done using ≥70%stenosis as cutoff. ***Results:*** AC increased the specificity of detection of (CAD) in the whole groupe of patients from 51% to 88%($p \leq 0.0001$), with a reduction in sensitivity from (96%to 86%) ($p=0.002$), with improved specificity was also noted in subgroups of male ans females patients and subgroups of obese and non- obese patients.Accuracy in the whole group of patients increased from 77% to 87% ($p=0.001$).CT-AC images had significantly lower sensitivity for detecting right coronary artery disease compared with NAC (from 79%to 91%) ($p=0.02$); but also high specificty from 67% for NAC to 98% dor AC ($p=0.001$),there was no significant difference in sensitivity and specificity in the left anterior descending artery (LAD) and left circumflex (LCX) between CT-AC and NAC images. ***Conclusion:*** In our study , the CT -based AC improved significantly the specificity especially in the right coronary artery but decreased sensitivity leading despite that to an improvement in overall diagnostic accuracy of tc99m sestamibi/MPI. ***References:*** 1. Sharma P, Patel CD, Karunanithi S, Maharjan S, Malhotra A. Comparative accuracy of CT attenuation -corrected and non attenuation corrected SPECT myocardial perfusion imaging.Clinival nuclear medecine.2012;37(4):332-8.2.Fricke E, Fricke H, Weise R,kammeir A, Hagedorn R,Lotz N, et al.Attenuation correction of myocardial SPECT perfusion images with low-dose CT:evaluation of the methode by comparison with perfusion PET.Journal of nuclear medecine .2005;46(5):736-44.3.Van Dijk J, Mouden M,Ottervanger J,Van DalenJ,Knollema S,Slump C,et al.Value of attenuation correction in stress -only myocardial perfusion imaging using CZT-SPECT .Journal of nuclear cardiology.2017;24:395-401.

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Integration of imaging and non-imaging data for risk prediction in cardiac amyloidosis using machine learning

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Aim/Introduction: The recent arrival of various disease-modifying amyloid-targeting therapies(1-3) has led to an increasing interest in the characterization and risk stratification of patients with transthyretin cardiac amyloidosis (ATTR-CA) to guide treatment decisions and assess treatment response. While the current diagnostic approach relies on visual interpretation of 99mTc-scintigraphy, risk assessment is largely based on a combination of blood, clinical, and imaging parameters from various modalities. The aim of this study was to evaluate machine learning-based integration of scintigraphy, echocardiography, and non-imaging parameters for the diagnosis, characterization, and risk stratification in patients with CA. ***Materials and Methods:*** This study included all consecutive patients who underwent [99mTc]Tc-DPD scintigraphy at the Vienna General Hospital between 2010 and 2023. Two machine learning models were created and the predictive importance of their parameters were assessed: 1) a model designed to identify patients displaying CA-suggestive uptake (Perugini grade 2/3) in [99mTc]Tc-DPD scintigraphy scans; 2) a model developed to predict the risk of future heart failure hospitalization (HFH) in patients with CA-suggestive uptake. Overall, 58 features were extracted from electronic health records including echocardiography, blood, demographic parameters, and comorbidities. Scintigraphy imaging features were extracted using a deep convolutional autoencoder. A random survival forest machine learning model was employed for HFH prediction and was validated using 100-fold stratified Monte Carlo cross-validation. ***Results:*** In total, 12 380 consecutively enrolled patients were included, of which 279 (2.3%) were affected by CA-suggestive uptake. The machine learning model performed well for the detection of CA (AUC 0.96 [95% CI 0.95-0.97], sensitivity 0.78 [95% CI 0.77-0.80] and specificity 0.99 [95% CI 0.99-0.99]. For the prediction of HFH, the machine learning model demonstrated good performance (C-index 0.71 [95% CI 0.68-0.75]). The most predictive parameters in the time to HFH analysis were right ventricular diameter, previous diagnosis of chronic heart failure and creatine kinase. ***Conclusion:*** Detection of patients with cardiac amyloidosis using machine learning is feasible with high performance while imaging features play a major role. Integration of imaging and non-imaging parameters can aid in the risk estimation of patients with cardiac amyloidosis, potentially guiding novel approaches for assessing disease progression and treatment response. ***References:*** 1.Maurer,-M.-S.-et-al.-Tafamidis-Treatment-for-Patients-with-Transthyretin-Amyloid-Cardiomyopathy.-N.-Engl.-J.-Med.-379,-1007-1016-(2018).2.Maurer,-M.-S.-et-al.-Patisiran-Treatment-in-Patients-with-Transthyretin-Cardiac-Amyloidosis.-N.-Engl.-J.-Med.-389,-1553-1565-(2023).3.Gillmore-Julian-D.-et-al.-Efficacy-and-Safety-of-Acoramidis-in-Transthyretin-Amyloid-Cardiomyopathy.-N.-Engl.-J.-Med.-390,-132-142-(2024).

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Comparison Between Two Software Programs of the Left Ventricular Ejection Fraction Obtained from Dedicated Cardiac CZT Camera

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Aim/Introduction: To compare the left ventricular ejection fraction (LVEF) during stress and rest phases of myocardial perfusion scintigraphy (MPS) acquired with a CZT cardiac scintillation camera, using two different software programs: software of common use for MPS (Software 1) and software dedicated for MPS analysis on CZT (Software 2). ***Materials and Methods:*** A retrospective study analyzing myocardial perfusion scintigraphy with Sestamibi-99mTc performed on a CZT cardiac scintillation camera in 2023 and 2024, involving 1523 consecutive patients. A nuclear physician experienced with both software programs performed the image processing and analysis, determining the LVEF for both phases in each patient. Cases where the LVEF could not be calculated by either program were excluded. LVEF values were described using median and interquartile ranges (IQR). The non-parametric Wilcoxon test was conducted to check for significant differences between the programs. The concordance correlation coefficient was also obtained, considered weak when less than 0.9; moderate between 0.9 and 0.95; substantial between 0.95 and 0.99; and perfect above 0.99. Analyses also included Bland-Altman plots (described as the difference between the means of the methods, as well as upper and lower limits) and Mountain-plots. In these analyses, Software 1 was considered the reference program. ***Results:*** Out of the 1523 patients analyzed, 1490 were included. The median LVEF obtained by Software 1 was 62.0% (IQR: 53.0-70.0%) and 60.0% (IQR: 51.0-67.0%) for rest and stress, respectively. In the Software 2 program, the median was 59.0% (IQR: 51.0 - 65.0%) and 58.0% (IQR: 50.0 - 64.0%). The Wilcoxon test showed a significant difference between the methods in both phases ($p<0.01$ for both). The Bland-Altman plots showed an average difference in ejection fractions of 3.4%, with a lower limit of -6.4% and an upper limit of 13.2% for rest. For stress, the average difference was 2.8%, with a lower limit of -6.3% and an upper limit of 12.0%. The correlation coefficient for the stress phase between the programs was 0.92 (Pearson $\rho = 0.94$ and Bias correction factor $Cb = 0.98$) and 0.90 (Pearson $\rho = 0.93$ and Bias correction factor $Cb = 0.97$) for rest. ***Conclusion:*** The LVEF obtained by the Software 1 and Software 2 programs had a moderate degree of agreement, with an average difference between methods of 3.4% for rest and 2.8% for stress. The comparison between the software also showed great precision and accuracy.

EP-0752

Prognostic Value of SPECT MPI Parameters in different sexes patients with ischemic heart disease

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Aim/Introduction: There are obvious gender differences in risk factors for ischemic heart disease (IHD) due to differences in physiologic anatomy and lifestyle habits. Single photon emission computed tomography (SPECT) myocardial perfusion imaging

(MPI) is important for the diagnosis and risk stratification of IHD. However, multiple studies have concluded that focusing on the same parameters and applying uniform thresholds between the sexes reduces the diagnostic and prognostic accuracy of the disease. This study aimed to investigate the prognostic value of traditional cardiovascular risk factors and SPECT MPI parameters in different genders IHD patients. ***Materials and Methods:*** Patients diagnosed with IHD who underwent resting gated SPECT MPI at the First Hospital of Shanxi Medical University from 2016 to 2021 were included and followed up. The study endpoints were major adverse cardiovascular events (MACE). The effects of traditional cardiovascular risk factors, total perfusion defect (TPD), left ventricular ejection fraction (LVEF), peak filling rate (PFR), eccentricity index (EI) and entropy on the prognosis of patients with IHD in different sexes were analyzed by univariate and multivariate Cox regression. The Youden index was used to select optimal thresholds for predictors, and the survival curve was plotted by Kaplan-Meier method. ***Results:*** A total of 1475 patients were included, including 1058 males (59.17±12.94 years old) and 417 females (63.84±11.29 years old). Compared with female, the proportion of traditional cardiovascular risk factors and partial drug use in male patients was higher (all p<0.05). During the follow-up period [3.05(1.71-4.97) years], there was no statistically significant difference in the incidence of MACE between the sexes (male: 40.9%, female: 36.2%, p=0.095). Multivariate Cox analysis showed: age [HR=1.016 (95% CI: 1.008-1.023)], prior myocardial infarction [HR=1.888 (95% CI: 1.547-2.303)], hypertension [HR=1.405 (95% CI: 1.151-1.714)], diabetes [HR=1.263 (95% CI: 1.034-1.542)] and EI [HR=0.002 (95%CI: 0.004-0.133)] were independent prognostic factors in males, and the optimal threshold of age and EI were 58.5 and 0.84 respectively. Age [HR=1.030 (95% CI: 1.014-1.047)], hypertension [HR=1.668 (95% CI: 1.106-2.516)], PFR [HR=0.621 (95% CI: 0.459-0.840)] were independent prognostic factors for women, and the optimal thresholds for age and PFR were 66.5 and 1.42 respectively. ***Conclusion:*** The prognostic value of traditional cardiovascular risk factors and MPI parameters in IHD should be fully considered in terms of gender. The male population should focus on the elderly, prior myocardial infarction, diabetes, hypertension and cardiac pathological remodeling (EI<0.84) patients; In female, the focus was on the elderly, hypertension, and diastolic dysfunction (PFR<1.42).

EP-0753

Dopamine Transporter SPECT Imaging in Patients with Parkinsonian Symptoms. Comparison of Visual Assessment and Semiquantitative Analysis with a Normal Database

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Aim/Introduction: 123I-ioflupane SPECT is used for the evaluation of nigrostriatal degeneration in patients with movement disorders. The assessment of studies is based on visual interpretation and semiquantification of tracer uptake in basal ganglia. Comparison with normal subjects' database is also available in several centers. The aim of this study was to compare the results of visual and semiquantitive evaluation with those obtained after comparison with a normal database and set optimal cut-offs in semiquantification. ***Materials and Methods:*** We studied 560 patients with movement disorders, mean age 67 years (SD=10.7) and median disease duration 24 months (IQR: 12-48 months). All patients underwent a brain SPECT 3 hours after the i.v. administration of 185 MBq 123I-ioflupane. Drugs known to interfere with tracer uptake were discontinued and oral Lugol's solution was given for thyroid protection. SPECT studies were evaluated by two experienced nuclear medicine physicians who rated images of the whole right(R) and left(L) striatum, R-L putamen and R-L caudate as normal or abnormal-reduced uptake. Semiquantitive evaluation was performed selecting the three slices with the most intense tracer uptake and drawing ROIs over the L-R striatum, L-R putamen, L-R caudate and occipital cortex. For the comparison, we used the normal subjects' database of Parkinson's Progression Markers Initiative-PPMI. ***Results:*** Compared with the results of PPMI normal database, visual assessment had a sensitivity ranged from 83.3% (for L-caudate) to 99.5% (for L/R putamen). Specificity ranged from 75% (for L-striatum) to 88.9% (for R-caudate). PPV ranged from 46.9% (for L-caudate) to 76.8% (for R-putamen) and NPV from 97.2% (for L-caudate) to 99.7% (for L/R striatum and putamen). Moreover, semiquantitative measurements had significant prognostic value [AUC ranged from 0.91 to 0.96, with p<0.001]. The optimal cut-off for L-striatum was ≤2.49 (sensitivity 89.2%, specificity 86.2%) and for R-striatum was ≤2.31 (sensitivity 89.5%, specificity 92.2%). For L-putamen the optimal cut-off was ≤2.39 (sensitivity 93.8%, specificity 87.6%) and for R-putamen the optimal cut-off was ≤2.47 (sensitivity 91.9%, specificity 83.8%). For L-caudate the optimal cut-off was ≤2.40 (sensitivity 87.1%, specificity 88.8%) and for R-caudate the optimal cut-off was ≤2.52 (sensitivity 89.7%, specificity 86.7%). ***Conclusion:*** Comparison with the normal database resulted in the identification of the optimal cut-offs in semiquantitive analyses, which would be particularly useful for the more accurate evaluation of SPECT studies in departments lacking the appropriate normal databases. ***References:*** Morbelli et al. Striatal dopamine transporter SPECT quantification: head-to-head comparison between two three-dimensional automatic tools. EJNMMI Res. 2020 7;10(1):137.

EP-0754

Long-Term Prognostic Value of Expert Scoring, Combined with Automated Measurements, in Nuclear Cardiology: Comparisons with the Angiographic Score

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Aim/Introduction: Myocardial perfusion imaging (MPI) has a crucial role in the non-invasive investigation of coronary artery disease (CAD). The interpretation of MPI studies is mainly based on the visual evaluation of the reconstructed images, while the automated analysis of the studies has been also incorporated into clinical practice. We aimed to investigate the role of expert reading of summed stress score (SSS), summed rest score (SRS), and summed difference score (SDS), combined with the automated measurements of these parameters, as long-term prognostic markers of cardiac events, in comparison to the prognostic value of the angiographic score. ***Materials and Methods:*** The study was conducted at the Nuclear Medicine Laboratory of the University of Thessaly, in Larissa, Greece. 378 consecutive patients

with known or suspected CAD were enrolled. All participants were referred to our laboratory for the performance of stress/rest myocardial perfusion single photon emission computed tomography. Automated measurements of SSS, SRS, and SDS were obtained by Emory Cardiac Toolbox (ECTb (Version 3.0), Emory University, Atlanta, GA, USA), Myovation (MYO, Xeleris version 3.05, GE Healthcare, Chicago, IL, USA), and Quantitative Perfusion SPECT (QPS Version 4.0, Cedars-Sinai Medical Center, Los Angeles, CA, USA) software packages. Coronary angiographies were scored according to a 4-point scoring system (angiographic score; O: normal study, 1: one-vessel disease, 2: two-vessel disease, 3: three-vessel disease). Follow-up data were recorded after phone contacts, as well as through review of hospital records. All participants were followed up for at least 36 months. ***Results:*** The sample consisted of 378 patients (61.9% males) with mean age 63.8 years (SD=9.6 years). Any cardiac event was recorded in 36.5% of the participants. Median angiographic score was 1 (IQR: 0-2). The prognostic value of the angiographic score was significant (AUC=0.71; 95% CI: 0.65-0.76) with an optimal cut-off point equal to 0.5. The prognostic value of expert scoring was also significant (AUC=0.88; 95% CI: 0.84-0.91), and significantly greater in comparison to the angiographic score (p<0.001). The prognostic value of expert scoring, combined with the prognostic ability of the three software packages, was also significant (AUC=0.91; 95% CI: 0.88-0.94) and significantly superior compared to the angiographic score (p<0.001). ***Conclusion:*** Based on our results, in patients with known or suspected CAD, the prognostic ability of expert reading, combined with the automated measurements of SSS, SRS and SDS, is superior to the prognostic value of the angiographic score.

EP-0755

Generation of an Age-dependent and Resolution-adaptive ^{18}F-FDG Brain-PET Atlas using High Sensitivity Short-Axial FOV PET/CT System

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Aim/Introduction: 18F-FDG Brain PET is crucial for the clinic and neuroscience research. However, PET scanner advancements have led to various spatial resolution and gray-to-white matter contrast recovery, causing quantitative errors when higher resolution data is interpreted with lower-resolution atlas,or vice versa. This study aimed to create a high-resolution FDG-PET brain atlas stratified by different ages and harmonize it with a lower-resolution atlas to generate an adaptive 18F-FDG brain atlas for various PET/CT scanners. ***Materials and Methods:*** The study retrospectively enrolled 160 subjects receiving whole-body and brain 18F-FDG PET/CT scan for staging of tumor, aged from 10 to 90 years, in groups of 20 per 10 years of age. Subjects with benign tumors or with malignant tumors staged as T1N0M0 were included. Sixty minutes after 18F-FDG administration for each participant, static data acquisition (matrix:440×440, OSEM, TOF=214ps, PSF, Iterations:6, Subset:5, Zoom:2, all-pass filter) with a duration of 4-min were performed. The 18F-FDG brain PET were normalized to the simulated BigBrain FDG activity map with FWHM=4.0mm smoothness and corresponding gray matter probability map. Spatial normalization was conducted in MNI space with 1.00mm isotropic resolution using ANTs toolkits with SyNRA registration algorithms for each subject. Cortical-to-cerebellum SUV ratios (SUVRs) were calculated and underwent 3D gaussian filter (FWMH 1.0mm to 12.0mm, 1.0mm interval). Age-dependent and gaussian-kernel-size-dependent atlases were generated by averaging the corresponding SUVRs in each group. Pearson correlation of the SUVR variations with age and kernel size was performed on frontal, temporal, parietal, occipital lobes, striatum and cerebellum gray matter respectively. ***Results:*** An array of atlases spanning ages from 10 to 90 years in 10-year interval, with gaussian filter FWMH sizes ranging from 1.0mm to 12.00mm, were generated for public research use as requested. The frontal, temporal, parietal, occipital lobes, striatum showed significant negative correlations with age for all kernel sizes (r = -0.72, -0.70, -0.71, -0.51, -0.61, respectively), while the correlation for cerebellum gray matter was 0.01. SUVRs in all regions significantly correlated with kernel size, with r value of -0.68, -0.67, -0.68, -0.83, -0.77, -0.97 for frontal, temporal, parietal, occipital lobes, striatum and cerebellum gray matter, respectively. ***Conclusion:*** Age-dependent, resolution-adaptive FDG Brain PET Atlases were created from high-resolution and high TOF PET/CT scanner to accommodate various spatial resolutions and gray-white matter contrast recovery, demonstrating age-related FDG uptake decline in cortical regions and striatum, and illustrating kernel size's impact on FDG uptake statistics.

EP-0756

A Potential Problem and Its Solution with the Algorithm for Calculating Washout Rate in Myocardial Single-Photon Emission Computed Tomography: Comparison of Total Count Washout Rate and Arithmetic Mean Washout Rate

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Aim/Introduction: Washout rate (WR) analysis is commonly used in nuclear cardiology to assess cardiac pathophysiology. WR is defined as the percentage of the difference in tracer counts between the early and time-decay-corrected late images relative to the tracer counts in the early image. The calculation of WR in myocardial single-photon emission computed tomography involves the use of dedicated software that calculates the arithmetic mean of the WR values for each pixel unit within a given region of interest (ROI) as the WR value for the ROI. The resulting value is called the arithmetic mean washout rate (AMWR). However, in patients with areas of decreased tracer uptake in early images, such as extensive myocardial necrosis, the WRs are calculated to be low using the AMWR algorithm. Therefore, we formulated a new algorithm to calculate WR, the total count washout rate (TCWR), based on the total count of the ROI and evaluated its clinical validity. ***Materials and Methods:*** We compared the AMWR and TCWR of iodine-123-beta-methyl-p-iodophenylpentadecanoic acid (^{123}I-BMIPP) in patients with various diseases associated with fatty acid and triglyceride metabolism. Participants included individuals with no cardiovascular disease detected (normal) (n = 11), CD36 deficiency (n = 6), triglyceride deposit cardiomyovasculopathy (TGCV) (n = 14), TGCV with old myocardial infarction (TGCV with OMI) (n = 17), and non-TGCV with OMI (n = 10). ***Results:*** The AMWR and TCWR values were not significantly different in the following groups: normal, 27.4 ± 8.5 and 27.3 ± 8.5% (p = 0.97); CD36 deficiency, -3.2 ± 6.5 and -4.1 ± 7.4% (p = 0.81); TGCV, 2.4 ± 6.3 and 2.2 ± 6.3% (p = 0.93); and TGCV with OMI, -0.9 ± 7.6 and -3.7 ± 8.4% (p = 0.32). However, the AMWR showed a significantly lower WR than the TCWR in non-TGCV with OMI (4.8 ± 8.7 and 18.9 ± 6.7%, p = 0.0008). This finding suggests that the AMWR may underestimate the WR in non-TGCV with OMI, potentially leading to misdiagnosis; a decreased WR (<10%) of ^{123}I-BMIPP is an essential criterion for the diagnosis of

TGCV. ***Conclusion:*** Our study demonstrated the superiority of the TCWR algorithm over the AMWR algorithm in differentiating TGCV from other cardiovascular diseases with extensive necrosis. Furthermore, the concept of TCWR has significant implications for quantitative analysis methods in imaging studies. ***References:*** National University Corporation Chiba University. International Publication Number: WO 2024/053646.

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A novel method on the harmonization of brain PET in PET studies using paired PET/CT and MRI images

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Aim/Introduction: Multi-center brain PET studies require the harmonization to minimize heterogeneity across PET/CT scanners. The more acceptable method is to use 3D Hoffman phantom scan to harmonize the imaging protocols used in multi-center studies. The Effective Image Resolution (EIR) based on 3D Hoffman phantom is the newly proposed method by AMYPAD Consortium, and can significantly reduce the image quality variability while minimally affecting quantitative accuracy. However, the implementation of 3D Hoffman phantom experiment is often challenge, which requires special skills to fill the phantom. In this study, we proposed a simple method using paired PET/CT and T1W MRI images, which is often acquired clinically, to provide a 2nd option in the case of 3D Hoffman phantom experiment is not easily carried out. ***Materials and Methods:*** The study retrospectively enrolled 3 subjects receiving 18F-FDG PET/CT and MRI scans. The total acquisition for brain PET was 4 minutes and its reconstruction were followed as, matrix:440×440, OSEM, TOF=214ps, PSF, Iterations:6, Subset:5, Zoom:2, and all-pass filter. The processing pipeline consisted of 1) the rigid alignment of T1W MRI images to PET/CT images in subject's space; 2) the deformative transformation of BigBrain T1W and its corresponding FDG activity map in MNI space into subject's space; 3) the calculation of EIR by identifying the lowest difference between the measured FDG and the smoothed activity map, which is generated by gaussian smoothing the transformed initial FDG activity map created from BigBrain project. All alignment and deformative transformations are conducted using ANTs toolkits. In the step 3), the gaussian FWHM was used and ranged from 1.0 to 12.0mm with 0.1mm as steps. ***Results:*** The EIR identified for 3 subjects were 5.4, 5.7 and 6.0, and the site digital reference object's (DRO) EIR was recommended within 5.0 - 6.0mm. The recommended site DRO EIR is in between 5.0 to 6.0mm, which was in accordance with the one measured using 3D Hoffman phantom. ***Conclusion:*** We proposed a simple method to calculate the Site DRO EIR for brain PET harmonization using paired PET/CT and MRI images as a 2nd option to the 3D Hoffman phantom experiment. The proposed method is more accessible in clinical environments, and more suitable for multi-center studies.

EP-0758

Predicting abnormal Myocardial Perfusion, stress Blood Flow and Flow Reserve from Calcium Scoring and coronary CT Angiography in hybrid Coronary Artery Disease Imaging using machine learning approaches

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Aim/Introduction: To evaluate the accuracy of using data-driven models based on machine learning approaches to predict myocardial ischemia, myocardial stress blood flow (sMBF) and myocardial flow reserve (MFR) from coronary artery calcium scoring (CAS) and coronary CT angiography (CCTA). ***Materials and Methods:*** A total of 184 patients (42% female, average age: 66.2 +/- 10.3 years (range: 36 - 86) underwent a hybrid protocol combining Rb-82 myocardial perfusion PET and CCTA. Ischemia score, sMBF, MFR were categorized in four grades (0-3), calcium score (CAS) and CAD-RADS scores for coronary stenosis grading were assessed by doubly board certified nuclear medicine physicians/radiologists. Correlation between the categories were evaluated and used to develop a data-driven model with machine learning to predict cardiac perfusion and flow scores from CAS and CCTA categories. For the evaluated models, we reported both the mean model accuracy and f1_weighted score with respective standard deviations. ***Results:*** 83% of the patients had no ischemia, 73% had normal sMBF and 76% normal MFR, 20% CAS score 0 and 22% CADRADS score 0. The model that presented the best results was based on XGBoost (eXtreme Gradient Boosting) using a k-fold cross-validation. Accuracy for this model varied from 70.3 +/- 5.1 % (corresponding f1_weighted score of 64.7 +/- 4.7 %) to 89.1 +/- 4.5 % (f1_weighted score 89.4 +/- 4.2 %), respectively for prediction of ischemia, sMBF and MFR using the CCTA scores. ***Conclusion:*** Our data allowed the evaluation of different CAD parameters in patients who underwent a hybrid Rb-82 PET/coronary CT angiography . The data-driven model can predict low-risk cardiac perfusion PET scores with over 80% accuracy from CAS and CAD-RADS score obtained by CCTA. This evidence has the potential to stratify patients more effectively by using CCTA as a gatekeeper before PET perfusion imaging.

EP-0759

Multicenter study on the use of Supervised Clustering for TSPO PET imaging

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Aim/Introduction: Supervised Cluster Analysis (SVCA) (10.1007/s00259-021-05309-z, 10.1038/jcbfm.2012.59) is a widely used approach for quantifying 18-kilodalton translocator protein (TSPO) in PET studies. While effective, this method requires for each clinical centre and camera access to both TSPO PET and MRI images of healthy subjects to generate typical kinetic classes. Such data isn't always available in research protocols. In this study, we evaluate the use of SVCA classes generated in one centre for the application of supervised clustering in another centre, to facilitate quantification of TSPO in studies were SVCA classes could not be generated with local data. ***Materials and Methods:*** This multicentre study was conducted between Toulouse and Tours on healthy high affinity binders subjects from two different studies: COMA3D (n=12, age range 22-75) and NIDECO (n=4, age range 56-76). PET images were acquired using a Siemens Truepoint HD scanner in Toulouse and a Philips Ingenuity PET scanner in Tours. $^{[18F]}$DPA-714 PET images were acquired in 32 frames for 60 minutes in Toulouse and in 31 frames for 59 minutes in Tours. Two sets of SVCA classes were generated independently for each centre. A temporal resampling was used to convert each set of classes to the framing of the other centre. The SVCA approach was used to

generate two reference activity curves on each PET image, using the local set of classes and the resampled set from the other centre. PET image quantification (BPnd) was performed using SRMT2 algorithm on Pmod (10.1007/s00259-014-2895-3). A run test for randomness of residuals between the two reference time activity curves (TACref) was performed (10.1007/s00228-006-0179-y). Paired t-tests were conducted to compare mean BPnd values in several regions. Significance was considered at p<0.05. ***Results:*** The run tests lead to random residuals between the two TACref, with Z=-1.623 ±0.623 on coma3d subjects and Z=-1.059±1.428 on nideco subjects. We obtained non-significant p-values when comparing the use of the two set of classes to generate the BPnd in all ROIs, with average differences of 0.0014±0.0164(p<0.734) in whole brain, 0.0003±0.0161(p<0.936) in white matter, 0.0039±0.0345(p<0.655) in thalamus and 0.0037±0.0169(p<0.39) for grey matter. ***Conclusion:*** On our multicentre dataset, no significant differences were found on the parametric values generated using SVCA classes from the other centre. The TACref were coherent. While the study should be extended to more centres and cameras, our results suggest that it could be possible to quantify correctly TSPO using the SVCA approach with classes from another centre.

EP-0760

Non-MRI Supervised Clustering for TSPO PET imaging

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Aim/Introduction: Supervised Cluster Analysis (SVCA) (10.1007/s00259-021-05309-z, 10.1038/jcbfm.2012.59) was developed to quantify the 18- kDa translocator protein (TSPO) in PET studies. While powerful, this approach usually requires the use of T1 MRI images to define the region used for normalization, which are not always available in research studies. In this study, we evaluated an alternative normalization method where MRI is only needed for the generation of SVCA classes but not required in future studies. ***Materials and Methods:*** 22 healthy control subjects (20-75 years old) from the Coma3d study (NCT03482115 DOI: 10.1093/brain/awae045) were considered, including 12 high-affinity binders and 10 mixed-affinity binders. All subjects underwent 18F-DPA-714 PET and MRI (T1) scans on a Philips 3T MRI scanner and a Siemens Truepoint HD PET. For the classical SVCA procedure, denoted SVCAMRI, all MRI images were segmented using Freesurfer and co-registered to PET images. The MRI segmentation was used for normalization and to generate the SVCA set of classes and the reference activity curve for all subjects. Alternatively, all MRI and PET images were registered to MNI space and the whole brain was segmented in the PET image using SPM12. In this process, denoted SVCAMNI, the classical SVCA approach was used except for the normalization step which was based on the brain ROI obtained from the PET image. Pmod implementation of SRMT2 algorithm (10.1007/s00259-014-2895-3) was used to obtain Binding Potential (BPnd) maps from the reference regions obtained with SVCAMRI and SVCAMNI. The residuals between the two reference curves of each PET image were calculated and a run test for randomness of residuals was performed (DOI: 10.1007/s00228-006-0179-y). A paired t-test was conducted to compare mean BPnd values in several regions. Significance was considered at p<0.05. ***Results:*** The run tests lead to having random residuals between the reference curve generated with SVCAMRI and SVCAMNI, with Z=-0.712±1.491. The BPnd values obtained with SRTM2 were not significantly different in all considered regions, with the following illustrative results. The BPnd differences were 0.0127±0,2113(p<0.78) in whole brain, -0.0006±0.2155(p<0.99) in white matter, 0.0137±0.3732(p<0.87) in thalamus, and 0.0249±0.2078(p<0.58) in grey matter. ***Conclusion:*** Our results suggest that an alternative normalization can be used in the SVCA approach. With this approach, MR images acquisitions are only required for the generation of the SVCA classes of the camera. Such results should facilitate the use of the SVCA approach for the quantification of TSPO in dynamic PET acquisitions when no MRI is available.

EP-0761

Quantification of [^{11}C]PIB amyloid in 3xTg-AD mice using reference tissue models

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Aim/Introduction: The aim of this work was to perform a quantitative analysis of microPET images acquired with the radiopharmaceutical [^{11}C]Pittsburg Compound-B ([^{11}C]PIB) in a triple-transgenic model of Alzheimer's disease (3xTg-AD) to determine accumulation of beta-amyloid (Aβ) plaques using two reference tissue models. ***Materials and Methods:*** Five 3xTg-AD male mice of 8, 12, 13, 14 and 15 months of age and one wild-type (WT) mouse (8 months of age) were included in this study. Imaging was performed in a Focus 120 microPET scanner. [^{11}C]PIB (18 ± 3 MBq) was intravenously administered as a bolus via the tail vain while animals were under anesthesia (2.4% isoflurane). Dynamic microPET scans of 16 frames of increasing length (4x30s, 3x60s, 5x180s, 4x600s; 60 min in total) were acquired. Images were reconstructed with a 2D ordered subset expectation maximization algorithm (2D-OSEM). Quantitative analysis was performed with PMOD software using the simplified reference tissue model (SRTM) [1] to calculate BPND, and the Logan reference tissue model (LRTM) (Logan et al., 1996) [2] to calculate DVR-1. LRTM analysis was done using the efflux constant (k2') calculated with SRTM. In both models cerebellum was used as reference region. ***Results:*** The values of BPND and DVR in the cerebral cortex of transgenic animals showed an increasing trend as a function of the age, consistent with the accumulation of Aβ in the 3xTG-AD model. The WT control showed similar quantitative values as the transgenic animal of the same age (8 months), so both animals could be considered as controls. The average percentage increase in DVR in the cerebral cortex of the transgenic animal group, compared to control animals, was on the order of 20%. DVR (BPND+1) values obtained with both reference tissue models were equivalent for the evaluated brain structures and a linear correlation analysis between the DVR values obtained with LRTM and SRTM gave correlation coefficients in the range of 0.924 to 0.996 for of 3xTg-AD animals of 8 and 15 months of age, respectively. ***Conclusion:*** SRTM and LRTM using cerebellum as reference region provide parametric images that appear qualitatively similar, and equivalent quantitative values for [^{11}C]PIB amyloid in 3xTg-AD mice. This research was supported by UNAM-DGAPA PAPIIT-IT201623. ***References:*** [1] Lammertsma & Hume, 1996, NeuroImage, 4:153-158. [2] Logan et al., 1996, J. Cereb Blood Flow and Metab, 16:834-840.

EP-0762

Blood transcriptomic biomarker of disease progression in Parkinson's Disease

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Aim/Introduction: Parkinson's disease (PD) is a neurodegenerative disorder characterized by progressive loss of dopaminergic neurons, resulting in motor and non-motor symptoms. Early and accurate detection of disease progression is crucial for timely intervention and management. The purpose of this study is to identify blood-based biomarkers that relate to disease progression in PD. ***Materials and Methods:*** This study used RNA-seq data of participants with PD and healthy controls (HC) from the Parkinson's Progression Markers Initiative (PPMI) database. Contrastive principal component analysis (cPCA) was applied to unveil enriched temporal patterns in a diseased subjects and derive gene expression-pseudotimes, which reflect the individual proximity to the pathology-free state. Gene expression-pseudotimes were correlated with progression of various clinical variables including DAT scan findings, Hoehn and Yahr Scale, and several proven progression milestones. ***Results:*** A total of 582 participants (PD 393, HC 189) were included in this study. The cPCA deriven gene expression-pseudotime was significantly higher in PD patients than HC (0.39 ± 0.25 vs. 0.06 ± 0.02, $P < 0.001$). The obtained pseudotime showed significant predictive associations with progression of mean striatal DAT binding (0.41 ± 0.25 vs. 0.26 ± 0.25, $P < 0.001$), Hoehn and Yahr Scale (0.35 ± 0.25 vs. 0.23 ± 0.25, $P < 0.001$), and progression milestones, including activities of daily living (0.39 ± 0.26. Vs. 0.27 ± 0.25, $P < 0.001$), autonomic dysfunction (0.36 ± 0.26 vs. 0.26 ± 0.25, $P < 0.001$), cognition (0.38 ± 0.25 vs. 0.25 ± 0.25, $P < 0.001$), functional dependence (0.38 ± 0.25 vs. 0.25 ± 0.25, $P < 0.001$), motor complications (0.41 ± 0.24 vs. 0.25 ± 0.25, $P < 0.001$), walking and balance (0.38 ± 0.26 vs. 0.26 ± 0.25, $P < 0.001$), and any domain (0.37 ± 0.27 vs. 0.21 ± 0.22, $P < 0.001$). ***Conclusion:*** Our study presents a peripheral biomarker signature that holds promise for predicting and monitoring disease progression in PD. The development of a reliable and minimally invasive biomarker assay based on these findings could significantly enhance clinical management strategies for PD patients, facilitating early intervention and personalized treatment approaches.

EP-0763

Visual Reading and Centiloid Scaling for the Evaluation of Brain Amyloid PET Imaging in Patients with Mild Cognitive Impairment: Impact on Conversion to Alzheimer´s Disease Dementia

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Aim/Introduction: In clinical routine, amyloid Positron Emission Tomography (A-PET) is important for diagnosing Alzheimer´s disease (AD). Centiloid (CL) scale is a standardized metric for quantifying A-PET acquired with different tracers. The aim of this study was to investigate the agreement of Centiloid scale with visual reading and progression of disease. ***Materials and Methods:*** 162 patients (69 females, 93 males) aged 71.3±6.2 years with Mild Cognitive Impairment (MCI) who underwent an A-PET (22 18F-florbetaben, 52 18F-flutemetamol, 88 18F-florbetapir) on a Biograph mCT scanner (Siemens Healthineers) at our institution were retrospectively reviewed. PET images were reconstructed iteratively using time-of-flight and point-spread-function (3 iterations, 21 subsets, 2mm Gaussian filtering). Patients were classified as "positive" or "negative" by consensus between two trained nuclear medicine physicians using visual reading procedures. Images were processed using a commercially available solution to calculate composite standard uptake value ratios (SUVR) using tracer-specific "target/reference" regions, which were then converted to the Centiloid scale using appropriate SUVR-to-Centiloid conversion equations. A receiver operating characteristic analysis (ROC) was performed to discriminate patients in agreement with the visual reading, and the optimal Centiloid cut-off value was calculated as the value that maximized the Youden's J Index of the ROC curve. Using the ROC, the Centiloid values were categorized into "clearly negative", "grey zone", and "clearly positive" ranges based on the sensitivity and specificity values. Cox regression analysis was conducted to study the rate of conversion to AD dementia during the follow-up. ***Results:*** The percentage of concordance between readers was 95% and the eight discordant cases were excluded from the ROC analysis. 107 (66%) subjects were visually classified as "positive" with CL=60.8±28.1, while 55 (34%) subjects were visually classified as "negative" with significantly lower CL=-7.5±20.5 ($p<0.05$). The ROC analysis yielded excellent agreement with visual-based classification with an area under the ROC curve of 0.9872, and a corresponding optimal CL cut-off value of 26 (sensitivity 92.0%, specificity 96.3%). A Centiloid "grey zone" range of 11 to 39, was determined where both sensitivity and specificity are less than 100%. The Cox regression analysis showed that patients classified as "positive", either visually or using Centiloids, converted more rapidly to AD dementia, but those in the Centiloid "grey zone" converted slower than "positive" (Table 1). ***Conclusion:*** Centiloid scale is a promising quantitative tool in the clinical routine to harmonize SUVR data across different A-PET tracers, with different progression patterns related to AD dementia conversion in MCI subjects.

EP-0764

Open-source MATLAB code for the identification of spatial covariance patterns in neuroimaging data

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Aim/Introduction: Positron emission tomography (PET) imaging offers in-vivo insights into brain pathology, which may improve diagnostic accuracy, allow for disease staging, and assess disease-modifying treatment. While univariate approaches are widely used in research, they do not consider spatial correlations between voxels. This limitation is addressed by multivariate analyses, such as the Scaled Subprofile Model using Principal Component Analysis (SSM/PCA). SSM/PCA is particularly well suited for studying conditions that involve dysfunction in brain networks. Moreover, it provides a disease-specific spatial covariance pattern (DP) that can be used to computer subject-specific expression scores, informing clinicians about disease progression and treatment effects. The aim of this work is to introduce a new open-source

MATLAB-based code for the SSM/PCA analysis of imaging data in neurological disorders. ***Materials and Methods:*** We developed an SSM/PCA software to evaluate spatial covariance patterns using PET data to create a DP. First, a mask is applied to exclude non-informative voxels (either by an intensity threshold or using a pre-defined mask), which is followed by a data-driven intensity normalisation (at subjects and group levels, yielding a "Scaled Subprofile"). Then PCA is applied to reduce data dimensionality, and components that together explain up to a certain variance of the data are included in the analysis. Subsequently, a stepwise logistic regression model is used to select and combine principal components in an optimal way to differentiate between healthy individuals and patients. This generates a disease-specific DP. This DP can then be used to evaluate the expression of a specific disease in the image of a new individual. ***Results:*** Different DPs have been generated to assess a variety of disorders. Metabolic patterns using ^{18}F-FDG have been identified for Alzheimer's disease, Parkinson's disease, spinocerebellar ataxia type 3, mild cognitive impairment, and others. Pathology-specific patterns for amyloid and tau accumulation in Alzheimer's disease using 11C-PIB and ^{18}F-Flortaucipir have been described. Furthermore, a serotonin DP using 11C-DASB in dystonia has been identified. Finally, a cerebrovascular reactivity DP in Parkinson's disease has also been detected. These patterns have been successfully used to differentiate patients from controls. ***Conclusion:*** Our SSM/PCA software offers an open-source code that is easy to apply to different radiotracers and disorders. This software has been successfully applied to a variety of neurological disorders and it is now available for download and research use.

EP-0765

Image-derived input function for (-)-[18F]Flubatine using a long axial field of digital PET system

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Aim/Introduction: Long axial field of view (FOV) PET-CT systems enable dynamic data acquisition throughout their entire axial FOV. That opens up the possibility of pharmacokinetic analysis and modeling simultaneously involving all body regions covered by the axial FOV, including the brain based on large blood pools, i.e. parts of the aorta. The partial volume effect, a known limitation of image-based input function derivation, is further mitigated by cutting edge, highly sensitive PET systems with improved spatial resolution compared to state-of-the-art standard digital PET systems with shorter axial FOVs. Furthermore, the use of (-)-[18F] Flubatine, a tracer with a comparatively low metabolic degradation targeting the alpha4beta2* nicotinic acetylcholine receptors [1], simplifies the otherwise complex radiometabolite correction. ***Materials and Methods:*** Within 26 days two whole-body PET-CT scans were performed with continuous measurement for the first 90 minutes in ultra-high sensitivity mode and a total imaging time of 360 minutes (0-90min, 195-225min, 330-360min p.i.). The scans were conducted after a bolus injection of ~300 MBq of (-)-[18F]Flubatine in a patient presenting with Long COVID. Metabolites, plasma to whole blood ratios, and tracer binding to plasma proteins ratios were determined by taking arterial blood samples, which served as the gold-standard. The image-derived input function was extracted from the aortic arch based on the segmentation of the thoracic aorta AC-CT-data. Kinetic modeling of the body including the brain was performed based on arterial as well as image-derived input functions. Kinetic analyses with various compartment models and graphical approaches (Logan plots) were employed for the evaluation of the data. ***Results:*** The image-derived input function shows small differences (1st scan: 0.43 ± 0.92 kBq/ml, 2nd scan: 0.20 ± 1.29 kBq/ml, n=29) with lower values observed for the arterial input function, which can be partially attributed to the ratio of plasma to whole blood. The results of the two investigations were found to be similar in this regard. ***Conclusion:*** (-)-[18F]Flubatine is a tracer that seems suited for kinetic modeling using an image-derived input function. Further studies are warranted to validate the clinical utility of long axial field of view PET-CT image-derived input functions for this tracer instead of arterial blood sampling and analysis. ***References:*** [1] Patt et al., Nucl Med Biol 2014; 41:489-94.

EP-52

e-Poster Area

D: Technical Studies -> D2 Data Analysis -> D22 Other Data Analysis

EP-0766

Comparative analysis of tumour segmentation methods in positron emission tomography (phantom study)

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Aim/Introduction: In nowadays different tumour delineation approaches exists on PET. That leads to incomparable results in studies which utilize volume PET-metrics. A choice of segmentation tool should be based head-to-head comparative analysis. The aim of present study was to compare repeatability and accuracy of six segmentation approaches. ***Materials and Methods:*** Two phantoms were used: NEMA IEC Body Phantom Set NU 2-2018 (NEMA-Ph) and in-house designed phantom (Ph2) which have 10L total volume and internal 235ml irregular shaped fillable insert (with less suffer from partial volume effect). Various target-to-background (TB) ratios were used: 1.5, 3, 4.5, 6, 7.5, 10 and 15 with [18F]FDG solution. Phantoms were scanned on 5 ring PET/CT system (Block Sequential Regularized Expectation Maximization, β=400, 3min p/b). Fixed threshold-based (SUVmax41% and SUV2.5), background subtraction (BSV) [1], gradient [2], adaptive threshold (AT) [3], adaptive iterative algorithm (AIA) [4] were analyzed. ***Results:*** Direct comparison of methods were possible within TB ratios range from 7.5 to 15, since at lower TBs some approaches (except AT, AIA) failed to perform delineation. The repeatability of all methods, except BSV, correlated with an object size (the highest for the Gradient ($r=-0.886$, $p<0.05$). Coefficient of variation (%) of AT, AIA, Gradient, BSV, SUVmax41%, SUV2.5 measurements were 0.21, 1.27, 16.98, 25.15, 0, 0, respectively. The average error (% (95-%CI)) of NEMA-Ph measurements were -4.23 (-12.4; 3.95) for SUVmax41%, 33.37 (26.51; 40.22) for SUV2.5, -79.23 (-95.05; -63.41) for Gradient, 39.27 (23.83; 54.73) for BSV, -3.68 (-7.11; -0.24) for AT, 5.44 (-1.88; 12.75)

for AIA. For Ph2 errors were 20.79 (-5.07; 46.65) for SUVmax41%, -16.88 (-82.94; 49.18) for SUV2.5, -9.92 (-11.49; -8.34) for Gradient, 31.26 (25.1; 37.4) for BSV, -1.63 (-5.96; 2.71) for AT, -6.67 (-8.1;-5.23) for AIA. A systematic underestimation of the volumes for both NEMA-Ph and Ph2 for Gradient (p=0.0127) and overestimation for BSV (p=0.0208) was revealed. ***Conclusion:*** The repeatability of measurements (except BSV) had inverse relationship with measured volume. A systematic misestimation of the volume by the Gradient and BSV was observed both on the NEMA-Ph and Ph2. The AT and AIA methods had the most optimal characteristics (wide TB range of applicability, high repeatability, comparatively small measurement error). ***References:*** 1. Burger IA. Nucl Med Biol. 2014;41(5):410-8. doi:10.1016/j.nucmedbio.2014.02.006 2. Graves EE. Technology in Cancer Research&Treatment 2007;6(2),111-121. doi:10.1177/153303460700600207 3. Schaefer A. Eur J Nucl Med Mol Imaging. 2008;35(11):1989-99. doi:10.1007/s00259-008-0875-1 4. Sebastian TB. Med Image Comput Comput Assist Interv. 2006;9(Pt 2):782-9. doi:10.1007/11866763_96

EP-0767

^{18}F-PSMA 1007 PET/CT metrics for Assessment of Whole-Body Tumor Burden in Patients with Metastatic Prostate Cancer

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Aim/Introduction: A prostate-specific membrane antigen (PSMA) ligand PET/CT may be applied to provide PSMA-derived SUVs, yet individual lesion SUVs may be inadequate to determine the overall response. On the way of the vision of the measurement of the whole-body tumor burden in patients with metastatic prostate cancer, and to standardize the evaluation of treatment-related changes; we unmet a quantitative imaging biomarker reflecting the whole-body tumor burden based on the size, number, and precise activity of tumor lesions, as well as being easily applicable in clinical practice for lesions. PSMA-derived volumetric parameters such as PSMA-total volume (PSMA-TV) and PSMA-total lesion parameters (PSMA-TL) that are calculated by multiplying the respective TV and mean SUV are hypothesized to be a tool for quantification of whole-body tumor burden in patients with metastatic prostate cancer. We aim to investigate PSMA ligand PET/CT volumetric parameters as a measure of whole-Body tumor burden, in comparison with PSA levels as a surrogate marker of tumor load. ***Materials and Methods:*** We enrolled 39 patients with prostate cancer and had PSMA avid metastatic lesions, from all suspected pathological lesions (n = 313), the mean and maximum SUV (SUV mean, SUVmax) and the tumor volume of each lesion were determined in VOIs with isocontours set at 41% of the maximum uptake within the respective focus; that is called PSMA-TV and finally, PSMA-TL calculated by multiplying the respective TV and mean SUV. ***Results:*** Whole body PSMA parameters (SUVmax, PSMA-TV, SUV mean, PSMA-TL) exhibited significant correlations with PSA (r=0.55 & p=0.001, r=0.31& p=0.05, r=0.6 & p=<0.001, r=0.6 &p<0.001 respectively) as well as with Gleason score (r=0.4 & p=0.03, r=0.4 & p=0.02, r=0.3 &p=0.046, r=0.4& p=0.006 respectively) Interestingly, when we analyzed only metastatic osseous lesions we found, osseous PSMA parameters (SUVmax and SUVmean) lost their association for the current population with PSA, but significant positive correlations between PSA and TV PSMA & TL-PSMA with P value (p=0.024 and p=0.02) respectively. ***Conclusion:*** PSMA-TV and PSMA-TL are considered promising parameters defining the lesions size and intra-lesional PSMA expression and providing a quantitative imaging biomarker of real volumetric assessment and total tumor burden. Moreover, PSMA-TV and PSMA-TL could refine better stratification of patients into low- and high-volume metastatic disease in clinical trials; that is recently of paramount use in precision appropriate treatment strategies of metastatic prostate cancer and subsequently an utmost tool in predicting metastatic cure.

EP-0768

Feasibility of Shortening the FDG Patlak Scan Time in a High Sensitivity Short-Axial FOV PET/CT System for Oncological Studies Using Deep Learning Denoising Algorithms

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Aim/Introduction: This study aims to investigate the clinical acceptability of 18F-FDG Patlak imaging in a high-sensitivity short-axial PET/CT scanner by comparing various Patlak protocols and employing a deep learning-based denoising algorithm. ***Materials and Methods:*** This study involved 15 patients who received a dual-time injection of 18F-FDG (80% of the dose administered at the first injection and the remaining 20% administered at the second injection starting at 80 min post-injection). Four protocols were generated to account for different arterial input functions (AIF), and whole-body passes (3, 4, 5, 6, 7 passes × 5 min/pass) obtained between 40 and 75 minutes after the injection were used for Patlak fitting after denoising. ANOVA was used to compare the four AIF protocols in Ki values in FDG-avid lesions and to analyze the effect of the number of whole-body passes on differences in Ki values. Additionally, Pearson correlation of Ki values between abbreviated protocols and the standard protocol (Protocol-1 with 7×5 min/pass) was performed. ***Results:*** Twelve out of 15 participants completed the entire protocol, and 12 FDG-avid lesions were manually contoured. Compared to the image-derived input function of the standard protocol, the abbreviated protocols exhibited a relatively lower area-under-curve. Ki values demonstrated good agreement and high correlation between different protocols, with R-squared values ranging from 0.8992 to 0.9999. In comparison to the estimation obtained from Protocol-1, the population-based input function (PBIF)-based Protocol-4, with 20 minutes of PET (i.e., 55 to 75 min post-injection), yielded <5% bias and <15% precision error for Ki in tumor lesions. The acquired Ki images using different protocols were visually comparable. ***Conclusion:*** The findings suggest that abbreviated protocols can provide acceptable Patlak Ki estimation from short-axial PET/CT systems. The 20-minute PBIF-based abbreviation protocol, enhanced by a deep learning-based denoising algorithm, holds promise for the potential application of Ki analysis in both scientific and clinical settings.

EP-0769

Recovery coefficients as an estimate of effective spatial resolution in SPECT

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Aim/Introduction: While there are many ways to measure the spatial resolution of a SPECT camera, determining the effective resolution of reconstructed SPECT images remains challenging. Due to the depth dependent resolution, non-circular detector rotation and resolution recovery (RR), the effective resolution is different from the system resolution and spatially variant. Since

recovery coefficients (RCs) are a measure for the partial volume effect, which is in turn determined by the resolution, these could be used to estimate the effective resolution. Therefore, our aim was to develop and evaluate a RC-based resolution calculation method. ***Materials and Methods:*** For an idealized SPECT system with a fixed full width at half maximum (FWHM), the RC of a sphere with diameter D is given by RC(d)=erf(d)+1/√π[(e^(-d2)-3)/d-2(e^(-d2)-1)/d3] where d=1.665*D/FWHM. Using this formula, the effective image resolution can be calculated directly from the RCs of spherical objects. This approach was tested by measuring a NEMA IEC body phantom containing 6 spheres filled with 99mTc on a SPECT/CT system (Siemens Intevo Bold) using low and medium energy collimators. The data were reconstructed with and without RR using MIM software. For each image, the RC-based resolution was determined and evaluated against two image-based methods: fitting a theoretical edge profile to each sphere and finding the Gaussian filter required to optimally match a smoothed template of the phantom with the SPECT image. ***Results:*** For the reconstructions without RR, the RC-based resolution matched the system resolution at the average sphere depth (14.3mm and 18.8mm at 25i2s for the low and medium energy collimator respectively), in line with the fitted profile (13.9mm and 18.8mm) and the matched filter methods (15.1mm and 19.6 mm). In the reconstructions with RR, the RC-based resolution was better (9.9mm and 11.4mm at 25i2s), in line with the matched filter method (9.5mm and 10.4mm), and continued to improve with increasing number of iterations. Meanwhile, the fitted profile method to failed due to Gibbs artifacts. The RC method also allowed to estimate the resolution for each individual sphere to investigate variations in effective resolution. Without RR, the resolution was position-dependent, with RR the resolution proved to be size-dependent. ***Conclusion:*** The RC-based resolution calculation method is a robust tool to assess the effective spatial resolution in reconstructed SPECT images and can be used to quantify local resolution variations.

EP-0770

Motion-Resolved Parametric Imaging for Short-Dynamic PET

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Aim/Introduction: [18F]Fluorodeoxyglucose (FDG) Positron Emission Tomography (PET) is currently conducted in a single time-point static acquisition mode, 60 minutes post injection. However, this clinical routine provides reduced information about the distribution of the radiotracer within the body over time, limiting the capability to distinguish cancer from inflammatory processes or perfusion effects, especially in assessing therapy response. This study explores the added value of parametric imaging in short-dynamic total body PET/CT scans to quantify time-dependent glucose metabolic rate and blood flow for enhancing our understanding of physiological processes. ***Materials and Methods:*** Four patients with malignant lymphoma underwent a 15-minute total body FDG PET scan for therapy evaluation. Parametric imaging framework was developed, incorporating population-based input function derived from retrospectively selected patients who underwent full dynamic FDG PET acquisition. Misalignments between PET and CT due to subtle patient motion were corrected with AI-based registration methods [1],[2]. ***Results:*** The motion correction process demonstrates significantly reduced mismatches between tomographic images without changing the voxel intensity values (variations below 1-2%). Post-therapy, two patients showed persistent malignancies in mediastinal and axillary lymph nodes, characterized by an average net influx rate of 0.13-0.25 ml/100ml/min that exceeded ten times the background. Overall, tissue-to-background ratio evaluated for the influx rate parameter was twice as high as the one for the SUV. This improved lesion readability in parametric images was particularly beneficial in delineating small size lymph nodes. Furthermore, the parametric representation exhibited more heterogeneous behavior of the lymph nodes with respect to the SUV mean. Notably, where SUV suggested an extended malignancy, the influx rate detected a reduced volume of the tumoral tissue, indicating potential contribution of perfusion or inflammation within the same region. ***Conclusion:*** The implementation of short-dynamic PET and parametric imaging offers valuable insights into kinetic responses of tissues, with additional advantages of removing motion effects in the parametric analysis framework, a step frequently overlooked in commercial software. ***References:*** [1] J. Schaefferkoetter, V. Shah, C. Hayden, J. O. Prior, and S. Zuehlsdorff, "Deep learning for improving PET/CT attenuation correction by elastic registration of anatomical data," Eur. J. Nucl. Med. Mol. Imaging, vol. 50, no. 8, pp. 2292-2304, Jul. 2023, doi: 10.1007/s00259-023-06181-9[2] L. K. S. Sundar et al., "Fully Automated, Fast Motion Correction of Dynamic Whole-Body and Total-Body PET/CT Imaging Studies," J. Nucl. Med., vol. 64, no. 7, pp. 1145-1153, Jul. 2023, doi: 10.2967/jnumed.122.265362.

EP-0771

Development of a real-word-data-based indicator system to evaluate the use of PET/CT and other major imaging equipment: A Delphi study

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Aim/Introduction: With increasing applications of PET/CT and other major imaging equipment in patient care, we aim to develop an indicator system to evaluate their use in routine clinical practice, using real-world data as the source. ***Materials and Methods:*** We first searched PubMed, CNKI, Wanfang Data, five national and international government websites (such as the US FDA and WHO website), and Microsoft Bing for studies and administrative documents that evaluated the use of major radiological imaging equipment (i.e., PET/CT, PET/MR, CT, and MRI), and collected indicators for evaluation. The accessibility of indicators was determined using electronic health records from four hospitals. A Delphi consensus process was then conducted involving a convenience sample of 17 experts to vote for indicators to construct the final system. These participants were invited from 9 provinces in China and from various specialties, including nuclear medicine, radiology, relevant clinical specialties, and methodology. Each indicator was rated for importance

and accessibility on a 5-point Likert scale (0 for complete disagreement; 5 for complete agreement). The first round of Delphi was completed and a second round is ongoing. ***Results:*** All experts approached returned their survey. The expert authority coefficient was greater than 0.7, and the coordination coefficients of experts in the total index were 0.309 (for importance) and 0.246 (for accessibility, both P<0.001). A preliminary three-level indicator system was developed for evaluation of the use of major radiological imaging equipment (i.e., PET/CT, PET/MR, CT, and MR) in routine clinical practice (Table 1). First-level indicators include clinical use, equipment and staff, and other efficiencies. Second (and third) level indications include: appropriateness of use (rate of appropriate use and of positive results), efficiency of use (number of examinations per day, annual number of examinations per equipment, annual days of operation, average time of a single examination, and annual rate of operation), safety (radiation exposure dose of patients and staff), reporting quality (completeness of reporting), equipment condition (year of service), staffing status (number of staffs), economic efficiency (annual income), and research efficiency (number of representative publications per equipment). ***Conclusion:*** This is the first real-world data-based indicator system for the evaluation of the use of PET/CT and other major imaging equipment in routine practice. This indicator system provides an efficient and objective approach of evaluation given its utilization of real-word-data as the source, and will help promote high-quality use of imaging equipment in patient care.

EP-0772

Health Economic Models to Assess Response to Therapy with Positron Emission Tomography in Oncology Care: A Methodological Review

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Aim/Introduction: This methodological review addresses model-based cost-effectiveness studies assessing response to systemic therapy with positron emission tomography (PET) for various cancer diseases. This review aims to identify the modelling methodologies used and to include a systematic assessment of the assumptions made, the extent of structural uncertainty and consequences on cost-effectiveness outcomes. The objective is to provide recommendations for future decision-analytic models assessing the cost-effectiveness of therapy response monitoring with PET in oncology care. ***Materials and Methods:*** Information sources included electronic bibliographic databases, reference lists of review articles and contact with experts in the fields of nuclear medicine, health technology assessment and health economics. Eligibility criteria included peer-reviewed scientific publications and published grey literature. Literature searches, screening and critical appraisal were conducted by two reviewers independently. The Consolidated Health Economic Evaluation Reporting Standards were used to assess the methodological quality. The Bias in Economic Evaluation checklist was used to determine the risk of bias in the included publications. ***Results:*** The search results included 2,959 publications. The number of publications included for data extraction and synthesis was ten, representing eight unique studies. These studies addressed patients suffering from lymphoma, advanced head and neck cancers, brain tumours, non-small cell lung cancer and cervical cancer. All studies studied response to chemo(radio)therapy. Most studies positioned PET as an add-on modality within the considered care pathways and a single study positioned PET as a replacement modality for conventional imaging. Three studies reported decision-tree structures, four studies reported cohort-level state-transition models and one study reported a partitioned survival model. No patient-level models were reported which was surprising given the heterogeneity observed in many of the patient populations. The simulation time horizons adopted by the studies ranged from one year to lifetime. Most studies reported probabilistic analysis, whereas two studies only reported deterministic analysis. Multiple studies did not adequately discuss model-specific aspects of bias. Most importantly and regularly observed was a high risk of structural assumptions bias, limited simulation horizon bias and wrong model bias. ***Conclusion:*** The reasons for selecting a specific modelling methodology were rarely discussed. Modelling approaches with event history analysis which considers time-to-events were absent. Future studies require more patient-level evidence, and flexible patient-level models are highly recommended. This also means that more time should be available to develop such flexible models and to increase validation efforts (linked to the development of more complex models).

EP-0773

Usefulness of Free Image Analysis Software in Appropriate Amyloid PET Imaging: A Multicenter Study for Site Accreditation Program in Japan

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Aim/Introduction: Currently in Japan, the Japanese Society of Nuclear Medicine is certifying PET imaging facilities (J-PEQi) to ensure the appropriateness of amyloid PET. In J-PEQi, image quality evaluation of Hoffman and cylindrical phantom is performed using PMOD software. However, few Japanese facilities own PMOD software, and it is difficult for each facility to evaluate image quality in advance to optimize PET imaging conditions for J-PEQi site accreditation. Recently, free image quality analysis software PETquactIE (Nihon Medi-Physics Co., Ltd.) has been developed and is being used in various facilities in Japan [1]. The purpose of this study was to determine the effectiveness of image quality analysis using PETquactIE in the optimization of amyloid PET imaging. ***Materials and Methods:*** Hoffman and cylindrical phantom imaging was obtained according to J-PEQi phantom procedure manual [2] using six different PET/CT scanners at five facilities. Image reconstruction was performed by 3D-OSEM method without PSF correction with 60-80 iterative updates, followed by smoothing using a Gaussian filter at 1mm intervals between none and 5mm. These PET images were analyzed using PETquactIE and PMOD to compare image reconstruction conditions that satisfied contrast (%contrast≥55%), image noise (CV≤15%), and uniformity (SDΔuROI≤0.0249). After 15 sets of PET images with 135s were reconstructed under optimized imaging conditions, image quality was evaluated and differences in analysis values between analysis software were examined. Statistical significance was compared by t-test. ***Results:*** For contrast, PETquactIE analysis was significantly higher than PMOD analysis (p<0.01), but the difference was within

3% for all scanners. There was no significant difference between the CVs of PMOD and PETquactIE for the two scanners, but for the three scanners. However, as with %contrast, the difference in CVs was within 3% for all scanners. The imaging conditions for a Gaussian filter that could achieve a CV≤15% were the same for both analysis software. The slight difference in %contrast analysis is likely due to the automatic alignment of ROI templates in PMOD, whereas PETquactIE is manually aligned. The slight difference in CVs may be due to the manual alignment between ROI template and PET images in both analyses. ***Conclusion:*** Image analysis using PETquactIE at each institution can help optimize PET images that meet the image quality criteria set by J-PEQi, but a margin of about 3% should be considered. Automation of ROI template alignment is important to obtain image quality assessment with higher agreement. ***References:*** [1] https://www.nmp.co.jp/member/hiroba/[2] Ikari Y,et al. EJNMMI Phys. 2016 Dec;3(1):23.

EP-0774

Quantitative PET/MR imaging for hepatic portal vein input function measurements: a phantom study

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Aim/Introduction: Precise pharmacokinetic modelling in PET relies on obtaining an accurate input function, ideally non-invasively from imaging data. In hepatic pharmacokinetic modelling, it is crucial to consider two input functions to accommodate the blood supply from both the hepatic artery and portal vein. However, obtaining image-derived measurements of the portal vein poses challenges due to its small size and respiratory motion induced blurring. In this study, we aim to demonstrate how a dedicated PET/MR protocol can address these challenges and showcase accurate input function measurements of the portal vein by approximating the clinical setup using a dedicated liver phantom. ***Materials and Methods:*** A liver PET/MR phantom with fillable compartments, fabricated using 3D printing, was developed to replicate the anatomy of the human liver and the portal vein. PET/MR scans were conducted with simulated respiratory motion induced by a non-magnetic piezoelectric motor. The fillable liver and portal vein compartments were filled with FDG activity concentration of 4.1 kBq/cc and 78.8 kBq/cc respectively. The proposed PET/MR protocol involved acquiring high-resolution anatomical MR images of the portal vein, followed by a 4-minute PET scan parallel to a motion-tracing MR sequence. Motion tracking and deformation data were extracted from both MR and PET scans. The data was used to reconstruct motion compensated dynamic PET series. Anatomical MR images were employed for correcting partial volume effects in the input function measurements, obtained from the motion-corrected PET series. ***Results:*** With motion-compensated reconstruction the resulting dynamic series of PET frames were nearly motion-free, facilitating accurate time activity measurement of the portal vein input function. Following partial volume correction of these measurements, the resulting values demonstrated a close approximation of the true activity in the portal vein compartment, with maximum deviation of 5.1%. ***Conclusion:*** The suggested protocol showcases the clinical applicability of PET/MR imaging for pharmacokinetic investigations of the liver, ensuring precise quantification of the portal vein input function. This is demonstrated by successfully addressing the challenges in PET imaging and quantification related to respiratory motion and partial volume effects.

EP-0775

Parametric Images and Clinically Accepted Glucose Metabolism: A Validation Analysis

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Aim/Introduction: Deriving pharmacokinetic parametric images from dynamic ^{18}F-FDG PET has become possible using physiology-aware neural networks [1]. The kinetic parameters of the 2-tissue reversible compartment model, namely K1 (mL/cm3/min), k2 (1/min), k3 (1/min), and k4 (1/min), describe the perfusion and the metabolic processes of glucose. Comprehensive literature on the expected values of the kinetic parameters is scarce, and parametric images are not conventionally used in clinical research. In this work we show that the generated parametric images are consistent with the current clinical knowledge of the metabolic pathways of glucose. ***Materials and Methods:*** The dataset included 23 oncological patients with heterogeneous tumour types. Dynamic ^{18}F-FDG PET scans were acquired using a long axial FOV (LAFOV) PET/CT scanner [2].The parametric images are generated by the neural network proposed by De Benetti et al. [1], using 18 patients for training and validation, and 5 for testing (including 3 patients with lymphoma, one with breast cancer and one melanoma). ***Results:*** The plausibility of the resulting parametric images was confirmed by an experienced nuclear medicine physician, and the kinetic parameters values per organ are consistent with [2].The predicted parametric images show high perfusion in the kidneys (K1=0.96, k2=1.30), and the liver (K1=0.58, k2=0.73). Brain and kidneys have a high phosphorylation rate (k3=0.30 and k3=0.07, respectively). We report high k1, k2, and k3 in the perfused regions of cancerous lesions, whereas they are absent in the cysts or in the necrotic regions of the tumours. Mediastinal glucose uptake (k3) was notably high in lymphoma patients. As expected [3], gluconeogenesis is observed in the liver (k4=0.25), the kidneys (k4=0.18), and intestines (due to patients fasting prior to imaging). ***Conclusion:*** The use of parametric images provides a novel method to non-invasively measure the perfusion and glucose metabolism throughout the body at a voxel level. Specifically, it facilitates the analysis of the kidney glucose metabolism, which is challenging with static PET images and has previously led to an underestimation of the kidneys' contribution to overall gluconeogenesis. In addition, the voxel-wise analysis of the k3 and k4 parametric images can give insights about the different regions of the kidneys with glucose uptake and gluconeogenesis, respectively. The agreement of the predicted parametric images with the current understanding of the glucose metabolism paves the way for a wider use of parametric images in clinical practice. ***References:*** [1] De Benetti, 2023. [2] Sari, 2022. [3] Legouis, 2022.

EP-0776

Report on respiratory motion amplitude in PET/CT

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Aim/Introduction: The degradation of image quality due to patient respiratory motion has become a primary concern in clinical PET imaging. Despite the growing attention paid to respiratory motion (RM) correction methods, there lacks reports of the amplitude of RM at organ level. This study aims to bridge

this gap by assessing the motion amplitudes of internal organs affected by RM. ***Materials and Methods:*** A cohort of one hundred subjects (55/45 M/F,58.4±15.5 years old,64.8±12.1 kg,166.0±8.0 cm, Chinese population) underwent whole-body 18F-FDG (6.79±1.30 mCi) scans. The motion amplitude of each organ was estimated as follows: data-driven RM signal was extracted using centroid-of-distribution (COD), which followed by RM gated reconstructions. Attenuation correction (AC) was performed using deep learning-based attenuation map to avoid AC artifacts. Non-rigid registration was performed between inspiration and expiration gate, where the yielded deformation field (DF) was used as the RM amplitude estimate for each voxel. N=49 organ volumes of interest (VOIs) were generated using AI-based segmentation methods based on CT. The mean and standard deviation (SD) values of DF within each VOI were calculated. ***Results:*** The mean value of RM amplitudes within the VOIs ranged from 0.5-12.0 mm (SD,0.6-5.1 mm). The liver dome region exhibited the largest amplitude among all organs (12.0±3.8 mm), followed by pancreas (10.5±1.9 mm), right kidney (9.9±2.5 mm), left kidney (9.1±2.5 mm), stomach (9.9±2.7 mm), spleen (8.9±2.6 mm), heart (7.3±1.8 mm), aorta arch (3.3±1.4 mm), bladder (2.0±1.2 mm), while the right lung lower lobe (9.2±5.1 mm), right lung middle lobe (6.9±2.8 mm), left lung lower lobe (6.2±3.8 mm), left lung upper lobe (2.9±1.1 mm) and right lung upper lobe (2.5±1.9 mm). The chest and abdominal walls show amplitudes of 3.1±3.0 mm and 5.5±3.0 mm, respectively. Males exhibit 7.5% in average higher motion amplitude than females. ***Conclusion:*** This study provides a quantitative evaluation of the motion amplitudes of internal organs affected by RM in a PET dataset of 100 subjects among Chinese population.

EP-0777

Detection of cancer-associated cachexia in lung cancer patients undergoing whole-body [18F]FDG-PET/CT imaging

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Aim/Introduction: Cancer-associated-cachexia (CAC) is a metabolic syndrome that substantially decreases the quality of life and survival of oncology patients. We aim to assess the potential of whole-body [18F]FDG-PET/CT imaging for providing metabolic imaging readouts indicative of CAC in lung cancer patients. ***Materials and Methods:*** 347 lung cancer patients (LCP) underwent [18F]FDG-PET/CT imaging for clinical staging. Using the body mass index (BMI)-adjusted weight loss (WL) grading system (WLGS), LCPs were stratified into three metabolic phenotypes: "No CAC" (WLGS-0/1 at baseline and first follow-up: N=159, 52F/107M), "Dev CAC" (WLGS-0/1 at baseline and WLGS-3/4 at follow-up: N=90, 34F/56M), and "CAC" (WLGS-3/4 at baseline: N=98, 31F/67M). Abdominal organs, muscles, subcutaneous and visceral adipose tissue were segmented automatically from PET/CT images [1]. Organ volumes and standardized uptake values (SUV) normalized to aorta uptake (SUVaorta) were calculated and compared statistically across the three cohorts. A correlation analysis was conducted to study inter-organ connectivity using Spearman correlations. A machine-learning model was trained to classify the LCP in "No CAC", "Dev CAC" or "CAC". SHapley Additive exPlanations (SHAP) analysis was employed to identify the parameters that primarily contributed to CAC for each patient. ***Results:*** Mean SUVaorta were highest in "CAC" patients in most regions ($p<0.05$), except liver and kidneys; the corresponding organ volumes were smaller than in the other two cohorts. In "CAC" patients, a strong negative Spearman correlation ($\rho=-0.8$) was identified between mean SUVaorta and volumes of the fat regions. Machine-learning based classification into "CAC" and "No CAC" was 81% accurate, while classification into "No CAC" or "Dev CAC" was low (54%). SHAP analysis identified SUVaorta of the spleen, pancreas, liver, and fat as the key parameters for the prediction of CAC. ***Conclusion:*** Whole-body [18F]FDG PET/CT imaging reveals elevated uptake levels in multiple organs associated with the metabolic disease. Metabolic patterns in LCP with CAC were distinct for LCP without CAC. "Dev CAC" prediction was not possible given the variability of metabolic profiles and requires further analysis on larger cohorts. ***References:*** [1] L. K. Shiyam Sundar et al. "Fully-automated, semantic segmentation of whole-body [18F]FDG PET/CT images based on data-centric artificial intelligence". In: Journal of Nuclear Medicine (2022).

EP-0778

Using machine learning and advanced filtering for denoising of simulated low-dose O-15 water PET sinograms to assess potential dose reduction in activation studies

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Aim/Introduction: Using radioactive tracers, positron-emission-tomography (PET) enables the assessment of increased neuronal activity with precise spatial assignment. In this regard, O-15-water is a useful tracer which allows statistical inferences on regional activations. As a basis to reduce the radiation exposure for future PET scans we simulated low-dose scans and evaluated the usefulness of machine learning (ML) to denoise sinograms. ***Materials and Methods:*** We included O-15-water-PET activation studies of five patients with different types of auditory implants in the cochlear (CI, n=1), brainstem (ABI, n=2) or midbrain (AMI, n=2). Patients were scanned in a full-ring PET/CT (LSO-Duo) during quiet and speech stimulation[1]. To simulate the application of lower radioactive doses we randomly reduced the number of coincidence events by different factors of the power of two. Normalised and corrected sinograms were used for reconstruction directly or after denoising with a Gaussian mixture-model-based machine-learning algorithm (GMM) or the advanced-filtering algorithm BM4D[2]. The outcome was assessed by computing (i) the signal-to-noise-ratio (SNR) in the reconstructed images, and (ii) the number of significantly-activated voxels in the auditory

cortices based on statistical-parametric-mapping (SPM). For the latter analyses, the number of available scans was also incorporated in the reduction level. ***Results:*** While reducing the scans without denoising led to a significant decrease in the SNR values on every reduction level compared to original scans ($p<0.05$), denoising with either BM4D or GMM was able to avoid a significant decrease in SNR up to a reduction factor of 32 and 64, respectively. Moreover, GMM was performing significantly better than BM4D when compared directly ($p<0.05$). In the SPM analyses of non-denoised data a reduction of coincident counts on every level led to a significant decrease in the number of detected activated voxel compared to the original (100% counts). Denoising with GMM was able to sustain the number of activated voxels up to a reduction factor of eight, while BM4D could sustain the same up to a factor of four. ***Conclusion:*** The present data indicates that the outcome in important parameters of activation studies could be sustained by suitable denoising if the patient would have been administered a significantly lower amount of radioactivity. We expect that denoising the sinograms with a GMM-based algorithm enables a dose reduction up to a factor of eight when being applied on the same PET system. ***References:*** [1]Berding G et al. PLoS One.2015; 10: e0128743. [2]Maggioni M et al. IEEE Trans Imag Process.2013; 22: 119-133.

EP-0779

Intra-subject and inter-group variability of whole-body [18F]FDG PET/CT imaging of healthy controls

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Aim/Introduction: Whole-body [18F]FDG-PET/CT imaging is a clinically viable method for managing oncology patients. To investigate disease-associated inter-organ aberrations of metabolic profiles, a normative database of Standardized Uptake Values (SUVs) is needed. This multi-centre study assessed test-retest variabilities of mean SUV body weight (SUVBW) of key organs at different time intervals (90 min, 1 month, and 1 year) in healthy cohorts. ***Materials and Methods:*** This study included three cohorts of healthy controls undergoing test/retest whole-body or total-body [18F]FDG-PET/CT imaging, with the following different time lapses between the test and retest scans: 90 min for 19 volunteers (10M/9F, 76±17 kg) scanned in Austria (AUT_90min, uptake-time: 71±5 min), 1 month for 25 controls (13F/12M, 74±13 kg) imaged with a total-body system in Austria (AUT_1m, uptake-time: 58±6 min), and 1 year for 49 participants (8F/41M, 69±13 kg) scanned in Japan (JPN_1y, uptake-time: 61±1 min). CT images were automatically segmented into volumes-of-interest (VOIs) for the key organs: brain, myocardium, kidneys, liver, pancreas, spleen, lung, skeletal-muscle, and subcutaneous-fat using the MOOSE software [1]. Mean SUVBW and volumes were extracted from each VOI. Intra-control differences and distributions across the centres were assessed using relative percentage differences (%D) between test and retest, and t-tests. ***Results:*** In the AUT_90min, mean SUVBW exhibited significant intra-subject variation only in brain (%D=-3%, p=0.01) and heart (%D=-16%, p=0.02). AUT_1m did not exhibit test-retest mean SUVBW variations in any region. In JPN_1y, intra-control mean SUVBW differences were significant only in kidneys (%D=-3%, p=0.05). Liver uptakes on AUT_90min and JPN_1y data were comparable (%D<5%, p=0.66). In all 3 cohorts, weight changes of the subjects between test and retest were not significant. Overall, participants in JPN_1y had smaller muscle and fat volumes than AUT_90min and AUT_1m cohorts ($p<0.05$). ***Conclusion:*** Differences in mean SUVBW in the test-retest studies of healthy controls were minimal, particularly in less perfused organs, suggesting that building a normative database of FDG- SUVBW is plausible. However, confounders, such as differences in demographics and uptake time, may contribute to variations in mean SUVBW distributions and should be addressed. ***References:*** [1] L.K. Shiyam Sundar et al. "Fully-automated, semantic segmentation of whole-body [18F]FDG-PET/CT images based on data-centric artificial-intelligence". In: J Nuc Med (2022).

EP-0780

Impact of Delay Calculation Methods in LAFOV PET Kinetic Analysis

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Aim/Introduction: Large axial field-of-view (LAFOV) PET scanners enable whole body parametric imaging using image derived input functions (IDIF). However, whole-body kinetic analysis faces challenges, such as the need to correct for delay between tissue and IDIF tracer arrival [1]. The conventional approach, joint estimation, fits the delay as an additional parameter in the tissue compartment model, which is computationally demanding at a voxel-level. The leading edge (LE) method has been proposed as a efficient alternative, but its validation is limited to [18F]FDG bolus injections [2]. This study assesses the LE method for estimating delay in both bolus and non-bolus injections of [15O]H2O and [18F]MC225, respectively, and evaluates its impact on kinetic parameter estimation. ***Materials and Methods:*** Four LAFOV PET scans were performed: two 10 minutes scans after a 5 seconds [15O]H2O bolus injection (500 MBq) and two 60 minutes scans after an extended 60 seconds [18F]MC225 injection (143-200 MBq). IDIFs were extracted from the ascending aorta. For tissue activity curves, eight regions of interest (ROIs) were segmented using Total Segmentator (brain, kidneys, spleen, pancreas, gluteus, myocardium). The delay between IDIF and the ROIs was calculated using the joint estimation (JE) and LE methods [1]. Kinetic modelling was performed using a reversible single compartment model ([15O]H2O) and two-tissue compartment model ([18F]MC225), using the delays obtained with both methods. Delay values and kinetic parameters estimated using LE were compared with those obtained using JE. ***Results:*** For the [15O] H2O bolus injection, an average difference of 2.88±1.27 seconds was found between the delays estimated using LE and JE (R2=0.94). K1 and volume of distribution (VT) derived with both delays showed, on average, a relative difference of 3.6 ± 5.3% and 1.7±2.0%, respectively (Table 1). For the [18F]MC225 non-bolus injection, an average difference of 9.25±3.26% seconds was found between the delays estimated using LE and JE (R2=0.66), resulting in a relative difference of 10.19 ± 3.30% and 15.72 ± 14.11% for estimated K1 and VT, respectively (Table 2). ***Conclusion:*** For a [15O]H2O bolus injection, the LE method shows very good agreement with the traditional JE method, for both delay and kinetic parameters. For the slow [18F]MC225 injection, delay and

kinetic parameters obtained using the LE method showed a poorer agreement with the JE method, indicating that the LE method may not be the optimal approach in case of non-bolus injections. ***References:*** 1.Li EJ et al.,J Nucl Med. 2022 Aug;2.Wang Y et al.,J Nucl Med. 2023 Jul.

EP-0781

Optimization of Platelet Kinetic Calculations Using a Comprehensive Programmed Spreadsheet

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Aim/Introduction: Autologous radiolabelled platelets are used to assess platelet kinetics in patients with immune thrombocytopenic purpura (ITP), characterized by low platelet count in an otherwise healthy individual. Platelet kinetic and scintigraphic parameters can establish the pattern of platelet destruction, which is predictive of splenectomy success as second-line treatment. Data processing of samples tipically involves a combination of spreadsheets, statistical software and manual calculations. We aim to unite all those tools into a single software solution. ***Materials and Methods:*** Platelet kinetics were studied in 10 ITP patients, following Thakur et al.'s method [1]. Counting rates from the standard and blood samples at 30 minutes, 2, 3, 4, 24, 48 and 72 hours post-injection were input into a Microsoft Excel 2013 spreadsheet, along with patient sex, height, weight and platelet count. The spreadsheet was programmed for regression by linear, exponential and multiple-hit method. Multiple-hit variables were optimized using Excel VBA and the Solver add-in. Results were validated against those from RStudio and the COST program [2]. ***Results:*** The program calculates mean counts per minute for each blood sample, charting them as a percentage of total platelet activity. Platelet recovery, mean survival time and turnover are automatically reported and compared to reference values. Results showed no difference compared to validated software. Reggresion residuals are displayed, and users can choose wether to calculate mean survival time by weighted mean or multiple-hit method, the latter being recommended by the International Council for Standardization in Haematology (ICSH) as it provides the closest fit to data. ***Conclusion:*** We have developed a useful tool to analize and report platelet kinetics in a single validated spreadsheet providing instantaneous results. Removing manual calculations and reducing the programs involved have two main benefits: decreased risk of error and faster analysis. The software is available upon request to the authors. ***References:*** [1] Mathew L. Thakur, Lisa Walsh, Harry L. Malech, Alexander Gottschalk. Indium-111-Labeled Human Platelets: Improved Method, Efficacy, and Evaluation. Journal of Nuclear Medicine Apr 1981, 22 (4) 381-385. [2] Lötter MG, Rabe WL, Van Zyl JM, Heyns AD, Wessels P, Kotzé HF, Minnaar PC. A computer program in compiled BASIC for the IBM personal computer to calculate the mean platelet survival time with the multiple-hit and weighted mean methods. Comput Biol Med. 1988;18(4):305-15.

EP-0782

Impact on SUV measurements of extravasation resulting from an intra-arterial administration of 2-[18F] FDG

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Aim/Introduction: Standardized uptake value (SUV) is widely used as a PET semiquantitative parameter and can be calculated as the ratio between activity concentration (MBq/mL) and administered dose (MBq) multiplied by the patient's weight, corrected taking into consideration the delay between injection time and the scan start time. An extravasation event may occur during radiopharmaceutical administration, making the SUV value less accurate since the administered activity is not entirely distributed.The purpose of this study was to evaluate the impact on SUV measurements of an arterial administration followed by radiopharmaceutical extravasation, in a 2-[18F]FDG PET/CT scan. ***Materials and Methods:*** We evaluated a PET/CT scan in which extensive extravasation was observed in the right forearm and hand, after an inadvertent intra-arterial injection of 2-[18F]FDG. The administered activity was corrected based on activity and time of calibrated dose, time of injection and residual activity. Volumes of interest (VOI) were drawn using isocontour in three hypermetabolic lesions in the pancreatic region and the extravasation site (right forearm). Activity retained in the administration site was then estimated by multiplying the activity concentration by the volume of the extravasation site. Corrected SUV values were estimated based on the extravasation corrected administration activity and relative differences were calculated. ***Results:*** Administered activity was 223.48 MBq at time of injection. The images were acquired 82 minutes after and SUVmax was found to be 7.79 g/ml, 7.48 g/ml and 4.73 g/ml in lesions 1, 2 and 3 with volumes of 69.41 cm3, 12.17 cm3 and 8.71 cm3, respectively. The extravasation site had 452.65 cm3 and a SUVmax of 184.59 g/ml, resulting in an injection site activity of 69.20 MBq. The corrected distributed activity calculated was 154.28 MBq. Absolute relative differences between initial SUVmax and estimated SUVmax based on distributed activity were in the range of 44.86% to 46.85%. ***Conclusion:*** It was observed that inadvertent intra-arterial injection and significant extravasation can alter substantially SUV values. This could be of critical clinical importance for both an initial diagnosis and therapy response assessment PET/CT. Extravasation should thus be reported to avoid false interpretations when using SUV values.

EP-0783

Comparison of Relative Renal Function with ^{99}mTc-DMSA from Planar Imaging and 360-degree CZT SPECT/CT

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Aim/Introduction: To compare the relative uptake of 99mTc-DMSA in renal scintigraphy obtained from planar imaging and 360-degree CZT SPECT/CT. ***Materials and Methods:*** Patients who underwent both imaging modalities on the same day were first included and those with functional DMSA exclusion or solitary kidney were excluded from analysis. The minimum, maximum, and mean relative uptake (with standard deviation) for each kidney using both methods were calculated. Relative uptake was categorized as follow: 45-55% (normal), 35-45% (mild reduction), 25-35% (moderate reduction), and <25% (marked reduction). Concordance between methods was assessed using the Bland-Altman test and the intraclass correlation coefficient for both kidneys. ***Results:*** To date, 24 patients have been analyzed. For the right kidney, the planar images showed a minimum uptake of 4.90%, a maximum of 97.10%, and a mean of 51.64% (SD 21.953); the left kidney showed a minimum of 2.90%, a maximum of 95.10%, and a mean of 48.61% (SD 22.032). With 360-degree CZT SPECT/CT, the right kidney showed a minimum

uptake of 2.50%, a maximum of 97.80%, and a mean of 50.41% (SD 22.370); the left kidney showed a minimum of 9.10%, a maximum of 97.50%, and a mean of 50.41% (SD 49.70). Regarding renal function classification, planar images revealed that 20.8% of patients had normal function, and 33.3%, 25.0%, and 20.8% had mild, moderate, and marked reductions, respectively. For CZT SPECT/CT images, 29.2% showed normal function, and 33.3%, 8.3%, and 29.2% had mild, moderate, and marked reductions, respectively. The Bland-Altman analysis showed a concordance between methods for the right kidney with limits of agreement from -8.0% to +5.5%, and for the left kidney from -8.2% to +11.8%. The intraclass correlation coefficient indicated good reliability, with a value of 0.8710 (95% CI: 0.7267-0.9419). ***Conclusion:*** The analysis demonstrates that the relative renal function measurements obtained from 360-degree CZT SPECT/CT are reliable and comparable to those obtained from planar imaging. Further patients are being enrolled in this analysis.

EP-0784

Enhancing Blood-Brain Barrier Penetration Prediction with Machine Learning and Explainable Artificial Intelligence

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Aim/Introduction: Predicting the penetration of the blood-brain barrier (BBB) is pivotal for the development of central nervous system (CNS) drugs and one of the bottlenecks of successful clinical phase I studies. In this study we employ traditional methods based on physico-chemical properties derived using experimental measurements and in silico methods. We enhance these molecular properties by machine learning (ML) integration to identify radiolabeled molecules capable of penetrating the BBB. ***Materials and Methods:*** For a dataset of 110 radiolabeled molecules previously measured in vivo for BBB penetration, we collected a total of 24 calculated and experimental molecular parameters such as molecular weight, polar surface area (PSA), logP values, hydrogen bond characteristics, and published values or prediction rules. Additionally, we enhanced these with novel in silico 3D calculations of non-classical polar surface area. Based on the collected data, we trained various ML models employing a 100-fold Monte Carlo cross-validation framework. Explainable artificial intelligence methods such as Shapley additive explanations (SHAP) and surrogate modeling were integrated to interpret the influence of individual molecular parameters on BBB penetration predictions. ***Results:*** The machine learning approach outperformed traditional predictive parameters, with the random forest model achieving the best performance for predicting binary BBB penetration (AUC 0.88, 95% CI: 0.87-0.90) and multiclass efflux transporter versus CNS positive and CNS negative prediction (AUC 0.82, 95% CI: 0.81-0.82). SHAP analysis identified the problem as highly multifactorial further emphasizing the benefit of multivariate models over single predictive parameters where novel and established parameters play important roles. A comparison with existing scoring systems like the CNS MPO (AUC 0.58) and BBB (AUC 0.67) scores (1,2) demonstrated the superior predictive capability of the ML model, while additionally allowing for the identification of efflux transporter substrates. ***Conclusion:*** Our integrated ML approach utilizing in vivo measurements and novel in silico approaches significantly enhances the prediction of BBB penetration, potentially reducing reliance on extensive experimental measurements and animal testing. This advancement not only accelerates CNS drug development but also offers a standardized database and hence a methodologically transparent approach through the application of explainable AI. ***References:***

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EP-0785

Total-body Organ Metabolic Analysis for Patients with Different Intensities of Smoking using uEXPLORER

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Aim/Introduction: Smoking history has always been an important indicator in lung cancer screening. We all know common sense that smoking damages lung function. However, whether smoking is harmful to other organs of total-body and what abnormalities may occur among various organs have not yet been studied. Moreover, it is also limited by the fact that previous scanners cannot simultaneously image the total-body. Until the emergence and development of total-body PET/CT (uEXPLORER), we can capture the metabolic status of organs throughout the body at the same time. This advanced technology facilitates the exploration of the correlation between abnormal metabolism among various organs of total-body. This work takes a group of lung cancer patients as an example and introduces the factor of smoking intensity to observe the metabolic abnormalities between organs and systems in different smoking groups. ***Materials and Methods:*** 18F-FDG PET and CT images from 60 anonymized subjects with 40 lung cancer patients and 20 healthy controls (HCs) are scanned from uEXPLORER PET/CT. Among lung cancer patients, smokers of varying intensities were surveyed (non-smokers: light smokers: heavy smokers = 21:4:15). For each scan, 17 regions of interests are outlined as total-body organs. To analyze the abnormal metabolism of different smoking groups, we construct individual abnormal metabolism networks and group abnormal metabolism networks, and establish a reference network based on HCs, inspired by the work of Sun et al[1]. ***Results:*** For the individual abnormal metabolism analysis, the proportion of smokers with significant abnormal metabolism is obviously higher than that of non-smokers. Besides, heavy smokers have a substantially greater proportion of metabolic decline compared with others for some organs like lungs, heart, kidneys and esophagus. In addition, for the group abnormal metabolism analysis, the abnormal metabolism of the lungs, esophagus and gland thyroid increases significantly as the intensity of smoking higher, and between the nervous system and other systems also show stronger abnormal metabolism. ***Conclusion:*** This work explores the impact of smoking intensity on total-body organ glucose metabolism in lung cancer. The proposed analysis method has the potential to be applied to other systemic diseases in the future. ***References:***

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EP-0786

Interrogating wastewater data for insight into medical radionuclide usage in the UK

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Aim/Introduction: The supply of medical radionuclides to the UK is integral for delivering healthcare for diagnosis and treatments. It is known that there is geographic variability on the quality of healthcare received [1], with the supply of medical radionuclides being limited in some areas. Understanding the quantity of radionuclides used in different areas of the UK will demonstrate which areas are underserved. However, getting access to the number of procedures performed per hospital is difficult considering data restrictions and different procedural recordings. As part of UK law, the discharge of radionuclides in aqueous waste must be estimated using assumed patient excretion factors and reported to the Environment Agency (EA) for monitoring purposes. We investigated whether the publicly available EA waste data inventory [2] could be used to show regional Usage of medical radionuclides. ***Materials and Methods:*** The total emission of all radionuclides via wastewater was interrogated from 2019 until 2022 using Python. The healthcare sites (both private and public) were separated from universities and other research sites to focus on just the radionuclides used in healthcare. For each radionuclide, the activity collated by the EA was divided by the recommended excretion factor [3] to get a total activity before administration at each of the healthcare sites. This total activity was cross-checked against detailed data of procedures performed with Tc-99m at the Royal Surrey, UK. ***Results:*** An interactive map was created that can interrogate the amount of radionuclides used at healthcare sites across the UK. The EA data when cross-checked with the detailed procedural data was on average consistent by 90%, providing confidence in the method applied. ***Conclusion:*** Estimates of environmental discharge of radionuclides can be utilised to understand the radionuclide usage in the UK. The map of radionuclide usage demonstrates clear geographic discrepancy in the amount of radionuclides used in the South compared with the North of the UK, which could be linked to healthcare deprived areas in the UK. The same methodologies could be applied in other nations where there are similar datasets available. ***References:***

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EP-0787

New autoradiography image analysis tool combining overlain microscopy and histology in Carimas multimodal DICOM image analysis software

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Aim/Introduction: Autoradiography is an essential tool for the many different stages of radiopharmaceutical development. It is often used in the assessment of thin layer chromatography (TLC) of synthesis products, metabolite products and can directly measure ex vivo tissues (whole and sections) with high spatial resolution. A new autoradiography analysis module was built into Carimas medical image analysis software to improve workflow and move closer to an all-in-one radiopharmaceutical image suite for in vitro, in vivo, and ex vivo studies. This new program was rigorously tested against existing software to examine its comparability and validity with existing workflows. ***Materials and Methods:*** Comparative testing of Carimas (Turku PET Centre) versus commercially available software (AIDA and TINA; Raytest) was done via practical methods and pixel-by-pixel testing in random clusters. First, fluorine-18-containing samples were exposed to phosphor imaging plates for 4 hours and scanned with a Fujifilm BAS-5000 using different encoding and resolution settings (8- and 16-bit depth as well as 25 µm and 50 µm resolution). Segmentation was performed on macro regions, pixel-by-pixel in random 6-by-3 clusters, and small 3×3 pixel areas extracting photo-stimulated luminescence (PSL) values. ***Results:*** All small region analyses were identical (after adjusting for a 1 pixel shift present in TINA) in PSL and PSL/mm2 output suggesting that the same quantification equation is employed in all three software suites. Macro regional analyses varied only by an average (n = 72 regions from 4 images and all analysed in each 3 software programs) of 0.084% ± 2.163, which was attributed to subtle differences in manual region drawing. A single factor ANOVA test suggested no significant differences between the three programs ($P = 0.999$, $F = 0.001$). ***Conclusion:*** The results showed no significant difference in data output between programs. Carimas was demonstrated to be an accurate program for analysing autoradiography image data and includes the ability to overlay histology images to conveniently guide segmentation.

EP-0788

Optimised model for elimination of baseline imaging for bile acid malabsorption tests

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Aim/Introduction: Bile acid malabsorption tests commonly consist of a baseline intrinsic gamma camera image 15mins-3hours following oral administration of a 400kBq 75-Selenium tauroselcholic acid tablet.The image is repeated at 7days and retained activity calculated.The baseline data captures the administered activity attenuated by patient tissues and published literature reports this can be replaced by a mathematical model based on administered activity,patient height and weight[1] or body mass index[2].The gamma camera model used in our centre

was not used in these studies.We hypothesised patient age and sex could affect tissue distribution and attenuation and including these factors may improve model performance.The aim of this project was to evaluate the optimal model to replace baseline imaging for the gamma camera model in our institution. ***Materials and Methods:*** 152 consecutive studies were included in this audit. Patient height,weight,sex,age,administered activity and counts in baseline and day7 images were recorded.Baseline,background-corrected,geometric-mean counts were normalised to measured capsule activity.Multiple regression analysis was performed for combinatoins of height,weight,BMI,age and sex for 108 studies forming the development group.The adjusted R2 was used to rank the models.The best three models were tested on the remaining 44 studies forming the validation group and retained activity compared between modelled and acquired data using a 15% cut-off between normal and abnormal studies. ***Results:*** The best three models had adjusted R2values (and variables in model) of 0.822(height,weight,sex), 0.814(height,weight) and 0.787(BMI) for the development group with identical sensitivity(100%) and specificity(97.8%) across all models.For the validation group the sensitivity was 92% and specificity was 100% for the models based on height and weight and height,weight and sex.These values decreased to 88% and 95% respectively for the model based on BMI.The calculated retained activity was not statistically significantly different if modelled or acquired data was used. ***Conclusion:*** For the gamma camera at our centre the optimised model used patient height,weight and age to calculate baseline image data for bile acid malabsorption testing.However in the validation group this model had identical performance to the model based only on patient height and weight.Including patient sex did not improve the accuracy of the models.The simpler model based on height and weight is recommended for use. ***References:*** [1]Smout A, Scuffham J, Hinton P.Single scan SeHCAT studies:a model for the prediction of the 3-h counts.Nucl Med Commun 2021;42:1209-1216[2]Duchstein L, Haedersdahl C, Nielsen J, Flensborg A.Replacing the 3 hours imaging in 75Se-SehCAT bile acid malabsorption investigations with a calculated value.Eur J Nucl Med Mol Imaging46(Suppl1), p333(2019).

EP-0789

A New Innovative Tool for Estimating Radionuclide Demand for Diagnostic Medical Imaging at a National Level

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Aim/Introduction: For the 3 million people diagnosed with cancer in the UK annually, radionuclide imaging is an element of agreed diagnostic protocols. We hypothesise that utilisation of radionuclide falls below the levels expected by our national cancer burden. We therefore designed a mathematical model to estimate demand for radionuclide incidence assuming all patients are imaged according to best evidence. We present initial insights based on prostate cancer and lymphoma. ***Materials and Methods:*** We implemented a discrete event simulation whereby incidence data for a specific clinical indication can be inputted and fed through a series of calculations to produce radionuclide specific demand values (measured as number of scans required) which can then be compared to the baseline (actual number of scans performed). We used data for England in 2019. This model is composed of 3 main components. 1. Cancer registration data is stratified by stage and deprivation level. 2. Stage specific scan burden is determined from best evidence (national guidelines, published protocols and expert clinical consensus). 3. Division of scan burden by radionuclide type using the Administration of Radioactive Substances Advisory Committee guidelines and diagnostic imaging datasets. ***Results:*** We calculated an increase in demand from the baseline of 86% for prostate cancer, and 265% for lymphoma, according to best practice. We then split total demand by radionuclide type, resulting in an increased demand of 1319% for F^{18} and Ga-68 for prostate cancer, and of 264% for F^{18} for lymphoma. Additionally, analysis of incidence data demonstrated a disparity in cancer staging at diagnosis between the most and least deprived areas. For prostate cancer, in the least deprived areas, 39% are diagnosed at stage 1 and 18% at stage 4, compared to 35% at stage 1 and 23% at stage 4 in the most deprived areas. ***Conclusion:*** Our results highlight that we are not providing the appropriate number of scans required to adequately diagnose prostate cancer and lymphoma according to best practice. The degree of disparity between the baseline and the best practice models is significant. Additionally, the most deprived areas are disproportionally affected by the insufficient number of scans performed, resulting in worse patient outcomes. Going forward, this model will be utilised to calculate true demand for additional cancer types and other clinical indications, both at a national and regional level.

EP-53

e-Poster Area

D: Technical Studies -> D2 Data Analysis -> D23 Image Reconstruction

EP-0791

Local Distortion by Hot Object during Iterative MLEM Tomographic Reconstruction: Lessons from Myocardial Perfusion Imaging and Solution for Artifact Resolution

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Aim/Introduction: To assess performance of MLEM iterative reconstruction in presence of a hot spot or object in myocardial perfusion images and to visualize the artifact and quantify extent of involvement of adjacent and other more distant myocardial walls. Then, a technique for artifact resolution is proposed. ***Materials and Methods:*** A cardiac NCAT phantom is constructed that is used as "control" in which no nearby hot spot or highly intense object exists. Four other phantoms are generated by creating a lung lesion close to lateral wall of LV, with the goal of producing a hot spot with spot-to-myocardium ratio (S/M Ratio) of 0.5, 1, 2, and 4. Another uniformly-thick 3D ellipsoid phantom of LV with adjacent lesion is created in the direction of z-axis and lesion is located along the x-axis. Then, the entire phantom is rotated 90° along the y-axis and x-axis. Sinograms of phantoms are created by forward projection along z-axis and Poisson noise is added. An in-house MLEM algorithm is implemented and utilized for tomographic reconstruction. Images are reoriented along LV long axis. Slices are segmented and normalized to maximum pixel value of LV. Each image is subtracted from control image

to form error images. Circumferential profile curves are plotted. All computations are conducted in MATLAB software. ***Results:*** Tomographic image of control phantom reveals an almost uniform intensity in lateral wall. However, as S/M ratio increases, the distortion worsens. In the S/M ratio of 4, a remarkable artifactual defect and non-uniformity are seen along the lateral wall. The circumferential curves of all walls are almost superimposed except for the wall close to the object (or lateral wall of the LV), where the gap between curve of control and curves of other phantoms widens. For second phantom (hot object along the x-axis of LV), when phantom is rotated 90° along y-axis, hot spot is situated along z-axis, therefore, no defect is visualized in adjacent LV wall. ***Conclusion:*** Presence of a hot spot or object creates artifactual defect in adjacent region of organ-of-interest (LV wall close to the hot lesion) during reconstruction by MLEM algorithm. The severity and extent of defect are related to the relative intensity of hot spot and LV myocardial wall. A solution to prevent this artifact from occurring is rotating the volume before reconstruction in a way that the hot spot and the organ-of-interest (LV) are situated along z-axis on which reconstruction is performed.

EP-0792

Evaluation of post-reconstruction filters applied on Methionine brain PET

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Aim/Introduction: Iterative reconstruction methods in nuclear medicine allows the reconstructed images to reflect the observed data and the data acquisition process. However, it suffers from low count rate and intrinsic system noise. To mitigate the noise in reconstructed images and better quantitative analysis of lesions, post-reconstruction filters such as Gaussian filters are utilized. Previously, we have shown that non-local mean (NLM) filter with entropy-based regulation can be effective to prevent blurring which is prevalent in Gaussian filters. This allows better delineation of lesions or anatomical structures. On the other hand, deep learning(DL)-based image filtering is known to be effective in automated feature extraction and generation. By proper design of unsupervised learning, the DL network can learn to denoise nuclear medicine scans without external dataset. In this work, we evaluate post-reconstruction filters based on reader studies. ***Materials and Methods:*** We acquired list-mode 11C-Methionine brain PET data (20 minutes post-injection) of 50 subjects using Biograph mCT40 and mCT64 PET/CT scanner. From each list-mode data, we reconstructed with full-, half-, and quarter-time of events. For each reconstructed image, we generated 4 types of image with filters; No filter, Gaussian, NLM, and DL. For DL filter, we used a network consisted of only 3-dimensional convolutional layers and leaky rectified linear unit activation functions. The network was trained for each subject with mean absolute error as fidelity and total variation as regularization. The scans were evaluated by two nuclear medicine physicians. The scans were graded in a 4-scale grade based on definition of lesion, definition of cortex, and noise in background. ***Results:*** In terms of definition of lesion, the grades were higher in order of Gaussian, DL, NLM and no filter for full count, and DL, Gaussian, NLM, no filter in lower counts. In terms of definition of cortex, the grades were unanimously higher in order of DL, Gaussian, NLM and no filter. For the background noise, the mean grades were higher in order of DL, Gaussian, NLM and no filter for full and quarter count, and DL, NLM, Gaussian and no filter for half count. The evaluators showed at least a fair correlation, and the highest correlation on definition of lesions. ***Conclusion:*** The DL filter was most effective and the NLM was limited in denoising the PET scan overall. The DL filter shows promise at removing image noise while preserving important features in brain.

EP-0793

Development of dedicated prostate TOF-PET based on ProVision detection concept: Initial image performance study

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Aim/Introduction: The ProVision scanner is a dedicated prostate PET system with dual-head configuration; it employs a new detector technology that provides high intrinsic resolution as well as depth-of-interaction (DOI) and time-of-flight (TOF) information. This study aims to develop a flexible image reconstruction framework for limited-angle TOF-DOI-PET to study the image performance of the current (V1) and proposed upgrade (V2) versions of the ProVision scanner. ***Materials and Methods:*** The ProVision detectors1 consist of four crystal layers which provide discrete DOI information (Y). Each layer contains six 30 mm-long crystals axially oriented, with a crystal pitch of 2.8 mm x 4.4 mm. Dual-ended shared readout yields timing resolution of 170 ps and intrinsic resolution of 8.24 mm (Z) and 1.88 mm (X) (FWHM). V1 and V2 consist of 2x2 and 3x4 detectors per head, respectively. The head-to-head distance is variable; the minimum distance of 19.5 cm is used in this study. A limited translational motion is possible, but no rotation. Using V1 experimental data of point sources, we explored the effects of a small translational head offsetting on the mitigation of truncation artifacts. For image reconstruction, we have extended the list-mode Maximum-A-Posteriori (One-Step-Late) with Total-Variation regularisation to include TOF information. The system matrix and sensitivity include models for detector attenuation and position uncertainty via multi-ray sampling2. Building upon that investigation, the image performance of the forthcoming V2 was studied using Monte-Carlo simulations (GATE) and different phantoms. ***Results:*** For point sources V1 experimental data shows a 38% reduction in elongation (FWHM) through head offsetting. V2 with translational motion (±8.04 cm) achieves FWHM of 1.27 mm (X), 4.42 mm (Y) and 3.49 mm (Z) (FWHM). Elongations caused by the limited angular coverage distort the reconstructed images despite the availability of TOF and DOI information. Nonetheless, V2 setup yields positive results compared to other systems with similar configurations3,4 and the field-of-view is large enough to cover the whole prostate. ***Conclusion:*** The innovative ProVision detector concept shows promising outcomes for inexpensive stand-alone PET. Further improvements in the reconstruction and in timing resolution, together with the use of artificial intelligence, should contribute to reduce the elongation artefacts. ***References:*** 1K Doroud et al 2019 JINST 14 P01016 2J E Gillam et al 2013 PMB 58 2377 3J Stiles et al 2022 Sensors 22 4678 4A Sanaat et al 2024 Ann. Nuc. Med. 38 31-70.

EP-0794

Improving image quantification in dynamic whole-body PET-CT: BSREM vs. OSEM

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Aim/Introduction: Dynamic whole-body PET-CT is a powerful tool for in-vivo glucose metabolic rate assessment in tissue. However, in conventional short-axis field-of-view PET-CT systems, typically short frame durations are used, resulting in relatively high noise levels. This necessitates higher administered 18F-FDG activity and, consequently, higher patient radiation dose. Block sequential regularized expectation maximization (BSREM) reconstruction methods suppress noise and lead to better signal-to-noise ratios in static PET-CT than the widely used standard ordered subset expectation maximization (OSEM) reconstruction method. This study aims to investigate whether the accuracy and precision of the net 18F-FDG influx rate (Ki) in dynamic whole-body PET-CT is improved with the use of BSREM compared to standard OSEM. ***Materials and Methods:*** Dynamic whole-body PET-CT data of five patients scanned under insulin stimulation and hyperglycemia were utilized. These data consisted of a ten minute dynamic scan of the thoracic region followed by six whole-body passes. All data were reconstructed using both OSEM and BSREM according to EARL2 standards. Regions of interest (ROIs) were delineated for the myocardium, quadriceps, hamstring, liver, subcutaneous adipose tissue (SAT), and the descending aorta for the arterial input function. ROI noise levels were calculated for both reconstruction methods. Time activity curves (TACs) for tissues with varying 18F-FDG influx rates (Ki = 0.01-0.06 ml (cm3min)-1) were computationally simulated. Noise was added to the TACs to determine the effect of BSREM and OSEM on the accuracy and precision of Ki calculated with Patlak analysis as a function of ROI size. Patient images were similarly analyzed to calculate Ki in all ROIs, along with the precision and relative bias of both reconstruction methods as a function of ROI size. ***Results:*** The noise in all ROIs was 40-55% lower for whole body passes reconstructed with BSREM ($p<0.05$). Simulations showed no systematic bias in Ki with either reconstruction method. Ki precision decreased with decreasing ROI size, with that of BSREM being superior compared to OSEM at smaller ROI sizes. The patient data corroborated these results, with BSREM providing the best precision for small ROIs of 0.55 cm3 in the quadriceps, hamstring, SAT and liver ($p<0.05$). ***Conclusion:*** BSREM reconstruction of dynamic whole-body PET-CT data yields more precise Ki values, especially for smaller ROIs, compared to standard OSEM. The improvement in precision, particularly for smaller ROIs, suggests the potential of BSREM to enhance the detection and characterization of metabolic activity of small tumors in oncological settings, which needs further confirmation.

EP-0795

Preliminary results from a PET-derived synthetic CT for attenuation correction of FDG brain studies

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Aim/Introduction: Attenuation correction (AC) in an essential component of PET-CT for accurate quantification that is performed using CT. For brain studies, the CT is for AC purposes only and hence offers no additional use in image interpretation. Recently, deep learning has been utilised to produce either synthetic CT or attenuation maps from emission data that can be used for AC. This potentially alleviates the need for a CT. This study presents preliminary comparison data of true CT and synthetic CT for AC of FDG brain scans in adult patients. High performance time-of-flight (TOF) has been shown to reduce the data inconsistencies - even in non-AC images and hence this approach may be especially suited to state-of-art PET systems. ***Materials and Methods:*** A 3D U-net was trained to produce a synthetic CT (SynCT) image using 100 non-AC FDG brain TOF PET images from 100 adults suspected of dementia, acquired on a SiPM PET-CT with 214ps TOF resolution. An independent testing set of 15 adult cases was separately acquired with attenuation corrected images produced from the CT and SynCT, derived from the 15-minute non-AC FDG PET images. Images were reconstructed with 3D iterative reconstruction using 8 iterations, 5 subsets, no post-filter and included TOF and resolution modelling. For AC PET voxels within the brain, the root mean squared error (RMSE) and mean voxel ratio (MVR) (SynCT-AC / CT-AC) were calculated for SynCT. Paired, but blinded, AC PET images were assessed visually in synchronised 3-plane orthogonal views using a matched "Spectrum" colour scale, by an experienced nuclear medicine physician to identify any clinically relevant discrepancies in FDG distribution between the paired images. ***Results:*** The mean and standard deviation of RMSE across the 15 patients was 350 ± 110 Bq/ml and the MVR was 0.985 ± 0.016. Visual review found no perceivable differences in FDG distribution in all but one case. This case showed a minor difference in basal-to-frontal intensity in the vertex region which would not impact clinical interpretation. One other case showed appreciable motion blur in the PET, but the synthetic CT generation was sufficiently robust that no difference was observable between the two AC images. ***Conclusion:*** This work has demonstrated that PET-derived synthetic CT can be used for AC of FDG brain scans with no impact on clinical interpretation. Further work involving comparison with normal databases is planned.

EP-0796

Real-life sensitivity gain with time-of-flight PET considering faster convergence of iterative reconstruction

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Aim/Introduction: Classical Time-of-Flight (TOF) PET theory describes a gain in contrast-to-noise ratio (CNR), that can be considered an effective sensitivity gain. An additional benefit of TOF is the improved convergence rate of iterative reconstruction, requiring fewer updates to achieve comparable or superior levels

of convergence. This work aims to establish real-life sensitivity gain (RLSG) by studying the CNR differences between TOF and non-TOF when reconstruction has converged. ***Materials and Methods:*** The NEMA image quality phantom, filled with a 10:1 ratio with ~83MBq F^{18}-Fluourodeoxyglucose, was scanned on a photomultiplier tube (PMT)-based PET-CT system (22.1cm axial field-of-view (AFOV), 540ps timing resolution), and then on a silicon photomultiplier (SiPM) PET-CT (26.3cm AFOV, 214ps timing resolution) for 30 min. Using CT attenuation correction and 3mm Gaussian post-filter, TOF and non-TOF reconstructions were made with a range of updates. Volumes-of-interest were assigned to the background and 10mm sphere. Curves of maximum activity concentration recovery (ACR) for the 10mm sphere were plotted against updates for all reconstructions. The number of updates at which the ACR curves plateaued, considered as convergence, were determined for non-TOF and TOF reconstructions from each system. For converged reconstructions, CNR for 10mm sphere:background were calculated. RLSG was defined as the additional acquisition time that would be required for the non-TOF reconstructions to achieve comparable CNR to TOF reconstructions on both systems. ***Results:*** Convergence was reached at 20, 42, 70 and 72 updates for SiPM TOF, PMT TOF, SiPM non-TOF and PMT non-TOF reconstructions, respectively. For the PMT system, TOF produced a RLSG factor of 1.9 compared with non-TOF. The SiPM TOF produced a RLSG factor of 8.4 compared with PMT non-TOF. These RLSG values are 81-82% of the effective sensitivity gain reported for these systems according to classical TOF theory. The SiPM TOF had a RLSG of 4.4 times that of PMT TOF, which matches the 4.3 times reported difference in effective sensitivity between these two systems. SiPM TOF demonstrated a RLSG of 3.4 times that of SiPM non-TOF, although this value is subject to bias from TOF information being used to enhance accuracy of corrections also for non-TOF reconstructions on this system. ***Conclusion:*** Considering the TOF effect on noise reduction, through faster convergence, it is shown that the RLSG is close to the estimates from the effective sensitivity value. This information allows clinically valid comparison of scanner performance for determining feasible scan time or dose reductions with newer systems.

EP-0797

Improving deep learning synthetic attenuation map generation by incorporating anatomical context from both early and late frame images in myocardial perfusion PET

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Aim/Introduction: Attenuation correction (AC) is an integral part of cardiac PET but can be challenging to register the heart position in a fast CT with PET data acquired over several respiratory cycles. We have previously demonstrated the utility of synthetic attenuation maps in rubidium-82 PET, generated using deep learning from non-AC PET in the late "uptake" portion of the image acquisition. While most cases showed good agreement to CT-derived attenuation maps, several examples showed discordant features in the synthetic maps: primarily missing pericardial fat (PCF) and vascular structures in the thorax. Pleural boundaries and vascular structures are more readily visible during the early frames, so this work evaluates an updated algorithm trained on dual PET image input: early blood-pool and late uptake to determine whether this resolves these discrepancies. ***Materials and Methods:*** A 3D U-net was trained using dual non-AC rubidium-82 input images: 0-120 second "blood-pool" and 120-300 second "uptake" to generate synthetic attenuation map (SynAC-D). Data originated from 100 routine rubidium-82 patients, with a 5-minute acquisition on a SiPM PET-CT. Fifteen independent cases were evaluated with the single input synthetic map (SynAC-S) and CTAC map. A visual comparison was performed by synchronised scrolling of these three maps. Discrepancies in anatomical structures were noted, using the CTAC map as reference. ***Results:*** PCF was noted on 5/15 of the CTAC maps and was well matched on the SynAC-D map but absent (n=2), reduced (n=2) and matched (n=1) on SynAC-S map. A large and highly tortuous descending aorta was observed in one case that was completely absent on SynAC-S but well matched on SynAC-D. A mismatch in size and position of aortic arch was seen in three SynAC-S maps, but well matched in SynAC-D maps. Liver and diaphragm positions were similar on the synthetic maps but differed in several cases compared with the CT. This was noted in previous work and attributed to the CT capturing the diaphragm at the extreme positions of the breathing cycle. ***Conclusion:*** Our preliminary work has demonstrated that dual time-point, deep-learning algorithm PET derived synthetic attenuation maps are closer to the ground truth CT derived maps than a single point attenuation map. This is likely due to improved anatomical detail of the vascular structures visible during the first-pass of the tracer infusion. Further work is planned to compare, both quantitatively and clinically, the impact on the AC of the PET image using this updated algorithm.

EP-0798

Sinogram-based Deep Learning Partial Volume Correction for Lu177-PSMA-SPECT

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Aim/Introduction: SPECT-based dosimetry is an essential tool for Lu177-PSMA treatment optimization but quantification is limited by Partial Volume Effects (PVE) [1] due to collimator response. Resolution Modeling (RM) correction applied during reconstruction helps but is still insufficient and anatomy-based methods such as iterative Yang (iY) rely on a segmentation. We propose a segmentation-free Deep-Learning-based method for Partial Volume Correction (PVC) on SPECT sinograms, to be applied before reconstruction. ***Materials and Methods:*** 15 patient CTs were automatically segmented and used to generate 5,000 Lu177 activity maps with lesion-to-background activity ratios set stochastically. In addition, inhomogeneity was included in various organs, and lesions were randomly placed and shaped. Each map was forward-projected with the RTK [2] Software: once with Point Spread Function (PSF) modeling during projection (PPVE sinogram) and once without (PnoPVE sinogram). The PSF was obtained from Monte-Carlo (MC) simulations with Gate [3] of the Siemens-Symbia-Intevo with Medium-Energy collimator. Poisson noise was applied to PPVE to obtain PPVE/noisy. The PVCNet framework contained two consecutive networks: the denoising network h1 taking PPVE/noisy as input and trained with PPVE as target; the deconvolution network h2 taking the output of h1 as input and PnoPVE as target. Both networks used the projected attenuation map and the sinogram obtained after a preliminary reconstruction (OSEM, 8 subsets, 10 iterations) followed by a forward-projection as additional input channels. h1 and h2 were 3D-Unets with 3 encoding/decoding layers. The

PVCNet method was evaluated with two experiments: a real Lu177 IEC phantom acquisition (6 spheres, target-to-background ratio of 13) and a MC simulation of a patient with Lu177 activity in kidneys, spleen, urinary bladder and three lesions. Three PVC methods were compared: RM, iY (applied after RM) and PVCNet applied before image reconstruction. All images were reconstructed with the OSEM algorithm (8ss, 20it). ***Results:*** On the IEC acquisition, Recovery Coefficients (RCs) on the three larger spheres were better with PVCNet (0.52/0.58/0.67) than with RM (0.36/0.43/0.60) but still lower than with iY (0.66/0.66/0.83). This results was expected since iY uses the CT segmentation, making the comparison with PVCNet unfair. On patient simulation, RCs on lesions with PVCNet (0.44/0.47/0.67) were also higher than with RM (0.28/0.26/0.44) and lower than iY (0.47/0.53/0.77). Finally, the global Mean Absolute Error on the image corrected with PVCNet was lower than with iY (0.51/0.52 respectively). ***Conclusion:*** PVEs on SPECT images can be reduced by a deep-learning framework trained on simulated data. ***References:*** [1]Erlandsson, 2012[2]Rit, 2014[3]Sarrut, 2022.

EP-0799

Optimal reconstruction algorithm for FDG-PET tests using CaLM with application of NLM filters

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Aim/Introduction: The FDG-PET test is useful in the diagnosis and management of patients with various types of cancer. However, as the quality of PET images is affected by the reconstruction algorithm and acquisition method used, it is critical to select the optimal reconstitution algorithm. In recent years, the Clear Adaptive Low-Noise Method (CaLM), a new noise reduction method that applies Non-Local Means (NLM) filters, has been developed, which can be used to reduce static noise without affecting image contrast. This study investigated the optimal reconstruction algorithm when using CaLM in clinical FDG-PET imaging. ***Materials and Methods:*** Twenty-two patients who underwent FDG-PET tests (Celesteion, Canon) between April 2019 and March 2021 were included in this study. All the patients showed accumulation of FDG in the head and neck region that was not affected by respiratory movement. The acquisition time was set to 150 sec. The acquired image data were reconstructed using TOF-OSEM algorithms (PSF(-), Iteration: 3, Subset: 10), and these images represented normal images. The target image was reconstructed using three CaLM parameters (Mild, Standard, and Strong) for the acquired image data. All the obtained images were investigated quantitatively and visually. Quantitative assessment involved calculation of maximum SUV (SUVmax), coefficient of variation (CV), and contrast-to-noise ratio (CNR), after setting regions of interest on the lesions. The effects of reduction of static noise on these quantitative indices were statistically analyzed using Dunnett's test. A p-value of less than 0.05 was considered significant. ***Results:*** Quantitative assessment revealed that the SUVmax of target images with all three CaLM parameters (Mild, Moderate, and Strong) was equivalent to that of normal images. The CV of target images (Standard and Strong) was significantly reduced by 17% and 27%, respectively, as compared to normal images. The results also showed a significant improvement in CNR of the target images (Strong) by 71% as compared to normal images. Visual assessment revealed that target imaging using the Strong parameter allowed for better detection of lesions and had higher image quality than normal images. ***Conclusion:*** The results of our clinical study demonstrate that target imaging using the Strong parameter facilitated better detection of lesions and image quality in FDG-PET tests than normal images. This suggests that it is useful to apply the Strong parameter in the reconstruction algorithm when using CaLM.

EP-0800

Continuous Bed Motion (CBM) for Short Range Axial Scans in Long Axial Field of View (LAFOV) Scanners

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Aim/Introduction: CBM ideally achieves uniform axial sensitivity in imaging. Its effectiveness has been demonstrated in Short Axial Field of View Siemens scanners, where there is a transition from Step and Shoot (S&S) multi-bed acquisition time to equivalent quality CBM bed speed. However, CBM's efficiency diminishes due to the discarding of lower sensitivity data during reconstruction, a disadvantage exacerbated in LAFOV. Nevertheless, in applications such as reducing CT scan dose to specific axial regions of interest (ROI) in LAFOV scanners, S&S becomes similarly inefficient. Here, CBM emerges as a competitive alternative, offering physiological benefits as patients are not required to remain stationary at the center of the scanner for prolonged periods. Additionally, CBM reduces the influence of highly attenuated oblique data by emphasizing direct plane data. ***Materials and Methods:*** Attenuation modeling was performed using an infinitely long cylinder phantom with a 20 cm diameter. The measured normalization of a Siemens Vision Quadra scanner was utilized to assess scanner sensitivity. These components were used to model patient axial sensitivity for CBM and S&S scans. The relationship between CBM speed and S&S acquisition time was derived to achieve maximum sensitivity matching for both scan modes. CBM and S&S acquisitions were also performed using a daily Quality Control (QC) phantom (30 cm long, 20 cm diameter) to verify image quality through assessment of phantom central plane roughness. ***Results:*** To achieve the best quality match with stationary bed imaging, CBM speed can be reduced by 40% through proper sensitivity modeling of patient scans. For instance, a CBM speed of 0.88 mm/s with an idealistic triangular sensitivity profile increases to 1.22 mm/s with a measured sensitivity profile to match S&S at 10 minutes per bed. By restricting the Maximum Ring Difference (MRD) from Quadra Ultra High Sensitivity (UHS) to 40 degrees, CBM sensitivity diminishes by only 2%, whereas S&S sensitivity drops by 9%. In High Sensitivity (HS) mode (18 degrees), CBM sensitivity drops by 54%, while S&S demonstrates a noticeable drop of 92%. These theoretical considerations are supported by measured phantom data. ***Conclusion:*** The analysis demonstrates that CBM benefits in LAFOV scanners by reducing the weighting of highly oblique data, resulting in CBM acquisition times that are significantly closer to static bed acquisition for short axial ROI applications. CBM favors direct data and smaller MRD use, thereby reducing potential issues associated with modeling of unknown attenuation maps beyond CT-measured ROIs.

EP-0801

Comparative Assessment of MRAC Techniques in Brain ^{18}F-FDG-PET Imaging: Atlas vs. ZTE Reconstruction on Integrated PET/MR

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Aim/Introduction: This study evaluates the impact of two MR-based attenuation correction (MRAC) methods, Atlas-based and ZTE-based(zero echo time), on brain PET imaging within an integrated PET/MR system. ***Materials and Methods:*** Retrospective analysis included 12 cases of 18F-FDG PET/MR and PET/CT imaging on 6 male and 6 female patients aged 41-58 years. PET/MR scans used Atlas-AC and ZTE-AC methods for 18F-FDG-PET reconstruction with PET/CT CT images as the gold standard AC-map. SUVr values for 116 AAL brain regions were computed using whole-brain references. Statistical analysis involved Spearman correlation and paired nonparametric tests. ***Results:*** Comparing PET images reconstructed with ZTE-AC and Atlas-AC to the gold standard CTAC, ZTE-AC exhibited significantly lower deviations. Correlations between brain region SUVr values from Atlas-AC and CTAC were 0.978, while for ZTE-AC, they reached 0.995. In the cerebellar region, correlations were 0.980 for Atlas-AC and 0.987 for ZTE-AC. The frontal lobe showed the lowest correlation in lobe analysis at 0.909 for Atlas-AC and 0.969 for ZTE-AC. Analysis of brain regions indicated that deviations under ZTE-AC were notably smaller than those under Atlas-AC, especially in regions like the hippocampus and posterior cingulate gyrus, where only 1.7% of brain regions exhibited over 5% absolute deviation with ZTE-AC compared to 6.4% with Atlas-AC. Inter-individual analysis confirmed that ZTE-AC reconstruction induced lower bias than Atlas-AC. ***Conclusion:*** PET images reconstructed with ZTE-AC exhibited reduced SUVr deviations compared to those reconstructed using Atlas-AC, relative to CTAC as the reference standard.

EP-0802

BPL vs OSEM FDG PET-CT; Which One to Choose?

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Aim/Introduction: Bayesian penalized-likelihood(BPL) iterative PET reconstruction algorithms were new field players. Decreased noise and improved lesion detection were the benefits of these algorithms. However, which algorithm must be used to hold standards in daily clinical settings is still controversial. This study investigated the clinical contribution of the BPL and digital motion correction(MC) vs OSEM algortihms. ***Materials and Methods:*** Patients who underwent FDG PET-CT reconstructed by OSEM, BPL, and BPL+MC for malignancy were included in this retrospective-single-center study. Clinical contributions of BPL algorithms were evaluated. Visual improvements in lesion conspicuity and detection of additional malignant lesions were noted. SUVmax and SUVmean of the liver, lesions under 10 mm (Group A) and lesions larger than 25 mm(Group B) by OSEM, BPL, and BPL+MC algorithms were assessed. ***Results:*** The study included 1503 images of 501 patients (F/M: 255/246). Median age was 58 (min-max: 4-87). Median BMI was 26 (range: 5.7), and median injected FDG activity was 233 MBq (min-max: 96-362). 235 group A lesions and 254 group B lesions were investigated. The majority of the evaluated lesions were located at lymph nodes(168), lung lesions(75), and liver(45). BPL reconstruction increased reader confidence for 16 patients in five liver lesions, three lungs (eg. OSEM-SUVmax: 1.9; BPL-SUVmax: 5.5), three adrenal, and five others. Only in two patients was an additional lesion detected in the liver and lung that was not visible in OSEM reconstructed images. However, no statistically significant difference or clinical contribution was observed between BPL methods with or without motion correction. The liver's mean SUVmean values were not statistically significant (2.2 for OSEM, BPL and BPL+MC). Median SUVmax of lesions for the group A were 2.7(0.6-14.4) for OSEM and 3.8 for BPL algorithms (increased 40% $p<0.001$) and also for group B 11.2 for OSEM and 11.8 for BPL algorithms (increased 5% $p<0.001$). ***Conclusion:*** ΔSUVmax of small lesions at BPL images were significantly higher than large lesions compared to OSEM. While reporting SUVmax values one must use same reconstruction algorithms especially for the smaller lesions. We recommend the usage of BPL algorithms for smaller lesions to increase reader confidence especially for liver.

EP-0804

Enhanced Diagnostic Imaging in Prostate Cancer: Evaluating the Impact of TOF and PSF Integration in 68Ga-PSMA PET/CT

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Aim/Introduction: Prostate cancer poses considerable difficulties in diagnosis, requiring the use of accurate imaging tools. The use of PET/CT with Gallium-68 labelled Prostate-Specific Membrane Antigen (68Ga-PSMA) has greatly changed the way prostate cancer is found and categorised, making it more accurate and sensitive. Additional advancements, such as Time-of-Flight (TOF) and Point Spread Function (PSF), have enhanced the resolution of images. This is important for accurately identifying and outlining tumors, as well as making informed decisions about therapy. ***Materials and Methods:*** The current study conducted a comparison between conventional TOF and TOF coupled with PSF in PET/CT images of patients with prostate cancer. The analyzed metrics were Signal-to-Noise Ratio (SNR), Contrast-to-Noise Ratio (CNR), Metabolic Tumour Volume (MTV), Total Lesion Glycolysis (TLG), and Contrast Recovery Coefficient (CRC). The statistical study used paired t-tests to identify disparities and evaluate concordance between the approaches. ***Results:*** The results of our study indicate that the use of TOF+PSF led to notable improvements in both SNR and CNR. These gains were statistically significant, as shown by t-tests of -11.03 and -11.19 for SNR and CNR, respectively, with p-values less than 0.05. In contrast, the CRC analysis showed that there was no statistically significant difference between the two approaches, as demonstrated by p-values greater than 0.05. The TLG and MTV analyses demonstrated significant but subtle differences, indicating the nuanced advantages of TOF+PSF in metabolic evaluation and lesion characterization. ***Conclusion:*** The use of TOF and PSF greatly improves the quality of PET/CT imaging, which is crucial for achieving greater accuracy in diagnosing and managing prostate cancer. Although CRC demonstrated only little improvement, the progress in SNR, CNR, TLG, and MTV highlights the possibility of TOF+PSF to enhance therapeutic outcomes by improving imaging accuracy. ***References:*** Fanti, S., et al. "68Ga-PSMA PET/CT: Joint EANM and SNMMI procedure guideline for prostate cancer imaging." European Journal of Nuclear Medicine and Molecular Imaging 44.6 (2017): 1014-1024.; Rowe, S.P., et al. "PET Imaging of Prostate-specific Membrane Antigen in Prostate Cancer: Current State of the Art and Future Challenges." Prostate Cancer and Prostatic Diseases 19.4 (2016): 300-307.

EP-0805

Segmentation of active lesions in breast cancer from 3D whole-body PET/CT scans using the MONAI framework

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Aim/Introduction: Breast cancer is the second leading cause of cancer death worldwide. PET/CT could provide useful information for defining patient-specific treatment strategies. Operator-dependent assessment of total disease burden from PET/CT images is a time-consuming process hardly feasible in a clinical setting. In this study we present an unsupervised segmentation method of FDG-PET/CT active lesions in breast cancer based on the 3D U-Net architecture from the MONAI framework. ***Materials and Methods:*** The tumor was manually segmented from 121 PET/CT images by two expert radiologists. Patients were splitted into training/test subsamples of n = 97 and n = 24 patients respectively.Primary tumor manual annotation was performed on fused PET/CT under PETVolume Computerized Assisted Reporting (PETVCAR version 2.0). PETVCAR uses an adaptive iterative volume delineation algorithm able to automatically segment the target volume from background tissue using a SUVmax threshold of 2.5 and a 3D isocontour of 41% of the maximum voxel value measured in the target lesion Automatic segmentation model used a variant of the Medical open network for AI (MONAI) library called DynUnet. MONAI provides a library of deep learning algorithms specifically designed to support diagnostic models based on medical images. The network was implemented with five layers each composed of two convolutions with $3 \times 3 \times 3$ kernels. Network output layer has a soft-max activation and a threshold of 0.5, which generates a binary image corresponding to the predicted structure. A dice similarity coefficient (DSC)-based loss function and the Adam optimizer were used during training. DynUnet was trained for 300 epochs. DCD index was used to assess the performance metric by measuring the degree of regional overlap between manual and unsupervised segmentations on test dataset. ***Results:*** The train loss progressively decreases, indicating the stability and accuracy of the optimization algorithm. The Dice index reaches the best performance with a plateau at epoch 266. At this epoch the model shows values of 0.27 and 0.61 for train loss and Dice index respectively. ***Conclusion:*** These results show that the presented segmentation technique has the potential to automatically identify lesions with high glucose metabolism in breast cancer.

EP-0806

Effects of Deep Learning-Based Image Quality Enhancement on a New-generation Digital-BGO PET System, Omni Legend 32 for ^{18}F-FDG Whole-Body Examination

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Aim/Introduction: The digital BGO PET/CT system, Omni Legend 32 (GE HealthCare), incorporates BSREM image reconstruction and a deep learning-based time-of-flight (TOF)-like image quality enhancement process (Precision DL, PDL). This study aimed to define the fundamental characteristics of PDL using clinical images. ***Materials and Methods:*** Thirty clinical whole-body 18F-FDG PET/CT examinations acquired on the Omni Legend 32 PET/CT system were included. All PET/CT examinations were performed with an acquisition time of 90 sec per bed position, with a matrix size of 384×384. Images were reconstructed using the OSEM+PSF and the BSREM at β values of 200, 300, 400, 500, and 600, combined with three different PDL strength levels (Low, Medium, High). Liver noise levels, mean SUV (SUVmean), and the tumor signal-to-noise ratio (SNR), signal-to-background ratio (SBR) and maximum SUV (SUVmax) were evaluated. ***Results:*** Noise levels decreased as a function of increasing β values in the BSREM, resulting in a higher SNR, but lower SBR. Combining PDL with BSREM, all β values produced better results in terms of noise, SNR, and SBR compared with OSEM. The stronger the application of the PDL method (High > Medium > Low), the higher the noise levels and SBR observed. The effect of PDL intensity on SNR varied among patients. The liver SUVmean did not significantly differ between the reconstruction methods, but tumor SUVmax was higher with BSREM than OSEM, and further increased with PDL. ***Conclusion:*** The combination of BSREM and PDL significantly enhanced the SUVmax of tumors and image quality compared with OSEM. The intensity of PDL modestly impacted tumor detectability, although it varied among patients. The β value influenced image quality and tumor detectability more than the intensity of the PDL, suggesting that the intensity of the PDL should be determined after setting β values. ***References:*** Shin Yamagishi*, Kenta Miwa*, Shun Kamitaki, Kouichi Anraku, Shun Sato, Tensho Yamao, Hitoshi Kubo, Noriaki Miyaji, Kazuhiro Oguchi. Performance characteristics of a new-generation digital-BGO PET/CT system Omni Legend 32 according to NEMA NU2-2018 standards, 2023, J Nucl Med, 64(12), 1990-1997. (*Contributed equally).

EP-0807

Validation of Dynamic Stochastic Resonance (DSR) for converting a low-count nuclear medicine (NM) image into a high-count image: a Phantom Study

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Aim/Introduction: In DSR, a controlled amount of noise is added to the image itself, to improve the signal-to-noise ratio. In brief, It can be explained using motion dynamics of a particle oscillating in a bistable double-well system, in the presence of a weak periodic signal, and noise, the double well gets tilted back and forth asymmetrically following the equation: xn+1= xn+δt [axn-bxn3+Signal+Noise], where Signal is the image and Noise is the internal noise of the image. We optimized the value of number-of-iterations and δt while keeping a = 0.5, and b = 0.185 as constant in the above equation to validate the role of DSR in converting a low-count NM image into a high-count image. ***Materials and Methods:*** A phantom was made of patient tubing (used for intravenous administration) and plastic box. 88.8 MBq of Tc-99m pertechnetate was administered in the phantom and then dynamic study of the phantom was acquired at 0, 3.3, 6.10, 8.54, 10.07, 20.45, 23.55 and 26.19 hour in 256 X 256 image matrix, and 30 seconds per frame for 10 minutes duration. High-count image was formed by summing all the frames of that study. Each low-count image (first frame of the study) after processing with DSR was compared with gold standard image (high-count image from 0 hour study). A MATLAB script was written for reading and processing the low count image using DSR iterative equation. At each value of δt = (0.1, 0.2,0.3,0.4,0.5, 1.0, 2.0, 2.5, 3.0, 4.0, 5.0, 5.5, 6.0, 7.0, 8.0, 9.0, 10.0, 10.5, 15.5, and 25.5), 30 iterations were performed that resulted in 30 high-count images (each iteration yielding one image). DSR processed images were subjectively and objectively (using SSIM metric) compared with high-count

gold standard image. ***Results:*** The optimized value of number-of-iterations and δt were found to be 30 and 0.4, for converting a low-count nuclear medicine image into a high-count image; the SSIM value of transformed low-count images was around 0.9923. The DSR transformed image (for 0 hour study) visually looks identical to high-count gold standard image. However, DSR transformed image (for 26.19 hour study, low-count image was having minimum counts) visually did not look identical to high-count gold standard image. ***Conclusion:*** The application of DSR algorithm can transform low-count NM image into a high-count image, whether the transformed high-count image will look identical to high-count gold standard image depends on the quality of the input low-count image.

EP-0808

Data Driven Head Motion Detection, Tracking and Correction in FDG Brain Positron Emission Tomography

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Aim/Introduction: In this study, we perform motion detection, tracking, and correction on simulated brain FDG PET scans using a dedicated brain scanner. ***Materials and Methods:*** A motion-free frame (300s) [jv1] [VD2] from one FDG patient (injected with 2MBq per kg) and corresponding CT was used to simulate tracer distribution using the open-source GATE software and exported as listmode. Bottom-up segmentation (BUS), a method that start with lots of time points where motion is assumed to occur then slowly remove all the incorrect time points, apart from the time points where motion probably occurred. Using BUS method, we can test for temporal and spatial sensitivity of motion detection, respectively, using the following simulation:1. In the first simulation we displaced the image (from left to right ear) every 10 seconds first by 3mm and gradually reducing the displacement by 1mm until reaching 0.5mm. This is for the spatial sensitivity of detecting motion.2. In the second simulation a fixed displacement of 3mm with an initial 10-second interval, repeated for ten cycles, reducing the interval by 2 seconds each cycle.A final simulation applied motion (10mm in each direction and rotation of 10 degrees in left to right ear and 10 degrees in chin to forehead every 150 seconds). Each [jv3] [VD4] frame, generated from BUS, is reconstructed using expectation maximization maximum likelihood estimation (EMML) with attenuation and scatter correction (via Single Scatter Simulation) using open-source software STIR with no post-filters. Rigid motion was estimated using a software called NiftyReg and motion correction was done using re-weighted average transform. For the evaluation, we use root mean square error (RMSE, measured in second for motion detection and tracking). A comparison static (no motion), non-motion-corrected (non-MoCor) and motion corrected image (MoCo) using visual analysis. ***Results:*** Simulation 1.) BUS method consistently detected motion up to 2mm. Simulation 2.) The BUS method consistently detected motion up to 6 seconds interval. The root mean squared error (RMSE) for motion tracking is [jv1] no more than 4mm. The MoCo images shows improvements over the non-MoCo but not as good as static. ***Conclusion:*** BUS method can detect motion and produce motion free frame for image reconstruction but better method for motion tracking is required to observed further improvement in image quality.

EP-0809

Impact of parameters in Block sequential regularized expectation maximization reconstruction with relative difference penalty for quantitative bone SPECT imaging using a ring-shaped CZT SPECT

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Aim/Introduction: The block sequential regularized expectation maximization (BSREM) reconstruction algorithm, which incorporates a relative difference penalty (RDP) and is known as Q.Clear™, has been integrated into the StarGuide system, marking its debut in single photon emission computed tomography (SPECT) systems. Although BSREM is well established in positron emission tomography imaging, its impact on SPECT imaging remains to be determined. The aim of the present study was to optimize reconstruction parameters such as update number, gamma factor, and beta value in BSREM to obtain quantitative bone SPECT images. ***Materials and Methods:*** A thoracic spine phantom was employed to replicate the thoracic region of a standard Japanese person. The vertebral body, normal spine, and simulated tumor were filled with a mixed 99mTc and K2HPO4 solution to simulate bone density. Activity concentrations were set at 8, 50, and 300 kBq/mL for the main body, vertebral body and normal spine, and simulated tumor, respectively. The phantom was scanned for five minutes under clinical conditions using the StarGuide. Reconstruction parameters were fine-tuned in the order corresponding to 100 - 200 iterations × subset (I×S) with/without scatter correction (SC) based on dual energy window method, 2 - 25 gamma factor with/without SC, and 0.90 - 1.10 beta value from manufacturer recommended conditions (I×S, 10×10; gamma factor, 2; beta value, 1.00). The %contrast in simulated tumor and reference region and background (BG) variability (%) were evaluated for each parameter setting. ***Results:*** The %contrast remained unchanged by update number, regardless of the presence or absence of SC. The reference region's %contrast was overestimated when SC was employed. The BG variability remained below 7.0% at fewer than 40 subsets but increased with higher subsets. The %contrast improved with a higher gamma factor but decreased with a higher beta value. Conversely, the BG variability decreased with a higher beta value. The BG variability was lower with SC than without. ***Conclusion:*** A limit cycle was observed at 40 or more subsets. A higher gamma factor enhanced %contrast by preserving edges. Beta value reduced image noise when using SC. %contrast with SC was overestimated due to attenuation correction errors. The optimal settings were determined as 100 (5×20) iterations × subsets and a gamma factor of 15 for SC and 10 without SC for quantitative bone SPECT imaging. Visual evaluations using clinical bone SPECT images are required to determine optimal beta value.

EP-0810

Impact of Reconstruction Algorithms on Digital PET/CT: Evaluating Small Pulmonary Nodules

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Aim/Introduction: Quantitative Positron Emission Tomography (PET) plays a crucial role in the detection and assessment of

pulmonary nodules, which is a challenging structure due to the increased number of small size nodules and respiratory motion's influence. The partial volume effect (PVE) often underestimates radiotracer uptake in small lesions due to limited spatial resolution1. This study compares various methods of PET/CT reconstructions by determining contrast and activity recovery coefficients (CRCs and ARCs). PVE correction was also applied in the lesions mean and maximum Standardized Uptake Values (SUV). ***Materials and Methods:*** A NEMA phantom was scanned on a digital PET/CT system and reconstructed using ordered subset expectation maximization (OSEM) with time of flight (TOF), OSEM with TOF and point spread function (PSF), and Q.Clear with varying β values (350-850). CRCs and ARCs were calculated and compared with Wilcoxon tests, fitting ARCs to sphere volume and diameter1. Fifteen adult patients were randomly selected for pulmonary nodule evaluation using consistent equipment, with scans reconstructed using identical algorithms. Exclusion criteria included undefined nodules, larger than 3 cm, semi-solid, cystic, or ground glass nodules. Mean and maximum SUVs of small pulmonary nodules were measured, PVE-corrected, and compared using Friedman tests, with ΔSUVmean and ΔSUVmax calculated for PVE correction percentage increase. ***Results:*** Phantom results showed that Q.Clear produced higher CRCs and ARCs values compared with other methods (p=0.03). Multiple Q.Clear reconstructions showed decreasing ARCs with higher β, indicating uptake underestimation, however without statistical significance. ARCs data showed a good fit to both functions for all reconstructions (R2=0.98). Patients' nodules had a mean diameter of (12±5) mm. Both mean and maximum SUV lesions with Q.Clear illustrated significant differences from those reconstructed with other algorithms (p<0.003). After PVE correction, highly significant differences (p<0.003) still existed in the SUV values measured by Q.Clear compared with those measured by the other two algorithms. ΔSUVmean were 114.1%, 113.9%, 78%, and 104% for OSEM TOF, OSEM TOF-PSF and Q.Clear (β=350 and β=850), respectively. ***Conclusion:*** The Q.Clear algorithm improved PET/CT accuracy towards the true uptake in both phantom and clinical studies, enhancing quantification of the ARC and CRC values. This could have a significant impact on the early diagnosis of small malignant pulmonary lesions before they grow to 8 mm. ***References:*** 1. Zhifang Wu, Binwei Guo, Bin Huang et al. Phantom and clinical assessment of small pulmonary nodules using Q.Clear reconstruction on a siliconphotomultiplierbased timeofflight PET/CT system.Sci Rep 11, 10328 (2021).doi: https://doi.org/10.1038/s41598-021-89725-z.

EP-0811

Examining a Deep Learning Algorithm for Generating Time-of-Flight (TOF) Images from Non-TOF Low-Activity [18F]FDG PET Data

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Aim/Introduction: Time-of-flight (TOF) PET imaging offers advantages in sensitivity gain, notably improving image quality. Acknowledging these benefits has led to alternative methods for non-TOF PET systems, such as integrating deep neural networks to generate TOF-like images. In this study we evaluate the effectiveness of various deep learning (DL) configurations when applied to non-TOF [18F]FDG PET datasets acquired over different acquisition times to simulate reduced-activity (1.6-2 MBq/kg) scans, aiming at identifying parameters that can optimize image quality and diagnostic accuracy. ***Materials and Methods:*** Our protocol for whole-body [18F]FDG PET/CT includes an administration of 2.5 MBq/Kg and an acquisition time of 1.5 min/bed. List mode data from 35 [18F]FDG PET scans acquired on a BGO-based PET/CT system (axial field-of-view=32 cm) were sorted to sinograms using varying time durations to simulate studies with 20%-33% activity reduction, and then reconstructed through block-sequential-regularized-expectation-maximization(BSREM) techniques. Regularization parameters(β) of 850, 600, and 450 were assigned to low (1 minute), medium (1.2 minutes), and high (1.5 minutes) count statistics, respectively. DL algorithms were applied with low-, medium-, and high-precision settings, resulting in six algorithm configurations: 1minβ850, 1minβ850-LPDL, 1.2minβ600, 1.2minβ600-MPDL, 1.5minβ450, and 1.5minβ450-HPDL. Standardized uptake values (SUV) and standard deviations(SD) both in target lesions and normal liver tissue were measured. Image quality was assessed by calculating Noise, as SDliver/SUVmean-liver, and signal-to-noise ratios(SNR), as SUVmax-lesion/Noise. Two nuclear medicine physicians rated the images based on a five-point scale (1-5, where 1-optimal) regarding noise, target-to-background contrast(TBC), sharpness, and diagnostic confidence(DC). Mean values and SDs were reported, and interobserver agreement was assessed using Cohen's kappa. ***Results:*** In quantitative evaluation, images with DL configuration showed better performances in all considered parameters. Mean SUVmax values were 2.30±0.84, 3.12±1.10 and 4.08±1.48 for 1minβ850-LPDL, 1.2minβ600-MPDL and 1.5minβ450-HPDL, respectively. Regarding image quality, all DL reconstructions displayed reduced noise levels, with a similar range of values: 0.11±0.02, 0.12±0.02 and 0.12±0.01 for 1minβ850-LPDL, 1.2minβ600-MPDL and 1.5minβ450-HPDL, respectively. The highest SNR was calculated for 1.5minβ450-HPDL (33.18±11.6), followed by 1.2minβ600-MPDL(27.25±10.13). In qualitative evaluations, DL configurations demonstrated superior noise performance, with 1minβ850-LPDL (1.61±0.75,κ=0.697,p<0.01) and 1.2minβ600-MPDL (1.70±0.71,κ=0.661,p<0.01) presenting the lowest noise levels. 1.5minβ450-HPDL exhibited the highest visual scores regarding TBC (1.73±0.76,κ=0.775), sharpness (1.79±0.70, κ=0.858), and DC (1.47±0.79,κ=0.882), p<0.01 for all. ***Conclusion:*** Our study demonstrates that integrating DL into non-TOF PET imaging significantly enhances image quality and diagnostic accuracy in low-activity [18F]FDG examinations. This enhancement needs a balanced trade-off between injected activity or scan/bed duration, and DL configuration, to optimize imaging characteristics.

EP-0812

Investigation of photopenic artifact in pet imaging due to arms motion: effect of scatter in a phantom experiment

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Aim/Introduction: Assess the accuracy of different scatter correction techniques used in PET imaging when photopenic artifacts appear due to patient's arm movement. ***Materials and Methods:*** To simulate the patient, two 68Ge/68Ga cylindrical phantoms were used, the first one (thorax_phantom) with 9.6kBq/ml, and the second one (abdomen_phantom) with 4.1kBq/ml. In order to mimic the arms alongside the body, two 1-litre bottles, containing a concentration of 18F similar to that of the abdomen_

phantom, were placed on either side of the thorax_phantom. After motion-free CT and PET acquisition (matched_PET/CT), the bottles were moved at a slight angle (≈10°) and a second PET scan (mismatched_PET/CT) was performed simulating the movement of the patient's arms between CT and PET. Each acquisition was reconstructed four times, with each available scatter correction technique: SC_Relative (standard method for clinical studies), SC_WB_Relative, SC_Absolute, SC_WB_Absolute. Both visual and quantitative analyses were conducted. For quantitative analysis, a circular region of interest (ROI) was delineated in each of the central slices of the thorax_phantom, and the mean standard uptake value deviation (Δ(SUVmean)) in each ROI was assessed (Pmod package). Values of Δ(SUVmean)<5% were accepted. ***Results:*** In the matched_PET/CT with clinical reconstruction, a photopenic artifact was observed in the slices around the end of the bottles (axial extent of 45mm, maximum Δ(SUVmean)=-12%). This first image was used as a reference to isolate the effect of motion. In the mismatched_PET/CT, the use of either SC_Relative or SC_WB_Relative makes the photopenic artifact wider in the axial direction, particularly, up to 132.5mm and 147.5mm, respectively, and more pronounced (maximum Δ(SUVmean)=-20% and -21%, respectively). Applying SC_Absolute and SC_WB_Absolute were found to eliminate the photopenic artifact, although an overestimation was observed across the entire thorax_phantom, regardless of the presence of the mismatch. The deviations for mismatched_PET/CT, along the thorax_phantom range from +4% to +14% (mean value of +9.4%) for SC_Absolute, and from +2% to +11% (mean value of +7.6%) for SC_WB_Absolute, which are similar to the matched_PET/CT. ***Conclusion:*** SC_Relative and SC_WB_Relative showed a photopenic artifact when there is arm movement between CT and PET. Conversely, absolute correction methods eliminated this artifact but produced an overestimation in all image slices, being this overestimation lower for SC_WB_Absolute. It follows that the absolute corrections techniques are more robust in case of arm movement, as long as it is taken into account that the quantification will not be entirely correct.

EP-0813

The effect of image reconstruction on DAT tracer distribution in an anatomical brain phantom: a preliminary SPECT study

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Aim/Introduction: An innovative anthropomorphic brain phantom, StepBrain(Human Shape Technologies S.r.l, Naples, Italy),was developed to characterize and standardize acquisition and reconstruction parameters in PET/CT.Here, we used the phantom in a SPECT/CT setting. ***Materials and Methods:*** StepBrain is a 3D-printed phantom derived from an MRI of a healthy volunteer.It replicates the real anatomy of three separate brain compartments to allow simultaneous simulation of the in-vivo activity distribution of gray matter(GM), white matter(WM), and dorsal striatum (DS).The phantom was created from a dataset of 1.5T MRI images of a 38-year-old normal volunteer. The volumes of the fillable inserts are 14.6, 407,and 714ml for STR,WM,and GM, respectively.The DS,WM, and GM compartments of the phantom were filled with Tc-99m pertechnetate and 123-I-Iofluopane with an activity concentration at acquisition times of 140,31, 46 kBq/ml and 70,17, 33kBq/ml, respectively.The phantom was then placed in an automatic shaker to homogenize the diffusion of the tracer for 40minutes.The phantom was acquired on an Infinia Hawkeye3/8" gamma camera with a fan-beam and a Low Energy-High Resolution (LEHR) collimator.Attenuation correction (AC) was obtained using the Hawkeye onboard X-ray tube. Images were reconstructed with filtered-back-projection,iterative reconstruction IR with 10subset and 2iteration applying progressively noAC,ChangAC with a coefficient of 0.07,measured AC, scatter correction, and varying the iteration number subset-product (ITSU 30-120)and the 10-power-low-pass filter threshold(0.55-0.89 mm).Analysis was performed considering fixed ROIs of 3cm2 conformed on the right and left DS.A 20% maximum threshold was applied to the images encompassing DS.DS/background ratio was calculated. ***Results:*** The average (± st.dev.)of DS counts with LEHR and FB collimators were stable with no significant changes among FBP and IR scatter, corrected but without AC (signal increasing factor of 1.01).However, it increased by a factor of 2.07 applying AC and remained stable varying the ITSU.Higher low pass filters led with LEHR to variation of st.dev up to 10%, but did not show a significant impact on FB.In particular, the average DS counts/background ratio with LEHR was 90/32 and 316/134 in FBP compared to 91/33 and 307/135 on OSEM noAC for Tc-99m pertechnetate and 123I-Iofluopane respectively. Average DS counts with FB collimator for Tc-99m pertechnetate was 903± 205 in FBP compared to 1055±214 on OSEM. Deeper quali-quantitative analysis is undergoing. ***Conclusion:*** According to preliminary findings, it is possible to measure the impact of various parameters on image quality using this new 3D-printed anthropomorphic brain phantom, which could help optimize the acquisition technique for comparative purposes in multicenter studies.

EP-0814

Preliminary Investigation of Enhancing FDG Brain PET Image Quality and Lesion Detection via MR-Guided Reconstruction in an integrated PET/MR

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Aim/Introduction: Integrated PET/MR systems provide an opportunity to enhance PET image quality by incorporating anatomical information. Although various techniques utilizing anatomical prior information have been proposed over the past decade, clinical experience with their application in brain tumors, including as diffuse large B-cell lymphoma (DLBL), remains limited. In this study, we aimed to explore the application of the algorithm in improving the quality of brain FDG PET images for patients with and without brain tumors based on an integrated PET/MR. ***Materials and Methods:*** Thirty patients without brain tumors and two patients with DLBL were retrospectively enrolled in this study. All patients underwent 18F-FDG PET/MR imaging on an integrated PET/MR system. The PET images were reconstructed using two distinct methods: MR-guided PET reconstruction and conventional OSEM method. For the MR-guided PET reconstruction, we employed the parallel level sets (PLS) method, and 3D T1-weighted MR images were used as prior input [1]. For patients without brain tumors, we compared key metrics

such as contrast-to-noise ratio (CNR), coefficient of variance (CV) and edge sharpness. Meanwhile, for patients with DLBL, we focused on analyzing the signal-to-background ratio (SBR), signal-to-noise ratio (SNR), contrast-to-background ratio (CBR) and contrast-to-noise (CNR) of the lesions. Wilcoxon signed-rank test was utilized for statistical significance analysis. ***Results:*** For patients without brain tumors, the utilization of the MR-guided PET reconstruction led to a noteworthy enhancement in CNR by 35.6%±29.5%, a substantial improvement in edge sharpness by 33.8%±30.8% and a reduction in the CV by 21.8%±13.7%, all in comparison to the conventional OSEM algorithm. In the case of the two patients diagnosed with DLBL, a total of 10 lesions were detected. Remarkably, all four quantitative metrics of the lesions exhibited significant improvements when using the MR-guided PET reconstruction (SBR enhancement of 15.0%±8.6%, SNR enhancement of 86.0%±18.7%, CBR enhancement of 13.0%±6.6% and CNR enhancement of 81.0%±13.0%). ***Conclusion:*** The MR-guided PET reconstruction algorithm exhibited substantial advantages in image quality, surpassing the conventional OSEM algorithm, for both patients with and without brain tumors. Consequently, it is anticipated that this algorithm will gain broader adoption in the integrated PET/MR system, thereby enhancing image quality and optimizing the diagnosis and treatment process for patients. ***References:*** [1] Ehrhardt, M.J., et al., PET Reconstruction with an Anatomical MRI Prior using Parallel Level Sets. IEEE Trans Med Imaging 2016. 35(9).

EP-0815

Feasibility of ultra-low-dose PET scan protocols with LSO-TX-based attenuation correction using a long axial field-of-view PET/CT scanner

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Aim/Introduction: Long axial field-of-view (LAFOV) positron emission tomography (PET) scanners, with their enhanced system sensitivity, are making it possible to significantly reduce the administered tracer activities while maintaining clinically feasible scan durations, Whole-body CT scans performed for PET attenuation correction can significantly increase the total radiation exposure in these examinations. In this work, we investigate the viability of an ultra-low-dose PET protocol and evaluate the performance of a CT-less PET attenuation correction (AC) method with low count PET data. ***Materials and Methods:*** Four healthy subjects (75-98 kg) were scanned using an ultra-low-dose 18F-FDG protocol (injected activity: 6.7-9.0 MBq) using a LAFOV PET scanner. PET emission data were acquired for 90 minutes, and PET images were reconstructed using different frame durations. Whole-body CT scans were also performed for PET attenuation correction. A separate set of PET reconstructions were also performed using a CT-free AC method which utilizes Lu176 background radiation (LSO-TX) found in the PET detectors. We assessed image quality using signal-to-noise (SNR) in the liver and contrast-to-noise (CNR) in the brain. We also compared regional mean SUV values in PET images reconstructed with CT- and LSO-TX-based methods. ***Results:*** Visual evaluation of PET images showed that 20 minutes of PET data with activities under 10 MBq 18F-FDG might yield high quality PET images. The SNR of PET images reconstructed with the CT-based AC was 8.5 ± 2.7 at 90 minutes, 6.8 ± 2.3 at 40 minutes and 5.1± 1.5 at 20 minutes scan duration. The SNR of PET images reconstructed with the LSO-TX-based AC was 9.0 ± 2.5 at 90 minutes, 6.8 ± 2.3 at 40 minutes and 5.1± 1.5 at 20 minutes scan duration. The average absolute difference in brain grey matter SUV values in PET images, using CT- and LSO-TX-based attenuation correction, was 2.2±1.9% at 90 minutes, 5.9±1.3% at 40 minutes, and 6.9±1.6% at 20 minutes. ***Conclusion:*** The preliminary results of this work suggest that LAFOV PET scanners can produce images with good visual image quality with at least 20 minute-long 18F-FDG scans for activities under 10 MBq. The LSO-TX-based AC method produced images with comparable quality to CT-based AC method in such protocols. These initial results indicate the feasibility of ultra-low-dose 18F-FDG scans in certain settings, possibly extending the utility of PET scans beyond its current applications.

EP-0816

Reducing Time and Radiation in Dynamic PET: A Deep Learning approach with Total-body PET

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Aim/Introduction: With the advent of total-body positron emission tomography (PET), its extended axial field of view enables single-pass total-body dynamic scans. Additionally, significant enhancements in system sensitivity now allow for low-dose scans that reduce radiation exposure for patients. Dynamic parametric PET images, representing kinetic parameters, offer more comprehensive insights into disease processes compared to static images. However, these benefits are countered by longer scan durations. Furthermore, dynamic PET scans typically require larger injection doses of radiotracer to ensure a sufficient signal-to-noise ratio for accurate data analysis, which poses a challenge in reducing the required dosage of radiotracers while maintaining image quality. This study aims to address these issues by implementing a deep learning-based approach for rapid, low-dose dynamic scanning using total-body PET, reducing both scan duration and the dosage of radiotracers required. ***Materials and Methods:*** 68 patients who underwent a 65-minute dynamic FDG PET scan with the United Imaging uExplorer. We developed a novel 3D Image Space Shuffle U-Net (ISSUnet) model that incorporates 3D shuffle/unshuffled layers into the well-known U-Net architecture. This modification aimed to reduce training time and GPU memory usage without performance compromise. Dynamic kinetic parametric images, considered as the gold standard, were derived from the last 30 minutes of data using the Patlak model. The last 5 minutes of static SUV images, including full-dose images and low-dose images reconstructed with dose reduction factors (DRF) of 5, 10, and 20, were considered as training inputs for predicting dynamic parametric images. Image quality was assessed using Mean Absolute Error (MAE), Peak Signal-to-Noise Ratio (PSNR), and Structural Similarity Index (SSIM). ***Results:*** Preliminary results indicate a high degree of accuracy in the correspondence between the parametric images predicted from different dose SUV images and ground-truth images. The ISSUnet model outperformed traditional U-Net and GAN models across all dose levels (DRF1, 5, 10, 20) in terms of MAE, PSNR, and SSIM, demonstrated superior capability in generating precise parametric images at varied dosage levels with a 5- minute scan. ***Conclusion:*** The proposed 3D ISSUnet has proven effective in accurately and rapidly generating kinetic parametric images

from a low-dose 5-minute static SUV image. This method could potentially reduce the required 65-minute dynamic scanning time to 5 minutes, with effective performance even at 1/20th of the standard dose. Combined with Total-body PET, this approach could effectively enhance the feasibility of dynamic scans in clinical diagnostics, aiding in disease assessment.

EP-0817

A Novel Method for Rebinning in 3D PET Reconstruction on XTRIM PET

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Aim/Introduction: Fully 3D image reconstruction algorithms such as 3DRP, or 3D iterative algorithms in 3D PET scanners are accurate, but is very time consuming and computationally complex. Rebinning algorithms have been introduced to increase the speed of reconstruction algorithm. In the rebinning algorithms sinograms are sorted into a stack of 2D data. Unfortunately, rebinning algorithms distort the reconstructed image and degrade image quality. In order to increase the image quality in preclinical PET imaging, this study aims to introduce and assess the impact of the weighted multi-slice rebinning (W-MSRB) algorithm in Xtrim-PET scanner. Furthermore, the performance of the W-MSRB algorithm was compared with the single-slice rebinning (SSRB) and multi-slice rebinning (MSRB) approaches. ***Materials and Methods:*** SSRB assigns oblique LOR measurements to the middle axial slice, while MSRB assigns them to each traversed axial slice with equal weighting. The W-MSRB approach is a variant of the MSRB method where the weight assigned to oblique LORs varies based on their ring difference. This study was evaluated by Monte Carlo simulation of two phantoms in Xtrim_PET scanner using GATE (V9.1). This scanner is composed of 10 detector blocks and each block consists of a 24×24 array of 2×2×10 mm3 LYSO scintillators. The axial length of the scanner is 50.4 mm. A uniform phantom (80 mm diameter, 25.85 mm height) was simulated as its surface was in the middle of the axial field of view (FOV). In addition, two-rod sources (1.2 mm diameter, 20 mm height) were centered at (0, +40, +12) mm and (0, -40, -12) mm coordinations, respectively. The rods were positioned perpendicular to the central axis of the scanner. The rebinned sinograms were reconstructed with a 2D MLEM algorithm (20 iterations) using an in-house software. ***Results:*** In the uniform phantom analysis, the axial Coefficient of Variation (COV) parameter was 45%, 31%, and 10% for SSRB, MSRB, and W-MSRB methods. Edge Spread Function (ESF) parameters were obtained by drawing an axial profile line, measuring 9.45 mm for MSRB (30-80% peak) and 3.76 mm for W-MSRB, representing a 60% improvement over MSRB. For the Rod phantom, SSRB images showed distortion and curved Rod structures, while MSRB and WMSRB yielded excellent Rod images. ***Conclusion:*** The W-MSRB method demonstrates a noteworthy improvement in uniformity, SNR, and axial resolution. Furthermore, it exhibits a substantial reduction in distortions, indicating its superior performance compared to the SSRB and MSRB methods.

EP-0818

Comparative Analysis of Forward Projection Algorithms in Tomographic Imaging: A Study on Siddon, Perfect Siddon, Rotate and Sum, and Radon Transform Forward Projection Methods

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Aim/Introduction: The process of forward projection in tomographic imaging involves mathematically modeling the acquisition of physical data. Alongside back projection, forward projection constitutes a foundational element in iterative image reconstruction. Proper implementation of forward projection is a critical consideration for achieving optimal speed and accuracy in iterative reconstruction. In this study, our objective was to implement and assess the performance of different forward projection methods in terms of efficiency and accuracy. ***Materials and Methods:*** In this study, we implemented various algorithms in Python for tomographic image reconstruction. Siddon's algorithm efficiently traverses rays emitted from detector cell centers, accurately determining intersection points and calculating intersection lengths. These lengths are used as weighting factors in forward modeling to ensure appropriate voxel contributions to the final projection. The Perfect Siddon method emits multiple rays from each detector cell toward the voxelized object to enhance accuracy, albeit at a higher computational cost. Rotate and Sum involves incrementally rotating the image around a fixed axis in discrete steps, computing projections along rays passing through the detector array at each angle. The Radon transform, available in Python's Scikit image library, computes line integrals along rays. We applied these methods to reconstruct images from the Shepp-Logan phantom using the MLEM iterative reconstruction algorithm with 20 iterations. Finally, we evaluated the reconstructed images using metrics like MSE and PSNR. ***Results:*** In Perfect Siddon, increasing the number of emitted rays per detector cell resulted in a decrease in MSE and an increase in PSNR. Under identical conditions (image matrix size, MLEM reconstruction with 20 iterations), Perfect Siddon exhibited the lowest MSE and the highest PSNR among the methods evaluated. The performance of Siddon was comparable to that of Perfect Siddon in terms of MSE and PSNR. Rotate and Sum showed the highest MSE and the lowest PSNR, while the Radon function in Python exhibited performance characteristics intermediate between Siddon and Rotate and Sum. ***Conclusion:*** The Siddon and Perfect Siddon algorithms operate similarly, but Perfect Siddon achieves greater accuracy by emitting more rays per detector cell compared to Siddon. However, this increased accuracy requires more computational resources. The Rotate and Sum method demonstrates lower accuracy mainly due to interpolation during each rotation step. Additionally, our analysis indicates that the Radon algorithm in Scikit-image provides higher accuracy than Rotate and Sum but slightly less than Siddon and Perfect Siddon methods.

EP-0819

Longitudinal Multi-modality Correlation-based PET Enhancement for Reducing Radiation Accumulation

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Aim/Introduction: Lymphoma patients undergo multiple PET/CT scans throughout the diagnostic and treatment process, which are crucial for effectively monitoring disease progression and timely adjusting treatment plans. However, the cumulative radiation from these repeated PET/CT examinations cannot be disregarded. Although deep learning has been widely used for enhancing low-dose PET images, the quality of these enhanced images at ultra-low doses often remains suboptimal. These images may lack detail and, in some cases, even introduce non-existent anatomical structures, thereby compromising clinical reliability. This study addresses these challenges by using full-dose PET images from the baseline examination to enhance low-dose PET images at follow-up examinations, reducing radiation exposure, improving image quality, and ensuring clinical usability. ***Materials and Methods:*** Our study involved 119 patients who underwent total-body PET/CT scans using the United Imaging uExplorer. Among them, 11 patients had baseline full-dose PET/CT scans and follow-up real low-dose (10%) PET/CT scans. The remaining 108 patients had full-dose PET scans at both baseline and follow-up, with low-dose PET images generated by subsampling a portion of the full-dose PET. We proposed a longitudinal multi-modality correlation-based method for PET image enhancement, utilizing the high-quality baseline full-dose PET/CT image to learn patient-specific anatomical structure information in the non-lesion region and employing follow-up low-dose PET images to guide the lesion uptake recovery. The global quality of enhanced PET images was assessed by PSNR, NRMSE, and SSIM, with further evaluation through different total-body organs segmentation. Regional image quality was determined by the SUVmax of the largest lesion and the SUVmean of the liver. ***Results:*** Preliminary results indicate that referencing baseline full-dose PET/CT images can significantly improve follow-up low-dose PET image quality across different dose levels (1%, 2%, 5%, 10%, 25%), showing reduced noise and enhanced structural details. In the case of ultra-low-dose (lower than 10%), more details are recovered in enhanced PET images, achieving higher PSNR and SSIM and smaller NRMSE. Additionally, there is promising performance in enhancing real-low-dose PET images. ***Conclusion:*** The quality of follow-up low-dose PET images is significantly enhanced by referencing baseline full-dose PET/CT images. As the number of examinations increases, this approach notably reduces the cumulative radiation dose experienced by patients. This method holds clinical significance for lymphoma diagnosis, providing patients with safer and more accurate imaging evaluations, and is poised to be widely applied in clinical practice.

EP-0820

Spatial Resolution Enhancement in Dedicated Brain PET Scanner Using an Analytic System Matrix

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Aim/Introduction: The spatial resolution in dedicated brain PET scanners is one of the most important factors in evaluation of brain metabolic process, neurotransmitter activity and early detection of diseases such as Alzheimer's. Resolution in PET is influenced by several factors such as crystal size, positron range and noncollinearity. Also in dedicated brain PET scanners, like whole-body PET scanners, the resolution is degraded by moving from the center to the edges of the transverse field of view (TFOV) due to the parallax error. The main objective of this study is to improve resolution in TFOV of our proposed dedicated brain PET scanner using Monte Carlo simulation and new analytic system matrix. ***Materials and Methods:*** The proposed dedicated brain PET scanner was simulated using Monte Carlo (GATE (V9.1)). This scanner configuration comprises 22 detector blocks in the transverse direction and 4 blocks axially. Each block is composed of a 23×23 array of 2×2×15 mm3 LYSO scintillators. Four cylindrical point sources (1.2 mm in diameter and 1 mm in height) filled with ^{18}F-FDG were positioned at the center of the TFOV and moved radially at 4 cm intervals. Image reconstruction was carried out using the OSEM algorithm via an in-house software. The full width at half-maximum (FWHM) of the point sources was determined in accordance with NEMA standards and subsequently utilized to compute an analytical system matrix employing a Gaussian function for resolution recovery enhancement. ***Results:*** The FWHM of point sources located at distances of 0, 4, 8, and 12 cm from the center of the TFOV without resolution recovery were determined to be 1.75, 1.96, 2.83, and 4.19 mm, respectively. By incorporating resolution recovery, the FWHM for these sources improved to 1.53, 1.49, 2.12, and 2.27 mm, respectively. The findings indicate that this resolution recovery technique has the capacity to enhance resolution by 12% and 45% for sources positioned at the TFOV center and 12 cm from the TFOV center, respectively. Therefore, implementing a resolution recovery algorithm with an analytical system matrix can result in more uniform spatial resolution in the TFOV. ***Conclusion:*** Utilizing data obtained from Monte Carlo simulations, an analytic system matrix was generated, demonstrating the capability of resolution recovery at various radial distances of TFOV. If the geometry of PET scanners and the FWHM of point sources at different TFOV radial distances are available, this method can potentially be modified to resolution recovery in other scanners.

EP-0821

Quantitative Accuracy of Reconstruction Methods in Preclinical PET and Effects on Kinetic Modelling

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Aim/Introduction: The selection of PET scanning mode and reconstruction method can influence quantification and image interpretation. Analytical methods, such as filtered-back-projection

(FBP) and reprojection (RP), are fast, but compromise image quality (IQ) [1]. Iterative ordered-subset-expectation-maximization (OSEM) can mitigate these issues, but may introduce bias [2]. This study assesses the effects of reconstruction algorithms on IQ and quantification of activity concentration in phantom and animal experiments. ***Materials and Methods:*** An IQ phantom filled with [18F]FDG solution (179.87kBq/cc) was scanned for 20 minutes with a preclinical PET scanner. The data was histogrammed into: (1) a static and (2) dynamic scans with different time-frames (40 frames of 30s and 10 frames of 120s). Reconstruction was conducted with FBP2D, RP3D, and OSEM2D, each using 128x128 matrix size, 1.898mm pixel size, and 0.796mm slice thickness. Additional high resolution OSEM2D (HR-OSEM2D) reconstructions were performed using 256x256 matrix size and 0.633mm pixel size. IQ metrics (activity concentrations, noise, spillover-ratios (SORs)) were extracted and analysed to establish a gold standard reconstruction protocol. Furthermore, dynamic scans of two Wistar rats injected with 34MBq of [18F]MC225, with blood sampling, were acquired with the same scanner and reconstructed using the aforementioned protocols [3]. Whole-brain tissue time-activity curves (TAC) were fitted to a 1-tissue compartment model (1TCM) and using metabolite-corrected plasma, K1 and k2 were derived. ***Results:*** In the phantom study, either OSEM2D exhibited similar and superior performances across IQ metrics with minimal activity concentration error, ranging from 0.03% to 1.02%, and the lowest noise levels and SORs, ranging from 2.40% to 3.18% and 0.04 to 0.18, respectively. For the rat scans, a strong correlation across reconstruction methods was observed for TACs ($r=0.943$, $p<0.001$). However, significant differences across kinetic parameters were found for one of the two rats, mainly between OSEM2D and FBP2D ($p=0.013$). Model-fit analysis showed that 1TCM fit best on HR-OSEM2D, as indicated by standard error of estimated kinetic parameters, ranging from 1.12% to 3.21% and Akaike information criterion (AIC=252.32 for HR-OSEM2D and AIC=309.88 for FBP2D). ***Conclusion:*** In preclinical static and dynamic scanning, OSEM2D and HR-OSEM2D performed similarly and outperformed the other reconstruction methods. However, the reconstruction does not affect the TACs and only inconsistently affects kinetic parameters. Additionally, the 1TCM fits best on HR-OSEM2D reconstructed images. Further investigation with varied sample size, reconstruction methods, and tracers is essential to optimize quantification and kinetic analysis. ***References:*** 1. Boellaard et al., 2001 2. Herranz et al, 20113. Garcia-Varela et al., 2022.

EP-54

e-Poster Area

D: Technical Studies -> D2 Data Analysis -> D24 Radiomics

EP-0822

Predicting Treatment Response in Esophageal Cancer Patients Using ^{18}F FDG PET/CT Texturel Features Parameters

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Aim/Introduction: Radiomics, a rapidly growing research field focused on the numerical properties of medical imaging, holds promise for personalized medicine's future. It aims at identifying characteristics that effectively predict clinical conformity and treatment response. Our study investigates the relationship between tumoral ^{18}F-FDG PET/CT Tissue Analysis Parameters and tumor localization, histopathological type, lymph node metastasis, mortality, and treatment response in esophageal cancer patients undergoing curative chemoradiotherapy (CRT). ***Materials and Methods:*** We retrospectively evaluated imaging findings of esophageal cancer patients diagnosed at our center, who underwent staging and treatment response assessment with ^{18}F-FDG PET/CT following CRT. Using the LIFEx version 7.3.0 software, we derived 105 different metabolic and tissue analysis parameters of the primary tumor. Statistical analyses were performed using IBM SPSS 26.0. The Kruskal Wallis H and Mann-Whitney U tests were employed for group comparisons. ***Results:*** A total of 39 patients (24 males, 15 females; age 65.5 ± 9.7 years) were included in the study. The mean survival time was 23.5±25.2 months. The tumor morphology was squamous cell carcinoma in 31 patients (79.5%) and adenocarcinoma in 8 patients (20.5%). Lymph node metastasis was present in 20 patients (51.3%). The tumor was located in the proximal esophagus in 8 (20.5%), mid esophagus in 21 (53.8%) and distal esophagus in 10 (25.7%) patients. According to treatment response, 13 (33.3%) patients were categorized as complete response, 22 (56.4%) as partial response and 4 (10.2%) as progressive disease. Nine patients (23.1%) died during the follow-up period.Significant statistical differences were found between groups in terms of 47 radiomic parameters for tumor histologic sub-type and 45 for tumor localization ($p<0.05$). Gray Level Co-occurrence Matrix (GLCM)_InverseVariance parameter was significantly higher in the progressed group than in the complete and partial response group ($p=0.036$). 13 first order radiomics parameters and Gray-Level Size-Zone Matrix (GLSZM)_SmallZoneLowGreyLevelEmphasis parameter were significantly different according to the presence of lymph node metastasis ($p<0.05$). GLCM_ClusterShade, GLSZM_ZoneSizeVariance and INTENSITY-HISTOGRAM_MaximumHistogramGradient parameters were significantly higher in dead patients compared to survivors ($p=0.042$, $p=0.013$, $p=0.047$, respectively). ***Conclusion:*** Our study highlights the potential utility of the GLCM_InverseVariance parameter, an indicator of local homogeneity, in predicting treatment response in esophageal cancer patients. Various radiomic parameters are related to tumor histologic sub-type, localization, lymph node metastasis presence, and mortality. We conclude that the textural features of primary esophageal tumors could serve as prognostic biomarkers for identifying patients with poor prognosis and warrant further investigation in prospective studies with larger patient cohorts.

EP-0823

Is F^{18} FDG PET/CT Based Radiomics Features Useful for Prediction of PD-L1 Expression in Non-small Cell Lung Cancer?

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Aim/Introduction: This study investigated the diagnostic test accuracy of F^{18} FDG PET/CT based radiomics features for prediction of PD-L1 expression in non-small cell lung cancer (NSCLC). ***Materials and Methods:*** A systematic search was performed in PubMed and EMBASE (last updated in 31 March 2023). Studies evaluating diagnostic performances of F^{18} FDG PET/CT based

radiomics features for prediction of PD-L1 expression in NSCLC. We determined the sensitivities and specificities across studies, calculated positive and negative likelihood ratios (LR+ and LR-), and estimated pooled area under curve (AUC). ***Results:*** The pooled sensitivity of F^{18} FDG PET/CT was 0.75 (95% CI; 0.64-0.83) and a pooled specificity of 0.66 (95% CI; 0.52-0.78) for prediction of >1% expression of PD-L1. For prediction of >50% expression of PD-L1, the pooled sensitivity of F^{18} FDG PET/CT was 0.77 (95% CI; 0.67-0.85) and a pooled specificity of 0.61 (95% CI; 0.55-0.66). For >1% expression of PD-L1, the pooled AUC of fixed effects was 0.791 (95% CI; 0.771-0.811) and of random effects was 0.783 (95% CI; 0.722-0.845). For >50% expression of PD-L1, the pooled AUC of fixed effects was 0.735 (95% CI; 0.718-0.751) and of random effects was 0.766 (95% CI; 0.706-0.825). ***Conclusion:*** Analysis of the available studies indicated that F^{18} FDG PET/CT based radiomics features showed a moderate diagnostic performances for prediction of PD-L1 expression in NSCLC. However, future studies would be necessary for standardization of the method for prediction of PD-L1 expression in NSCLC using F^{18} FDG PET/CT based radiomics features.

EP-0824

Evaluating the impact of the Radiomics Quality Score: A systematic review and meta-analysis

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Aim/Introduction: The radiomics quality score (RQS) has become the de facto quality appraisal tool for radiomics studies, consisting of 16 criteria which reward/penalise studies based on methodological approach (range, -8 to 36). However, an encompassing meta-analysis of its application within the literature is yet to be undertaken. Here we report a systematic review and meta-analysis on the impact the RQS has had on radiomics studies to date and to assess if adherence to its 16 criteria is improving over time. ***Materials and Methods:*** A systematic search was conducted from January 1, 2022, to December 31, 2023, for systematic reviews which implemented the RQS (CRD42024493843). Articles prior to 2022 were taken from a previous review. Data extracted from each included article were (where available) mean RQS, the RQS of individual radiomics papers, criteria scores, and multiple reader data. Date of publication of respective radiomics studies were matched with their assigned RQS from reviewers. Average score, average adherence (score>0) and inter-observer variability were evaluated for the 16 criteria. Correlation of quality scores and criteria scores with time were assessed using Pearson correlation. Errors in application of the RQS criteria were noted and corrected in systematic reviews which provided criteria scoring data. ***Results:*** A total of 130 systematic reviews were included for analysis, with mean RQS 130/130 (100.0%), quality scores of individual radiomics studies 117/130 (90.0%), criteria scores 97/130 (74.6%), and multiple reader data 24/130 (18.5%) extracted. A total of 3247 quality scores were extracted from radiomics studies with respective date of publication. Overall mean RQS was 9.89±3.87. Analysis of individual quality scores over time were positively correlated (Pearson R=0.32, p<0.001) and significantly higher after publication of the RQS (before publication, 5.58±6.16; after publication, 10.17±6.10; p<0.001). Only 233/3247 (7.18%) scores were ≥ 50% of the maximum RQS. The average percentage of the maximum score and adherence achieved ranged from -2.20% to 70.86% and 1.12% to 89.06%, respectively. Median Cohen's kappa ranged from 0.36 to 1.00. Correlation analysis revealed that ten, four, and two of the criteria had a significant positive correlation, no significant correlation, and significant negative correlation with time, respectively. Errors in criteria scoring were discovered in 38/97 (39.2%) of articles which provided criteria scores. ***Conclusion:*** Methodological approaches in radiomics studies are increasingly adhering to the criteria outlined by the RQS. However, current progress is still lacking for clinical translation of radiomics models in the future.

EP-0825

Evaluation of Endometrial Cancer Subtypes Metabolic, Volumetric, and Tumor Heterogeneity Parameters Obtained from F^{18} FDG PET/CT Imaging

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Aim/Introduction: The study's aim is to examine the relationship between endometrial cancer subtypes and lymph node metastasis status and texture parameters reflecting metabolic, volumetric, and tumor heterogeneity of the primary tumor obtained from F^{18} FDG PET/CT images. ***Materials and Methods:*** The study comprised 159 patients who had F^{18} FDG PET/CT imaging for staging after being diagnosed with endometrial cancer. Age, BMI, primary tumor subtypes, grades, and lymph node metastasis status of the cases were determined. Cases were first grouped into high- and low-grade subtypes according to their primary tumor subtypes. The same patient group was then divided into groups with and without lymph node metastasis. Images were evaluated in the LIFEx program. The primary tumor was segmented and texture features reflecting metabolic, volumetric and tumor heterogeneity were obtained. The relationships between these parameters and the groups were examined. ***Results:*** Patients with high-grade endometrial cancer had higher were older ages and had higher BMIs. When metabolic and volumetric parameters are measured, MTV, TLG, SUVmax, SUVmean, and SUVmin values were higher in patients with high-grade endometrial cancer. When these parameters were analyzed using logistic regression analysis, SUVmin was found to be the most efficient parameter on high-grade endometrial cancer. TLG had the highest value, with an AUC of 0.724. Cut-off values were found as 13.0368 cm3 for MTV, 5.00566 for SUVmin, 7.97611 for SUVmean, 15.48811 for SUVmax, and 100.4407 for TLG in ROC analysis. SUVmin and TLG levels were higher in patients with lymph node metastases than in those without. When ROC analysis was applied to these parameters between the groups with and without lymph node metastases, TLG had the highest value, with an AUC of 0.745. The cut off values obtained were 10.496 cm3 for MTV, 3.29881 for SUVmin, 9.15647 for SUVmean, and 121.7133 for TLG. There was no significant AUC value for SUVmax. Considering the texture parameters, while the parameters reflecting heterogeneity are observed to be high in high-risk endometrial cancers and patients with lymph node metastases, the parameters reflecting homogeneity are found to be high in low-grade endometrial cancers and patients without lymph node metastases. ***Conclusion:*** In our study, we showed that metabolic and volumetric parameters of the primary tumor obtained from F^{18} FDG PET/CT imaging and radiomics data reflecting tumor heterogeneity can contribute to distinguishing

endometrial cancer types and predicting lymph node metastasis ***References:*** https://pyradiomics.readthedocs.io/en/latest/, https://www.lifexsoft.org/.

EP-0826

Radiomic Features Extracted from PET Images Aid in Identifying Cachexia in Cancer Patients

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Aim/Introduction: Cancer-associated cachexia severely impairs the quality of life of cancer patients and is difficult to reverse in advanced stages of the disease. Therefore, early prediction of cachexia is crucial. The objective of this study was to investigate radiomic features extracted from PET images for the detection of cachexia in cancer patients who underwent [18F]fluoro-2-deoxy-D-glucose ([18F]FDG) positron emission tomography (PET)/computed tomography (CT) scans. ***Materials and Methods:*** Cancer patients who received [18F]FDG PET/CT scans between October 2017 and October 2020 were retrospectively enrolled for analysis. Radiomic feature extraction and model development were executed utilizing the FeAture Explorer Pro (FAE, Ver. 0.5.3) on PET scans encompassing volumes of interest, including the liver, pancreas, visceral and subcutaneous fat, as well as the psoas and sacrospinal muscle. We utilized pearson correlation analysis, analysis of variance, and logistic regression in the process of feature selection and construction of the radiomics model. Univariable and multivariable logistic regression were employed to identify variables independently associated with cachexia, facilitating the construction of both clinical and clinical-radiomic models. The discriminative ability of the models was assessed using the area under the curve (AUC), and statistical differences in AUC values between different models were compared using the DeLong test. ***Results:*** A total of 390 patients were included in this study, with 273 individuals in the training set and 117 in the testing set. In the training set, the AUC values for the clinical model, radiomic model, and clinical-radiomic model were 0.752, 0.746, and 0.782, respectively. The AUC value of the clinical-radiomic model was significantly higher than that of the radiomic model (P = 0.018). In the testing set, The AUC value of the clinical-radiomic model was significantly higher than that of the clinical model (0.754 vs 0.701, P = 0.049), while there was no statistical significance observed between the clinical-radiomic model and the radiomic model (0.754 vs 0.741, P = 0.617). ***Conclusion:*** Radiomic features extracted from [18F]FDG PET/CT scans hold significant utility in distinguishing cachexia among cancer patients.

EP-0827

Effects of Q.Clear reconstruction algorithm on predicting distant metastasis of non-small cell lung cancer from ^{18}F-FDG PET/CT images

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Aim/Introduction: This study aim to compare the effects of Bayesian penalized likelihood (Q.Clear) and ordered subset expectation maximization (OSEM) reconstruction algorithm on texture feature derived from ^{18}F-FDG PET/CT images and further clarify the advantages of the Q.Clear reconstruction algorithm for predicting distant metastasis for non-small cell lung cancer (NSCLC) PET/CT omics-related machinelearning (ML) modeling. ***Materials and Methods:*** A prospective multicenter study was conducted, including a total of 239 NSCLC patients from three hospitals. PET/CT data were reconstructed using both Q.Clear and OSEM reconstruction algorithms. A total of 125 image features were extracted based on each reconstruction algorithms, and eight ML methods were employed to build predictive models and evaluate their impact on prediction capabilities. Ten-fold cross-validation was performed to evaluate the reliability of ML models on training sets, which were subsequently validated on testing sets. The predictive performance of each model was assessed using receiver operating characteristic (ROC) curves, area under the ROC (AUC) values, decision curveanalysis (DCA) curves, and calibration curves. ***Results:*** The AUC values demonstrated that the Q.Clear algorithm exhibited superior predictive accuracy and reliability compared to the OSEM algorithm across all eight ML models, regardless of whether in the training or testing sets. Specially, in the training sets, significant differences in AUC values between Q.Clear and OSEM algorithms were observed for the k-nearest neighbors (KNN, r: 0.0406), random forest (RF, r: 0.0470), and support vector machine (SVM, r: 0.0404) models. Similarly, in the test sets, significant differences in AUC values between the Q.Clear and OSEM algorithms were observed for the KNN (r: 0.0496), RF (r: 0.0487), and SVM (r: 0.0492) models. Additionally, the ROC, DCA, and calibration curves further supported the superior performance of the KNN, RF, and SVM models when usingthe Q.Clear algorithm. ***Conclusion:*** The Q.Clear algorithm showed superior predictive accuracy and reliability in predicting distant metastasis of NSCLC using PET/CT radiomics compared to the OSEM algorithm. This improved performance may be attributed to the Q.Clear reconstruction algorithm providing more valuable information in PET/CTimages obtained.

EP-0828

3D Printed Radioactive Phantoms for the Validation of Texture Features in PET Radiomics

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Aim/Introduction: Image textures are clinically relevant biomarkers and can be quantified with radiomics analyses. It is therefore important to investigate whether underlying structures are reliably detected. 3D printing allows the use of clearly defined activity distributions with complex geometries. The aim of this study was to validate radiomic texture features in PET imaging using phantom measurements with 3D-printed radioactive components. ***Materials and Methods:*** A homogeneous sphere and three heterogeneous radioactive objects were produced using a stereolithographic 3D printer [1]. The structure chosen for the heterogeneous objects was a cuboid with a chessboard-like cross-section in fine patterns of different scales (2/4/6mm). High-resolution PET/CT image data were acquired with a Mediso NanoScan system. Binary images were generated from the CT data to obtain ground truth (GT) activity distributions. Texture features were extracted for comparison between ground truth and PET radiomics. ***Results:*** The texture feature glcm_Contrast (C) was very low for the homogeneous sphere (GT: Csphere=0.34; PET: Csphere=0.45). The ground truth contrast was lowest for the coarsest textured object (C6mm=0.7) and highest for the finest object (C2mm=177.4), while the values were inverse for the PET

images (C6mm=8.6; C2mm=1.1). A similar trend was observed for other texture features such as ngtdm_Complexity and firstorder_Uniformity. ***Conclusion:*** The results confirm that heterogeneous structures can be successfully produced and characterized using 3D printing. The difference between the ground truth and PET data indicates that quantification is strongly influenced by parameters such as resolution. 3D-printed radioactive phantoms can potentially be used to validate radiomics texture features and facilitate the optimization of image parameters. ***References:*** 1. Gillett D, Marsden D, Ballout S, Attili B, Bird N, Heard S, et al. 3D printing ^{18}F radioactive phantoms for PET imaging. EJNMMI Physics. 2021;8(1).

EP-0829

Enhancing Prediction of Neoadjuvant Chemotherapy Response in Locally Advanced Breast Cancer Through [18F]FDG PET-Based Radiomics

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Aim/Introduction: Machine learning and radiomics present exciting opportunities to enhance the clinical management of locally advanced breast cancer patients eligible for neoadjuvant chemotherapy (NAC). These technologies can provide valuable insights and potentially improve treatment outcomes for these patients. ***Materials and Methods:*** In this retrospective study, 71 breast cancer patients underwent PET/CT imaging with [18F] FDG as part of initial staging before neoadjuvant chemotherapy. By analyzing 87 textural features extracted from PET/CT scans and incorporating patient age, we identified predictive features using a LASSO regression approach. This methodology allowed for the selection of the most relevant features, enhancing the predictive accuracy of outcomes for these patients. ***Results:*** Five variables, including textural features (NGTDM_STRENGTH, GLCM_CORRELATION, GLSZM_LZHGE and GLSZM_HGZE) and age, were selected by LASSO regression analysis. These variables were used to create a radiomic model, which was related to three categorical variables of patients' response to NAC (Complete Response, CR; Partial Response, PR; No Response, NR). The AUCs obtained for these three variables were respectively 81.50% (NR), 73.0% (CR) and 69.0% (PR). ***Conclusion:*** These findings suggest that a predictive model incorporating radiomic features from PET/CT scans along with patient age can significantly enhance the accuracy of identifying non-responders to neoadjuvant chemotherapy (NAC). This integrated approach holds promise for more precise patient stratification and tailored treatment strategies in breast cancer care.

EP-0830

In Ga-68 PSMA PET/CT Treatment Response Evaluation in Prostate Cancer; the Effect of Tissue Heterogeneity on Treatment Response

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Aim/Introduction: We aimed to investigate the relationship between lesion-based volumetric and texture parameters obtained from pre-treatment Ga-68 PSMA PET/CT images and treatment response in patients with prostate adenocarcinoma. ***Materials and Methods:*** Between December 2018 and November 2022, 226 patients with prostate cancer who underwent Ga-68 PSMA PET/CT imaging both before and after treatment were included in the study. A total of 452 Ga-68 PSMA PET/CT images were analyzed retrospectively and comparatively. Baseline and post-treatment blood parameters of 97 patients with mixed response according to treatment response evaluation were recorded. Images were re-evaluated according to the PSMA expression status of the lesions. In 82 patients with mixed response (bone, lymph node), 1148 metastatic lesions (1012 bone and 136 lymph node) were divided into two groups according to the increase and decrease of PSMA expression. Images were evaluated in the LIFEx program. Metastatic bone lesions and lymph nodes were drawn with a 40% threshold and volumetric and textural features were obtained. The relationship between these data and the change in PSMA expression was analyzed. ***Results:*** In bone lesions, SUVmax, SUVmean and SUVmin values were lower in lesions with decreased PSMA expression (reference values: 6.51, 4.71 and 2.49, respectively). PSMA-TV was higher (reference value: 8.92 cm3). No significant difference was observed in the TL-PSMA value. In logistic regression analysis, TL-PSMA and PSMA-TV affected the change in PSMA expression by -0.007 and 0.056 folds, respectively. In lymph nodes, SUVmax and SUVmin values were lower in lesions with decreased PSMA expression (reference values: 5.40 and 3.58, respectively). No significant difference was observed in SUVmean, PSMA-TV and TL-PSMA values. In logistic regression analysis, SUVmax was -0.953-fold and SUVmean was 1.74-fold influential on the change in PSMA expression. When texture parameters are analyzed, intensity-based parameters such as kurtosis, GLCM-Entropy, GLCM-Contrast, GLCM-Dissimilarity and GLSZM-ZS. ENTR were higher in lesions with increased PSMA expression, while parameters such as intensity histogram-uniformity, GLCM-Angular second moment, GLCM-Inverse difference, GLCM-Inverse difference moment and GLSZM-LZHGE were lower. ***Conclusion:*** In this study, we demonstrated that when texture parameters obtained from Ga-68 PSMA PET images are evaluated on a lesion basis, they may play a role in predicting treatment response by showing the heterogeneity of lesions. ***References:*** https://www.lifexsoft.org/https://pyradiomics.readthedocs.io/en/latest/index.html.

EP-0831

Prediction of Response to TARE Treatment with Y90 Glass Microspheres in Patients with Colorectal Cancer Metastatic to the Liver Using Artificial Intelligence-Assisted FDG PET Radiomics Model

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Aim/Introduction: Transarterial Radioembolization (TARE) plays a crucial role in treating metastatic colorectal cancer. To enhance decision-making, radiomics-based analyses have gained prominence alongside existing biomarkers. While morphological images like CT and MRI are commonly used, studies exploring metabolic radiomics features from FDG PET scans are still limited. Challenges in FDG PET-based radiomics studies include heterogeneous study groups (encompassing both primary liver tumors and liver metastases) and lack of stratification based on resin or glass microspheres. In this single-center study, we focused on metastatic colorectal cancer patients treated with glass microspheres, aiming to predict treatment response using pre-TARE FDG PET radiomics modeling. ***Materials and Methods:***

We evaluated treatment response using PERCIST criteria. Lesions were categorized as responders (complete/partial regression) or non-responders (stable/progressive disease). Target lesion segmentation was performed using 3D Slicer on PET images (Voxel size 3.64x3.64x3.26 mm^3, bin size 0.5 g/mL). Radiomics features (RF) were extracted using PyRadiomics. Data were split into training and testing sets (80:20 ratio). Standardization of features was achieved with StandardScaler (mean = 0, standard deviation = 1), and principal component analysis (PCA) reduced feature dimensionality. ***Results:*** A total of 107 RFs were found in the analysis of 82 treated lesions (n:56/26; responders/non-responders). ICC (intraclass correlation coefficient) and PCA reduced the RF to 7. Among the 3 different PCA threshold combinations of 11 classifier models, the 4 best combinations (70.6% accuracy) were found. Among these 4 models, "AdaBoostClassifier with PCA threshold of 0.99" had the highest sensitivity and accuracy. ***Conclusion:*** In this study, it was found that treatment response could be predicted with 70.58% accuracy using PET radiomics model before TARE. Clinical features are planned to be added to these models in the next phase and it will be tested whether the ideal threshold of 80% accuracy can be reached.

EP-0832

Prediction of Amyloid PET Positivity from FDG PET: a Machine Learning-Based study

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Aim/Introduction: Amyloid positron emission tomography (Aβ PET) serves as a pivotal diagnostic tool in the diagnosis of Alzheimer's disease (AD). However, not all patients could undergo this examination. With this limitation in mind, we aimed to develop a model utilizing fluorodeoxyglucose positron emission tomography ([18F]FDG PET) as a means to predict Aβ PET outcomes. ***Materials and Methods:*** A total of 155 patients who underwent [18F]FDG PET, [18F]AV45 PET, and T1-weighted magnetic resonance imaging (T1WI) were enrolled in the study. Of these, 70 patients were Aβ PET positive and 85 were negative. PETSurfer was employed to automatically segment brain regions, and standardized uptake value ratio (SUVR) values were extracted. SUVR values and the ratios of SUVR values between brain regions were utilized as separate features. Feature selection was performed using mutual information, Pearson's coefficient, and Boruta. The selected features were then used to train a logistic regression model, which was then evaluated on a separate test set to assess its performance. This process was repeated 100 times for stability. ***Results:*** When using SUVR values alone as features, our model demonstrated a noteworthy performance in the test set, achieving an area under the curve (AUC) of 72.68% ± 5.49%, an accuracy of 72.34% [70.21%, 76.60%], a sensitivity of 77.43% ± 7.26%, a specificity of 67.93% ± 10.92%, a positive predictive value(PPV) of 74.43% ± 7.96%, and a negative predictive value(NPV) of 71.67% ± 8.90% in the test set. However, when incorporating the ratios of SUVR values across different brain regions as features, the model's performance was further enhanced, attaining an AUC of 76.23% ± 7.20%, an accuracy of 76.60% [70.21%, 80.85%], a sensitivity of 80.12% ± 8.55%, a specificity of 72.34% ± 11.77%, a PPV of 78.08% ± 8.98%, and an NPV of 74.67% ± 10.90%. Statistical analysis revealed significant differences between the two methods across all evaluated metrics (including AUC and accuracy, $p < 0.001$; specificity and PPV, $p < 0.01$; sensitivity and NPV, $p < 0.05$). ***Conclusion:*** We introduce a machine learning model leveraging [18F]FDG PET data to forecast Aβ PET outcomes, potentially offering an alternative for patients without Aβ PET access. Utilizing ratios of SUVR values across brain regions as features significantly improves performance over using original SUVR values, likely due to effectively capturing complex inter-regional relationships.

EP-0833

Multicentric whole-body 177Lu-PSMA-SPECT Total Metabolic Tumor Volume (TMTV) extraction for predicting PSA change in 177Lu-PSMA therapy

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Aim/Introduction: An automated method to extract Total Metabolic Tumor Volume (TMTV) from 177Lu-PSMA-SPECT images is proposed. It is used to assess the predictive potential of SPECT images for PSA change. ***Materials and Methods:*** This study involves 4 hospitals using the VERITON SPECT/CT system (Nancy, Kuopio, Rouen, Lyon) and will gather +150 patients. To date, 50 patients who completed 1 to 6 cycles of 177Lu-PSMA have been analyzed. Patients were categorized into 'responders' and 'non-responders' based on PSA nadir (difference between the initial PSA and the lowest PSA value observed throughout the course of treatment). Whole body SPECT/CT images acquired 24hrs after injection of the first cycle were analyzed. To obtain the TMTV, lesion uptake was separated from physiological uptake automatically segmented from the CT images using a deep learning method, followed by application of a threshold based on the mean uptake in physiological areas. Mean uptake in TMTV regions was plotted against response status. A subset analysis focused on bone lesions (TMTVbones) and was automatically extracted by selecting uptake voxels belonging to bones. The Wilcoxson-Mann-Whitney test was employed to analyze the distribution disparities between responders and non-responders. ***Results:*** Statistical analysis revealed significant differences in TMTV between responders and non-responders for 177Lu-SPECT's TMTV and TMTVbones (p-value 0.026 and 0.016 respectively). ***Conclusion:*** Automated TMTV extraction from 177Lu-PSMA-SPECT confirms the potential for prediction of PSA change. These findings underscore the importance of intra-treatment imaging modalities in guiding personalized therapy decisions and optimizing patient outcomes.

EP-0834

Radiomics analysis of 64CuCl2 PET in muscle-invasive bladder cancer: correlation of the primary tumour textural features with the disease extension

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Aim/Introduction: 64CuCl2 is a tracer of cancer metabolism with exclusive hepatic excretion; for this reason, it represents a promising tool in the PET imaging of muscle-invasive bladder cancer (MBC). However, uptake of this tracer within the cancer tissue can be heterogeneous, reflecting intrinsic

MBC characteristics that may be linked with its aggressiveness. We tested this hypothesis by applying a radiomics analysis to the 64CuCl2 PET images in a cohort of MBC patients. ***Materials and Methods:*** We prospectively enrolled patients referred to our institution for pathology-confirmed MBC staging/re-staging between September 2021 and January 2023. All patients underwent a whole-body 64CuCl2 PET/CT; the primary tumour was identified on both series, and volumes of interest were drawn manually. Radiomics features were extracted using LifeX®. Differences in these features between patients with or without nodal (N+ and N-) and distant (M+ and M-) were tested via a univariate analysis, applying Bonferroni correction. Stratification of the features according to the T stages was also tested. ***Results:*** In the PET images, four parameters had a significantly higher value in M+ patients than in M-: Intensity (p=0.0007), metabolically active volume (p=0.0007), GLCM_InverseVariance (p=0.0008) and GLRLM_RLNU (p=0.0009). In the CT datasets, eight parameters were higher in M+ patients than in M-; the most significant were volume (p=0.0008), energy (p=0.000056), GLRLM_RLNU (p=0.0009), and GLZLM_LZE/LZLGE/LZHGE (p=0.0007). Across all parameters, only GLCM_ Normalised InverseDifference in PET was higher in N+ patients than in N-. Entropy, GLCM_Entropy, GLZLM_GrayLevel/ZoneSize_NonUniformity were higher in T3/T4 tumours than in T1 (p<0.001). ***Conclusion:*** Texture analysis identifies a specific pattern in MBC with distant localisations: they are larger, present higher metabolic activity, and have a prevalence of large homogenous areas in the CT texture, possibly corresponding to necrotic or homogenously hypervascular areas. Conversely, no specific pattern identifies MBC with local nodal spread. Radiomics may represent a non-invasive biological characterisation in MBC. Tumours with relevant local extension (T3/T4) have markedly increased heterogeneity than the superficially confined (T1) forms.

EP-0835

Decoding recurrence in Prostate Cancer: Insights from ^{68}Ga-PSMA PET/CT radiomics features

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Aim/Introduction: The recurrence of prostate cancer (PCa) remains a significant concern despite advances in diagnosis and treatment. Tumor heterogeneity poses a challenge in accurately predicting recurrence risk and tailoring management strategies. 68Ga-PSMA, a PET tracer recently introduced for the imaging of patients with PCa at diagnosis, staging/restaging and to assess the patients with any post-treatment biochemical failure. However, PET/CT has also a limitation to characterize subtle tissue variation and tissue or tumor heterogeneity. This study aims to explore the utility of 68Ga-PSMA PET/CT imaging combined with radiomics features by assessing spatial heterogeneity in tumors through mathematical analysis of texture features in predicting PCa recurrence in patients those achieved post-treatment complete metabolic response (CMR). ***Materials and Methods:*** We ambispectively reviewed PCa patients who underwent 68Ga-PSMA PET/CT to know the disease status. Patients were evaluated based on post-treatment CMR and recurrent disease based on PSMA expression on 68Ga-PSMA PET/CT. Using the MRIcron software (https://www.nitrc.org/projects/mricron), the region of interest (ROI) for CMR and recurrent disease areas were delineated over 2-4 slices on fused PET/CT images with the help of experienced Nuclear Medicine Physician. Haralick texture features were evaluated using a custom-built texture analysis toolbox in MATLAB (v. 2018; MathWorks, Natick, MA, USA). ROC curve analysis was done on significant parameters to estimate the cut-off values along with corresponding sensitivity and specificity. All the analysis was done using SPSS software v22.0. ***Results:*** A total of 31 PCa patients those achieved post-treatment CMR, mean age 63.96±7.62 years were included for the tumor recurrence prediction. The mean duration of CMR with treatment to recurrence was 11.2 ± 4.2 months. A total of 29 texture parameters [9 Gray Level Co-occurrence Matrix (GLCM), 8 histogram & 12 Run Length Matrix (RLM)] were assessed. Of 29 texture parameters, 23 were found to have statistical significance, comprising 8 out of 9 GLCM, 5 out of 8 histogram, and 10 out of 12 RLM features. The determination of concordance and discordance in texture parameters was based on post-treatment CMR as the reference standard. For GLCM parameters, energy, contrast and autocorrelation, showed highest diagnostic accuracy of 82.26%; mean, median, mode showed highest diagnostic accuracy of 90.32% among histogram features and SRHGE and GLV demonstrated the highest diagnostic accuracy of 80.26% among RLM texture features to predict the tumor recurrence. ***Conclusion:*** This approach could facilitate early detection of recurrence and optimize treatment planning, ultimately improving patient outcomes in PCa management.

EP-0836

Exploring the Impact of ^{68}Ga-PSMA PET/CT Radiomics Features to distinguish between normal prostate tissue vs malignant prostate Cancer

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Aim/Introduction: The known heterogeneous nature of tumor on both gross and cellular levels, genetic and phenotypic levels might affect tumor diagnosis and prognosis thereby impacting the treatment. PET/CT based radiomics features is being applied to study the spatial heterogeneity in tumors that involve the application of various mathematical methods to analyse the relationship between the grey level intensity of pixels or voxels and their position within an image, thereby providing an objective, quantitative assessment of tumour heterogeneity. Present study is aimed to explore the potential of texture parameters extracted from 68Ga-PSMA PET/CT scans in distinguishing between normal prostate tissue vs malignant prostate cancer (PCa). ***Materials and Methods:*** We ambispectively reviewed PCa patients who underwent 68Ga-PSMA PET/CT to know the disease status. Patients were categorized into normal prostate tissue and malignant PCa patients based on PSMA expression on 68Ga-PSMA PET/CT. Using the MRIcron software (https://www.nitrc.org/projects/mricron), the ROI over normal and malignant prostate areas were delineated over 2-4 slices on fused PET/CT images with the help of experienced Nuclear Medicine Physician. Haralick texture features were evaluated using a custom-built texture analysis toolbox in MATLAB (v. 2018; MathWorks, Natick, MA, USA). All the analysis was done using SPSS software v22.0. ***Results:*** A total of 426 biopsy proven (300 malignant; 126 normal) patients with mean age of 67.78±7.17 years were evaluated in retrospective as well as prospective manner. A total of 29 texture parameters [9 Gray Level Co-occurrence Matrix (GLCM), 8 histogram & 12 Run Length Matrix (RLM)] were assessed. All Haralick texture parameters were

found significantly different among PCa and normal prostate tissue ($P < 0.05$). The concordance and discordance of texture parameters was determined based on the Gleason score as reference standard. Among GLCM parameters, dissimilarity and autocorrelation emerged as the top performers in differentiating PCa from normal prostate tissue with AUROC curve of 94.2% and 95.1% with sensitivity, specificity of 91.67%, 92.06% and 90.33%, 95.24%, respectively and having diagnostic accuracy of 91.78%. Similarly, in the context of histogram parameters, mode demonstrated highest diagnostic accuracy of 87.09% with AUROC curve of 93.8%, and sensitivity, specificity of 81.67%, 100%, respectively. For RLM texture parameters Long Run Low Grey-Level Emphasis (LRHGE) showed highest diagnostic accuracy 91.08% with AUROC curve of 94.8%, and sensitivity, specificity of 89.33%, 95.24%, respectively. ***Conclusion:*** Our study findings suggest the feasibility of employing radiomics-based approaches as adjuncts to PET/CT for improved diagnosis and treatment planning in PCa patients.

EP-0837

^{18}F-FDG PET/CT Radiomics features in distinguishing normal kidney from Renal Cell Carcinoma (RCC)

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Aim/Introduction: Conventional imaging (CT/MRI) are fundamental for staging primary tumors during the initial diagnosis of Renal cell carcinoma (RCC). 18F-FDG PET/CT is a useful adjunct to conventional imaging in establishing metastatic disease in lesions detected by CT, MRI or bone scan. Although F-18 FDG PET/CT is not recommended for diagnosis and staging of RCC based on national and international guidelines. Also, high background of renal pelvis from physiological excretion of FDG limits the evaluation of small primary RCC. The utilization of radiomics features, holds the promise to explore the subtle differences in metabolic activity and tissue characteristics between normal kidney and malignant renal masses by scrutinizing the heterogeneity and complexity of lesions. Thus, the present study is aimed to distinguish between normal kidney vs RCC using 18F-FDG PET/CT radiomics features. ***Materials and Methods:*** This study included 62 histopathologically confirmed RCC patients (50 males; 12 females) with a mean age of 55.46 ± 11.02 years in a retrospective and prospective manner. Using the MRIcron software (https://www.nitrc.org/projects/mricron), the region of interest (ROI) for normal renal parenchyma and RCC mass was delineated within the same patient. Experienced nuclear physicians assisted in delineating ROIs over 2-4 slices on fused PET/CT images. The texture analysis was conducted using a custom-built texture analysis toolbox in MATLAB (v. 2018; MathWorks, Natick, MA, USA). Further, all analyses were conducted using SPSS v22.0 software from IBM Corporation. ***Results:*** A total of 29 texture parameters [9 Gray Level Co-occurrence Matrix (GLCM), 8 histogram & 12 Run Length Matrix (RLM)] were assessed. Eighteen (18) Haralick texture parameters including 8 GLCM, 2 Histogram and 8 RLM parameters were found significantly different among RCC and normal renal parenchyma ($P < 0.05$). The concordance and discordance of texture parameters was determined based on the SUVmax as reference standard. Among GLCM parameters, entropy emerged as the top performers in differentiating RCC from normal renal parenchyma with AUROC curve of 91% with sensitivity, specificity and diagnostic accuracy of 87.1%. Similarly, in the context of histogram parameters, entropyA demonstrated highest diagnostic accuracy of 76.61% with AUROC curve of 81%, and sensitivity, specificity of 58.06 %, 95.16 % respectively. For RLM texture parameters Short Run Low Grey-Level Emphasis (SRLGE) showed highest diagnostic accuracy 88.71% with AUROC curve of 93%, and sensitivity, specificity of 88.7%. ***Conclusion:*** The texture analysis enhances diagnostic accuracy, potentially allowing for earlier and more precise identification of RCC.

EP-0838

The importance of textural analysis of metabolically active thyroid nodules incidentally detected in PET/CT studies

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Aim/Introduction: With the growing popularity of PET/CT examinations, the number of accidentally detected metabolically active thyroid nodules is increasing. The nature of these nodules cannot be determined solely on the basis of conventional parameters used in everyday clinical practice. Textural analysis may be helpful, as it allows us to characterize features invisible to the physician with the naked eye. ***Materials and Methods:*** Radiomic features were extracted from PET images of 50 patients utilizing the PyRadiomics Python library. Subsequently, after selecting 20 features with the largest and 20 with the lowest regression coefficients, a logistic regression model for malignancy classification was created. A leave-one-patient-out cross-validation was used to evaluate three types of input variables: clinical data, clinical and radiomic data, and radiomic data only. The results of the textural analysis were correlated with the cytological results of the biopsy or histopathological results in the case of thyroidectomy. ***Results:*** In the cohort of 50 studied patients, 11 were diagnosed with malignant thyroid cancer (60 ± 11 years, female: N=5), and 39 had benign thyroid nodules (58 ± 11 years, female: N=34). An area under the receiver operating curve (AUC) for leave-one-out cross-validation with 20 radiomics features for logistic regression was: 0.89 (95% CI, 0.74-1.00), for support vector machine (SVM): 0.84 (95% CI, 0.67-1.00), and for gradient-boosted decision tree models (XGBoost) it was: 0.77 (95% CI, 0.62-0.92). ***Conclusion:*** Radiomics features may contribute to better characterization of incidentally detected metabolically active thyroid nodules.

EP-0839

A Prognostic PET Radiogenomic Signature for Non-Small Cell Lung Cancer

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Aim/Introduction: Positron emission tomography (PET) has emerged as a significant imaging modality for diagnosis and treatment response assessment. Radiomics extracts quantitative imaging biomarkers from medical images and non-invasively provides valuable insights into tumor development and likely prognosis [1]. Simultaneously, clinical genomics plays a pivotal role in selecting personalized management strategies [2]. This study aimed to evaluate the integrative value of a prognostic PET-radiomic signature and tumor genomic characteristics obtained from transcriptomics analysis in non-small cell lung

cancer patients. ***Materials and Methods:*** Radiomic features, RNA sequencing data, and clinical risk factors from several NSCLC datasets were assessed in this study. The most significant features and genes were selected using Cox-univariate analysis and the least absolute shrinkage and selection operator (LASSO). Prognostic multivariate signatures were then developed to predict overall survival (OS) and categorize patients into risk groups using each model. To evaluate the association between radiomic risk cohorts and transcriptomic, we performed genomic analyses related to immunomodulator molecules, immune cells, and oncogenic signaling pathways. A multi-omics nomogram was constructed by integrating radiomics, genomics, and clinical data. ***Results:*** We independently developed three predictive models: a PET-radiomic signature (C-Index, 0.71; 95%CI: 0.67, 0.75) (Table 1), a genomic signature (C-Index, 0.82; 95%CI: 0.78, 0.86), and a clinical model (C-Index, 0.65; 95%CI; 0.61, 0.69). Each of these models significantly stratified patients into high- and low-risk groups. Our analysis revealed significant correlations between the radiomic risk score and various subcategories of clinical factors (such as TNM stages, age, and gender), immune cell types, and oncogenic pathways (p<.01). The high-risk cohort exhibited characteristics associated with tumorigenesis, while the low-risk cohort indicated anti-tumor immunity. The integrated nomogram significantly improves predictive performance. ***Conclusion:*** PET radiomic features demonstrate significant potential as non-invasive tools, aiding in risk assessment and providing valuable information on the biological characteristics of NSCLC. The fusion of radiomics and genomics insights in such radiogenomic analyses holds immense promise for advancing personalized NSCLC management. ***References:*** [1] J. J. Van Griethuysen, A. Fedorov, C. Parmar, A. Hosny, N. Aucoin, V. Narayan, R. G. Beets-Tan, J. C. Fillion-Robin, S. Pieper, and H. J. Aerts. Computational radiomics system to decode the radiographic phenotype. Cancer Res., vol. 77, no. 21, pp. e104-e107, 2017. [2] Araujo-Filho JAB, Mayoral M, Horvat N, Santini FC, Gibbs P, Ginsberg MS. Radiogenomics in personalized management of lung cancer patients: Where are we? Clin Imaging. 2022; 84:54-60.

EP-0840

Response Prediction to Chemotherapy in DLBCL patients using dissemination feature Dmax derived from Baseline ^{18}F FDG PET scan

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Aim/Introduction: DLBCL is the most common type of NHL, which is a more aggressive tumour. Dmax is a simple 3D feature that represent the maximal distance between the two farthest hypermetabolic PET lesions. Despite their heterogeneity, most studies showed a significant prognostic role of Dmax in predicting progression free survival and overall survival in DLBCL. In this study we aim to predict the metabolic response to first line chemotherapy in accordance with Deauville score in patients with biopsy proven DLBCL by using Dmax radiomics feature. ***Materials and Methods:*** 36 biopsy proven DLBCL patients (20 men and 16 woman, median age of 49 (13-76) years) were retrospectively analysed from march 2022 to march 2024. All of these patients underwent ^{18}F-FDG PET/CT scan before treatment and after 3 to 4 courses of chemotherapy. Their height were measured during the time of scan.These patients were followed up for a median period of 6 (3-17)months. The Dmax was calculated automatically using the LifeX software and were analysed by using Mann Whitney U Test (independent). ***Results:*** Of those 36 patients, 12 shows disease progression/ relapse, 13 shows complete metabolic response and 11 shows partial response to chemotherapy. The distance between the two farthest lesions (Dmax) of the baseline ^{18}F-FDG PET/CT were calculated. The mean of Dmax in the treatment response group is 26.73cm and the progression group is 48.74 cm respectively. It shows significant difference in Dmax between the progression and the treatment response group, with p value of 0.007 (p<0.05). However, no significant difference in the height of the patients between the progression and the treatment response group were observed (p valve of 0.934). ***Conclusion:*** This study concludes that the patients with high Dmax has more likely to have disease progression/relapse than patients with low Dmax.

EP-55

e-Poster Area

D: Technical Studies -> D2 Data Analysis -> D25 Artificial Intelligence

EP-0841

Revolutionizing Colorectal Cancer Evaluation: A Comparative Analysis of AI-Driven and Conventional PET Imaging Techniques

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Aim/Introduction: AI in medical diagnostics is a paradigm change, especially in cancer diagnosis. Colorectal cancer, a major cause of cancer deaths, requires new diagnostic methods to improve therapy. This study studies how AI improves metabolic tumour assessments in colorectal cancer using PET imaging. To show how AI can consistently identify and measure tumour metabolic activity, we compare Syngo Via software with an AI-based platform. This might revolutionize cancer diagnosis. ***Materials and Methods:*** We conducted a study that included comparing a group of 15 individuals who had been diagnosed with colorectal cancer. The ^{18}F-FDG PET/CT scan was performed on every patient, and the analysis was conducted using both the regular SyngoVia software and the AI-enhanced RECOMIA platform. Our primary objective was to assess SUVmax, SUVmean, MTV, and TLG, which are crucial parameters for assessing tumour metabolism. The purpose of this comparative method was to evaluate the efficacy and precision of AI in tumour assessment, emphasizing the capacity of AI-powered platforms to enhance diagnostic accuracy. ***Results:*** The findings of the comparison investigation revealed notable disparities between the conventional and AI-driven assessments, namely in the SUVmean, MTV, and TLG measures. The RECOMIA platform, which is powered by artificial intelligence, demonstrated a significant advantage in accuracy. The mean differences observed were -0.87±1.81 for SUVmax (p=0.188), 7.49±6.94 for SUVmean (p=0.0119), -59.60±56.16 for MTV (p=0.0129), and -368.97±595.61 for TLG (p=0.1002). The aforementioned results highlight the enhanced sensitivity and accuracy of artificial intelligence (AI) in identifying small metabolic alterations inside tumours, surpassing conventional diagnostic techniques. ***Conclusion:*** Our work concludes that AI is a powerful tool for assessing colorectal cancer metabolism. AI's better SUVmean, MTV, and TLG metrics analysis supports RECOMIA's use in clinical diagnoses. Integration into

tumour metabolism might improve colorectal cancer therapy by enhancing therapeutic tactics and patient outcomes. This study enables AI-driven cancer diagnoses, advancing precision medicine. ***References:*** 1. 1.Bergstrom M, Muhr C, Lundberg PO, Langstrom B. PET as a tool in the clinical evaluation of pituitary adenomas. J Nucl Med. 1991; 32: 610-5) 2. 2. Huijun Ju, Jinxin Zhou, Yu Pan, Jing LV and Yifan Zhang. Evaluation of pituitary uptake incidentally identified on ^{18}F-FDG PET/CT scan. Oncotarget, 2017, Vol. 8, (No. 33), pp: 55544-55549 3. 3. Hyun SH, Choi JY, Lee KH, Choe YS, Kim BT. Incidental focal ^{18}F-FDG uptake in the pituitary gland: clinical significance and differential diagnostic criteria. J Nucl Med. 2011; 52: 547-50).

EP-0842

Feasibility of deep progressive learning reconstruction (DPR) method in ^{18}F-FDG PET/MR for bone lesion diagnosis

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Aim/Introduction: Bone metastasis commonly occurs during tumor progression. However, the limited spatial resolution of PET imaging may impede the detection of microlesions. The advent of deep progressive learning reconstruction (DPR) method, leveraging convolutional neural networks (CNN), presents a novel approach [1]. We hypothesize that the DPR algorithm will improve the image quality and focal lesion detection of 18F-FDG PET images. This study aims to utilize DPR to optimize 18F-FDG PET/MR imaging and demonstrate its feasibility for bone lesions diagnosis. ***Materials and Methods:*** We examined ten patients using a PET/MR clinical system. PET images were reconstructed with both the DPR and the conventional ordered-subset expectation-maximization (OSEM) algorithms. The DPR method employs a denoising network (CNN-DE) to eliminate noise from the input image and an enhancement network (CNN-EH) to map a low-convergence image to a high-convergence image. Both networks were trained through a custom-designed feedback network [2]. Quantitative analyses were conducted measuring the standard uptake value (SUV) of bone lesions, the target-to-background ratio (TBR), and the signal-to-noise ratio (SNR). Additionally, three experienced radiologists independently conducted qualitative assessments, rating noise levels, lesion conspicuity, and overall image quality using a five-point Likert scale. They also evaluated diagnostic performance by identifying the number of bone lesions using both magnetic resonance (MR) morphological criteria and abnormal 18F-FDG uptake. ***Results:*** The DPR reconstructions exhibited increases of 48%, 44% and 21% in SNR, SUVmax and TBR, respectively, compared to the conventional group (all $p < 0.01$). On the five-point Likert scale, the DPR group received significantly higher scores for noise level (median score, 4 vs 3), lesion conspicuity (median score, 4 vs 3), and overall image quality (median score, 4 vs 3) (all $p < 0.01$). Moreover, radiologists reported a significantly higher incidence of bone lesions in the DPR group (15.8 ± 1.4) versus the conventional group (12.5 ± 1.6, $p < 0.01$). ***Conclusion:*** The DPR method appears promise in markedly enhancing the quality of bone imaging over standard imaging reconstructions. The improved SNR achieved with the DPR technique enables the detection of small bone lesions that may be masked by noise in conventional reconstructions, thus potentially improving the diagnostic accuracy of 18F-FDG PET/MR imaging for bone lesions. ***References:*** 1. Lv Y, et al. PET image reconstruction with deep progressive learning. Phys Med Biol. 2021;66(10): 105016.2. Wang T, et al. Deep progressive learning achieves whole-body low-dose F-FDG PET imaging. EJNMMI physics.2022;9(1):82.

EP-0843

PSMA-positive prostatic volume prediction with deep learning based on T2-weighted MRI

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Aim/Introduction: High PSMA expression might be correlated with structural characteristics such as growth-patterns on histopathology, not recognized by the human eye on MRI images. Deep structural image analysis might be able to detect such differences and therefore predict if a lesion would be PSMA positive. Therefore, we aimed to train a neural network based on PSMA PET/MRI scans to predict increased prostatic PSMA uptake based on the axial T2 weighted sequence alone. ***Materials and Methods:*** All patients undergoing simultaneous PSMA PET/MRI for PCa staging or biopsy-guidance between April 2016 and December 2020 at our institution were selected. To increase the specificity of our model, the prostatic beds on PSMA PET scans were dichotomized in positive and negative regions using an SUV threshold greater than 4 to generate a PSMA PET map. Then a C-ENet was trained on the T2 images of the training cohort to generate a predictive prostatic PSMA PET map. ***Results:*** 154 PSMA PET/MRI scans were available (133 [68Ga]Ga-PSMA-11 and 21 [18F]PSMA-1007). Significant cancer was present in 127 of them. The whole dataset was divided into a training cohort ($n = 124$) and a test cohort ($n = 30$). The C-ENet was able to predict the PSMA PET map with a dice similarity coefficient of 69.5±15.6%. ***Conclusion:*** Increased prostatic PSMA uptake on PET might be estimated based on T2 MRI alone. Further investigation with larger cohorts and external validation is needed to assess whether PSMA uptake can be predicted accurately enough to help in the interpretation of mpMRI.

EP-0844

Development of a Radiopharmaceutical Verification System using Smart Device and Mixed Reality

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Aim/Introduction: One of the most serious accidents is the misadministration of radiopharmaceuticals used in nuclear medicine examinations. There have been reports of the occurrence of misadministration and its causes [1,2]. To prevent such misadministration, radiologists take measures such as checking drugs every morning and labeling patients scheduled for administration. After all, the possibility of human error still exists because of human management. Therefore, in this study, we developed a deep learning model to classify radiopharmaceuticals using mixed reality device in hospitals. Furthermore, we

attempted to develop a system that can easily classify the type of radiopharmaceuticals by displaying the results on a hologram. ***Materials and Methods:*** Images of radiopharmaceuticals were captured using a mixed reality device. There were 15 types of radiopharmaceuticals to be captured. The images were taken in a radiopharmaceutical administration room in a hospital. These images were used as training data, and the pre-trained GoogLeNet of ImageNet was used for transfer training. A total of 12464 images were prepared, and 10-fold cross-validation was performed. In addition, Grad-CAM was applied to provide a basis for classification. ***Results:*** Accuracy of 99.98% was achieved. Observation of GradCAM also revealed that the classification was based on the shape of the radiopharmaceutical container, mainly the radiopharmaceutical label. Although some of the images showed the effects of over-learning, they can be used as a double-check. ***Conclusion:*** A system for matching radiopharmaceuticals has been developed. In the future, by developing and combining face recognition technology for patients, it will be possible to determine whether a drug can be administered by taking a picture of the drug with a smart terminal in the hospital, such as a mixed reality device. In other words, it will be possible to prevent incorrect administration. In addition, because a camera attached to a mixed reality device captures a radiopharmaceutical in the hand simply by bringing it into their view, it is possible to classify radiopharmaceuticals with more natural movements and to take measures that are more visually comprehensible, such as adding annotations to the real space. ***References:*** [1] Bogner, M. S., Human Error in Medicine, CRC, Press, pp. 179-196 (2018) [2] Marks, P., Pressures of the day can lead to misadministration of radiopharmaceuticals within an Aus- tralian setting, J. Nucl. Med., 57(supplement 2), 2659 (2016).

EP-0845

Deep learning-based classification and segmentation of whole-body ^{18}F-FDG PET/CT examinations using manually generated segmentation masks

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Aim/Introduction: As convolutional neural networks (CNNs) are demonstrating progressive benefit in various medical specialties, we aimed to implement a medical image analysis tool for the automated classification and segmentation of integrated whole-body 18F-Fluorodeoxyglucose (FDG) Positron Emission Tomography/Computed Tomography (PET/CT) scans. The objective was to prospectively reduce medical misdiagnosis and oversights, enhance reporting efficiency, and facilitate easier access for unexperienced professionals. To address this aim, we primarily evaluated the performance of a CNN in classifying individual transverse PET/CT slices as either physiological or pathological. Subsequently, we programmed a CNN to delineate areas of increased uptake using the same images. ***Materials and Methods:*** The initial training dataset consisted of 262 individual whole-body PET/CT studies (152 male, 58.2 ± 14.8 years; 110 female, 59.1 ± 15.8 years), acquired at our institution between 2015 and 2021. These studies were primarily categorized as diseased (n = 98) and healthy (n = 164). All patients in the diseased group underwent manual segmentation and annotation for pathological and physiological regions. Due to technical constraints, only 76 of the diseased studies were available for training after preprocessing. Additionally, 15 random patients of the healthy group were selected and underwent physiological segmentation to create an independent testing dataset. To ensure diverse training, various approaches were conducted, such as generating different-sized image patches, varying the number of input layers, and overlaying CT and PET in different opacities. This resulted in 72 independent experiments for binary classification using a DenseNet121-based CNN and 60 for segmentation using a U-Net-based CNN. ***Results:*** The leading classification model for categorizing individual PET/CT layers achieved a predictive accuracy of 0.986 ± 0.029. Related F1-score, sensitivity and precision were 0.985 ± 0.029, 0.986 ± 0.029 and 0.987 ± 0.025, respectively. Regarding pathological segmentation, the best model obtained a Dice coefficient (DSC) of 0.659 ± 0.016 and a Hausdorff distance (HD) of 13.619 ± 2.624. For physiological segmentation, the corresponding DSC and HD were 0.800 ± 0.023 and 12.957 ± 1.737. Applied to the independent test dataset, the same models achieved an accuracy of 0.916 ± 0.036 for classification and a DSC of 0.522 ± 0.019 and a HD of 27.883 ± 1.230 for segmentation. ***Conclusion:*** Despite a relatively small dataset, especially the classification CNN models showed promising results for future integration into clinical practice. Therefore, additional training data augmented with supplementary information and multiple independent tests are required in follow-up studies to ensure reliability.

EP-0846

Performance Clinical Deep Learning Reconstructions applying Half dose FDG PET/CT protocols

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Aim/Introduction: FUESMEN installed a new digital SiPM PET/CT system, which enables high-speed scanning through its advanced AI iterative reconstruction engine. The AI reconstruction is a CNN-based iterative reconstruction which uses a pre-trained neural network to predict low noise PET images and improve image contrast[1]. This new system doubles the number of patients scanned each day and reduces the injected doses by half compared to the previous BGO PET/CT system. The aim of this study is to evaluate the image quality of Deep Progressive Reconstruction (DPR) compared to the standard OSEM in FDG scans of patients administered with half the injected standard dose. ***Materials and Methods:*** Image quality was evaluated in one hundred oncology patients injected with 2.035 MBq/kg to reduce the radiation dose by optimizing FDG PET/CT protocols. Two PET reconstructions were applied: standard OSEM (2 iter, 20 subsets) and AI recon (DPR ST1).Volumen of interest (VOI) in the liver, blood pool and muscle were located. For the VOIs measurement were obtained SUV max, SUV mean and standard deviation (SD). Image quantitative analysis applying coefficient of variation percentual (COV) in the liver (COVliver) were compared between OSEM and DPR reconstructions. Normal physiological biodistribution in liver, muscle and blood pool were compared, a T-student test was performed to establish the relationship. For

each overall image quality was subjectively rated by the referring physician on a 4-point scale (IQ score: 1 excellent, 2 good, 3 poor but interpretable, 4 poor not interpretable). SUVmax measurements and anatomic axial size were obtained from 92 malignant lesions. ***Results:*** Normal physiological distribution values were SUVmean-liver-OSEM= 2.414 and SUVmean-liver-DPR= 2.438, T-student test found a statistically significant relationship between SUVmean OSEM and SUVmean DPR [p = 0.006 (95% CI) values and pearson coefficient of 0.98 and high linear correlation R2= 9,65(Figure 1). In the image quantitative analysis values in the liver were COV-DPRmean = 6.98 and COV-OSEMmean = 11.39, obtaining 40.29 % of high reduction noise(Figure 3). The size range of the metastatic lesions was from 4 mm to 82 mm. The SUV max values presented a linear correlation with a determination coefficient of 0.871 (Figure 3). For half dose image quality score evaluation 92 % for PET OSEM were IQ good and for DPR were IQ Excellent. ***Conclusion:*** DPR reconstructions present a promising tool in PETCT protocols, offering excellent image quality with half the activity injected per patient. ***References:*** [1] Amirhossein,Isaac,Hosseini,Ismini,René,Habib. Deep learning-assisted ultra-fast/low-dose whole-bodyPET/CT imaging. EJNMI. 2020. https://doi.org/10.1007/s00259-020-05167-1.

EP-0847

Deep-learning based classification of [18F]FDG PET/CT images for the diagnosis of neurodegenerative diseases

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Aim/Introduction: ^{18}F-Fluorodeoxyglucose (FDG) PET/CT has been proven to be an effective biomarker of neurodegeneration, aiding the diagnosis of various diseases such as Alzheimer's disease. Recently, convolutional neural network (CNN) has been widely adopted to classify FDG PET/CT scans into various diseases, such as Alzheimer's disease. Extending on previous studies, this study aims to explore whether CNN is capable of classifying FDG PET/CT images to detect persons with normal condition (NC), Alzheimer's disease (AD), multiple system atrophy (MSA), progressive supranuclear palsy (PSP), and Lewy-body disease (LBD). ***Materials and Methods:*** This retrospective study involved 243 patients (mean age: 67.0±9.4, 132 male) who underwent FDG PET/CT examinations at Severance Hospital from 2015 to 2023. Labels were assigned on the consensus of two experts, one nuclear medicine physician and one clinician. ^{18}F-FP-CIT PET/CT examinations had been performed for the diagnosis of MSA and PSP. For external validation, 198 FDG PET/CT scans (mean age: 75.5±7.7, 109 male) were collected from Alzheimer's Disease Neuroimaging Initiative (ADNI). All scans were spatially normalized to the Dementia-Specific [18F]-FDG PET template1. Intensities of the scans were normalized by 99.9th percentile voxel intensity and clipped between [0, 1]. Out of a total of 441 data from Severance and ADNI, 332 scans were used for training and validation (136 NC, 88 AD, 45 MSA, 44 PSP, 19 LBD), and 109 scans were left out for test (38 NC, 44 AD, 11 MSA, 11 PSP, 5 LBD). DenseNet was implemented for classification, and model performance was evaluated by accuracy for general performance and AUROC for class-specific performance. ***Results:*** The accuracy of the model was 0.878 for in-house and 0.867 for external test set. For in-house test set, the AUROC of each class versus others was 0.970, 0.998, 0.914, 0.967, and 1.000 for NC, AD, MSA, PSP, and LBD respectively. For external test set, the AUROC was 0.956 and 0.949 for NC and AD. The confusion matrices for in-house and external dataset are provided in the table below. ***Conclusion:*** Experimental results demonstrate that convolutional neural network can robustly perform multi-class classification of ^{18}F-FDG PET/CT scans into NC, AD, LBD, MSA, and PSP. Future work should involve FDG scans from different institutes to further validate our findings. ***References:*** 1. Della Rosa, Pasquale Anthony, et al. "A standardized [18 F]FDG-PET template for spatial normalization in statistical parametric mapping of dementia." Neuroinformatics 12 (2014): 575-593.

EP-0848

TB-GAN: A new developed Deep Learning Framework for SPECT Myocardial Perfusion Image Denoising

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Aim/Introduction: In the field of single-photon emission computed tomography (SPECT) myocardial perfusion imaging (MPI), image denoising is a critical issue as it can impact clinical decision. This paper introduces an innovative deep neural network approach aimed at improving the quality of SPECT myocardial perfusion images by minimizing noise. ***Materials and Methods:*** This study was conducted on 407 individuals using a dual head gamma camera. Myocardial perfusion SPECT was performed with a projection time of 26 seconds to acquire images with standard noise levels. Immediately following the SPECT imaging, a 180-second planar scan was initiated (anterior and lateral views). This latter scan served as the high-quality, low-noise ground truth. The deep network structure proposed in this study, referred to as TB-GAN (Two-branches generative adversarial network), is composed of two encoder paths and one decoder section. One encoder network is responsible for computing the noise features, while the other extracts the signal features. The output features from these two encoders are combined and fed into a decoder to reconstruct a low-noise image. A discriminator network is employed as the adversarial objective function.The results obtained from this method were compared with those from the traditional noise-to-clean U-Net GAN framework. Quantitative evaluation was carried out using the peak signal-to-noise ratio (PSNR), structural similarity index (SSIM), and root mean square error (RMSE). ***Results:*** The quantitative assessment revealed a statistically significant enhancement in both PSNR and SSIM when utilizing the proposed framework. Specifically, PSNR increased from 34.74 to 41.95 and SSIM from 0.805 to 0.949 when comparing TB-GAN to the traditional GAN. Although the traditional GAN network produced outputs with a slightly lower RMSE than TB-GAN, the difference was not statistically significant (RMSE=0.116 for GAN vs. 0.159 for MV-GAN). Furthermore, both visual and count profile analyses demonstrated the superior performance of the proposed network. ***Conclusion:*** The newly proposed deep neural network structure named as TB-GAN, designed for enhancing image quality in SPECT myocardial perfusion images, has demonstrated superior noise reduction results compared to the traditional noise-to-clean U-Net GAN framework.

EP-0849

The impact of introducing deep learning based [18F] FDG PET denoising on EORTC and PERCIST therapeutic response assessments in digital PET/CT

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Aim/Introduction: [18F]FDG PET denoising using deep learning artificial intelligence (AI) was previously found to induce slight modifications in lesion and reference organs' quantification and in lesion detection. As a next step, we aimed to evaluate its clinical impact on solid tumour treatment response assessments in PET, while comparing "standard PET" to "AI denoised half-duration PET" ("AI PET") during follow-up. ***Materials and Methods:*** 110 patients referred for baseline and follow-up standard digital [18F]FDG PET/CT were prospectively included. "Standard" EORTC and, if applicable, PERCIST response classifications by 2 readers between baseline standard PET1 and follow-up standard PET2 as a "gold standard" were compared to "mixed" classifications between standard PET1 and AI PET2 (group 1; n=64), or between AI PET1 and standard PET2 (group 2; n=46). Separate classifications were established using either lean body mass standardized uptake values (SUL) from "ultra-high definition (UHD)" PET reconstruction (± AI-denoising), or EANM research limited version 2 (EARL2)-compliant Gaussian filtered SUL in standard PET and using the same filter in AI PET. ***Results:*** Overall, pooling both study groups, in 11/110 (10%) patients at least one EORTCUHD or EARL2 or PERCISTUHD or EARL2 mixed vs standard classification was discordant, with 369/397 (93%) concordant classifications, unweighted Cohen's kappa = 0.86 (95% CI: 0.78-0.94). These modified mixed vs standard classifications could have impacted patient management in 2% of patients. ***Conclusion:*** Although comparing similar PET images is preferable for therapy response assessment, the comparison between a standard [18F]FDG PET and an AI denoised half-duration PET is feasible and seems clinically satisfactory.

EP-0850

3D Automatic Segmentation of Colorectal Liver Metastases Detected in FDG PET Images Using Deep Learning

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Aim/Introduction: This study aims to utilize deep learning algorithms for the automatic three-dimensional segmentation of liver metastases in PET images of patients with colorectal cancer. ***Materials and Methods:*** Twelve patients diagnosed with at least one liver metastasis were included. Intestinal and renal activities were removed from three-dimensional PET images using 3D Slicer, isolating the liver for creating ground truth and test images. Two models were trained and tested using the Monai Label extension package and Python (version 3.11.5). The accuracy of these models in detecting lesions was evaluated. Additionally, their effectiveness in segmentation was assessed using Dice scores. ***Results:*** The first model was trained on a patient with three lesions (15 mm to 68 mm), and the second model was trained on the same patient plus another with nine lesions (5 mm to 29 mm). Testing involved ten patients with 79 lesions, 21 of which were under 10 mm. The first model accurately segmented 58.2% of lesions, and the second segmented 69.6%. Excluding smaller lesions, segmentation accuracies were 79.3% and 89.6%, respectively. Average Dice scores were 0.76 and 0.80. ***Conclusion:*** Deep learning algorithms appear to be effective for the automatic 3D segmentation of liver metastases in FDG PET images. The second model, trained with more lesions, demonstrated higher accuracy. This indicates that the quantity and diversity of lesions used in training significantly affect model performance. ***References:*** 1) Pieper, S., Halle, M., & Kikinis, R. (2004, April). 3D Slicer. In 2004 2nd IEEE international symposium on biomedical imaging: nano to macro (IEEE Cat No. 04EX821) (pp. 632-635). IEEE.2) Diaz-Pinto, A., Alle, S., Nath, V., Tang, Y., Ihsani, A., Asad, M., ... & Cardoso, M. J. (2022). Monai label: A framework for ai-assisted interactive labeling of 3d medical images. arXiv preprint arXiv:2203.12362.

EP-0851

Deep Learning FDG PET only CT-Free organ segmentation using nnU-NET.

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Aim/Introduction: Automated and reliable organ segmentation is useful in various applications in nuclear medicine. A number of studies used reregistered CT images to segment healthy organs using deep learning (DL). However, CT used for attenuation correction (CTAC) are usually low-dose or ultra-low dose, thus affecting the performance of models. Besides, the high prevalence of mismatch between CT and PET images is another limitation (1), impacting the relevance of the approach. Moreover, this approach is not applicable to CT-less attenuation and scatter corrected PET images (2). The aim of this study was to develop a DL-based segmentation pipeline using only PET emission images. ***Materials and Methods:*** A total of 1487 total-body and whole-body ^{18}FDG PET/CT images were collected. Overall, 22 organs were segmented from co-registered CTAC images using previously developed models (3). Pairs of PET and CT images and their segmentations were visually assessed and 947 cases presenting with mismatch between CT and PET images due to respiratory motion, or bulk motion were excluded. The remaining 540 images were visually evaluated and used to train a nnU-Net model (4) employing uncorrected PET images as input and segmentation masks as target in a five-fold data split scheme. The organs were divided into two subgroups, namely (i) bones plus brain and eyeballs (8 organs) and (ii) soft-tissue and lung (14 organs). Training was continued for 2000 epochs and the average five-fold Dice coefficient was reported. ***Results:*** The average Dice coefficients achieved were 0.90±0.03, 0.76±0.06, 0.80±0.06, 0.63±0.23, 0.86±0.09, 0.94±0.02, 0.92±0.12 , 0.60±0.13, 0.73±0.12, 0.90±0.07, 0.85±0.15, 0.80±0.10, 0.84±0.11, 0.93±0.02, 0.83±0.11, 0.90±0.06, 0.89±0.03, 0.71±0.09, 0.88±0.03, 0.86±0.03, 0.96±0.03, 0.77±0.07 for Aorta, Colon, Oesophagus, Gall Bladder, Kidneys, Liver, Lungs, Adrenal Glands, Pancreas, Rectus Abdominus Muscle, Spleen, Stomach, Urinary Bladder, Heart, Eyeballs, Femoral Heads, Iliac, Rib Cage, Sacrum, Vertebrae, brain, and clavicle, respectively (Table 1). Overall, a Dice coefficient of 0.82 on average over all organs was obtained. ***Conclusion:*** We developed a deep learning-based pipeline for automated segmentation of 22 organs from uncorrected PET images. This pipeline is capable of segmenting multiple organs with high accuracy in cases where the co-registered CT or MRI segmentation is either not available or not reliable owing to either mismatch or low performance achieved due to noisy CT images. ***References:*** 1.Shiri I, Salimi Y, et al. Clin Nucl Med. 2023;48(12):1035-46. 2.Yang J, Sohn JH, et al. Radiology: Artificial Intelligence. 2020;3(2):e200137. 3.Salimi Y, Shiri I,etal.medRxiv. 2023:2023.10.20.23297331. 4.Isensee F, Jaeger PF, et al.Nat Methods. 2021;18(2):203-11.

EP-0852

Feasibility study of low-dose PET/MR imaging based on deep learning

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Aim/Introduction: Reconstructing the low-dose PET (L-PET) images to the high-quality full-dose PET (F-PET) ones based on deep learning is an effective way that both reduces the radiation exposure and remains diagnostic accuracy. ***Materials and Methods:*** The imaging of L-PET was simulated by reconstruction with 10% of the original data. A total of 9000 slices of (^{18}F-FDG) PET date in 30 patients with malignancy. we propose a resource-efficient deep learning framework for L-PET reconstruction and analysis, referred to as transGAN-SDAM, to generate F-PET(100%) from corresponding L-PET(5%). The transGAN-SDAM consists of two modules: a transformer-encoded Generative Adversarial Network (transGAN) which generates higher quality F-PET images, and a Spatial Deformable Aggregation Module (SDAM) which integrates the spatial information of a sequence of generated F-PET slices to synthesize wholebody F-PET images. Another 20 PET date in patients with malignancy were used as validation objects. The average peak signal-to-noise ratio (PSNR), structural similarityindexmeasurement(SSIM), andvoxel-scalemetabolic difference (VSMD) were adopted to quantitatively evaluate the generated F-PET slices vs. original F-PET slices. We compared the proposed transGAN-SDAM with 6 state-of-the-art models that were specially designed for L-PET reconstruction or medical image synthesis: uNet, dNet , CycleGAN, fpGAN, BiGAN, and 3D Cycle-GAN. An experienced nuclear medicine doctor evaluates the image quality of the original image and the reconstructed F-PET image, and gives the diagnostic results. ***Results:*** The transGAN-SDAM framework significantly outperformed all of the com-peting models with the highest PSNR (30.1±3.8), SSIM (0.930±0.05), and the lowest VSMD (0.048±0.042), indicating that the quality of generated F-PET images by transGAN-SDAM is closest to the ground-truth F-PET images. TransGAN and transGAN-SDAM can produce richer and more accurate structural and metabolic details than other approaches. TransGAN-SDAM achieved the smallest voxel-scale difference to the ground-truth F-PET images. Quantitative analysis from the Bland- Altman and paired t-test show that wholebody F-PET image generated by transGAN-SDAM has smaller 95% limits of agreements (from -0.21 to 0.21), smaller 95% CI (from - 0.020 to 0.0120) and stronger correlation coefficient (0.815) than that from transGAN(Fig.3). These results showed that SDAM can optimize the whole-brain SUVR analysis and achieve more comparable results.There was no significant difference in image quality score and diagnostic results between the reconstructed F-PET image and the original image($P<0.05$). ***Conclusion:*** The transGAN-SDAM can be as a resourceefficient framework for L-PET(10%) reconstruction and accurate wholebody quantitative analysis. This framework is likely to become an effective method to reduce radiation dose in PET examination in the future.

EP-0853

Can Deep Learning Techniques Bridge the Disparity in Image Quality between Low and High-Performance PET Scanners

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Aim/Introduction: PET images from scanners with high sensitivity and resolution are usually of better quality than those from lower performing systems. In this work, we present a diffusion model-based pipeline to improve the quality of PET images from low performing (LP) PET scanners and compare the results to high performing (HP) systems. ***Materials and Methods:*** Our pipeline consists of a modified U-Net encoder in addition to a conventional image-conditioned denoising diffusion probabilistic model. An input image from a LP scanner is first encoded into a feature image in the modified U-Net model in order to account for misalignment/pixel-size/field-of-view differences between the LP and HP images. The feature image is then concatenated with a randomly noisy ground truth PET image (HP) before inputting the results into the diffusion model. To train this model, F^{18} FDG brain PET scans from 10 patients were acquired on a Siemens Quadra scanner (HP) and a GE DMI-5 Rings scanner (LP). Data was acquired (HP/LP) for 6/3 min and reconstructed using OSEM with $440 \times 440 \times 180$ and $1.62 \times 1.62 \times 2$ mm3/ $256 \times 256 \times 119$ and $2.73 \times 2.73 \times 2.8$ mm3 respectively. Datasets from HP and LP scanners were then registered using MIM software before input into the model. For each patient dataset, we selected an average of 55 2D axial slices. All models were fine-tuned using the ADAM optimizer on the PyTorch platform and executed on NVIDIA A100 GPUs. We compared the performance of our model with the ground truth (HP) using visual inspection and line profiles as well as calculating PSNR and SSIM. ***Results:*** Visual inspection of the resultant images show that our model produces similar image quality compared to the ground truth. Average PSNR/SSIM results over 10 non-continuous slices for LP with respect to HP were 28.25dB/0.966 while those from our model were 29.62dB/0.971 respectively. ***Conclusion:*** Our model has the capacity to improve the quality of LP scanners thereby bridging the disparity with respect to HP scanners. Future work is to extend the current 2D model to a 3D version and validate the results on a full size patient datasets.

EP-0854

A pilot study of structuring radiology reports of FDG-PET/CT using LLM followed by SUVmax-based voxel identification algorithm

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Aim/Introduction: We previously demonstrated that using SUVmax values described in FDG-PET/CT reports enabled the identification of voxel locations on images by matching of SUVmax values [1]. Locating lesions enables the chronological comparison of their progression and efficient creation of datasets for supervised learning. Compared to traditional natural language processing (NLP) methods, recently developed large language models (LLMs) are expected to extract information more efficiently from report texts. This pilot study is designed to explore the potential of using LLM to extract "site and SUVmax" data from reports and to assess the feasibility of determining lesion coordinates by identifying voxel locations on images. ***Materials and Methods:*** In this IRB-approved study (#23-0128), we reviewed patients who underwent FDG-PET/CT examinations at our institute from 2009 to 2023. A total of 100 patients were randomly selected for the analysis. All reports were written in Japanese. The LLM used was Llama2-based "ELYZA-japanese-Llama-2-13b". The reports were input into the LLM with a prompt that ask to return a JSON-format text like {site: "pancreas", SUVmax:

"3.141"}. The ground truth was determined by consensus of two nuclear medicine physicians. The LLM's accuracy was evaluated using the Dice similarity coefficient (DSC). The voxel having the exact value of SUVmax was scanned in the image. ***Results:*** From the reports of 100 cases, an average of 2.64 (range 0-10) pairs of site-SUVmax per report were annotated by physicians. The DSC was 0.631 ± 0.365 (mean ± SD) with 34 (34%) cases of perfect match (DSC=1). In some instances, so-called hallucinations were observed, i.e., the creation of SUVmax values not described in the original report text. Of 264 SUVmax values in the ground truth, 173 (66%) were correctly extracted by the LLM. Among the 173, by referring the corresponding image, the coordinates of voxel that had the SUVmax were uniquely determined in 87 (50%). When restricted to cases of SUVmax with three decimal places (e.g., 3.141) or SUVmax greater than 5, the unique identification was achieved in 49 out of 66 cases (74%). ***Conclusion:*** Combining LLM-based report structuring with voxel identification algorithm using SUVmax as a lesion identifier enabled the construction of a multi-modal system of lesion localization, although accuracy is expected to be further improved by refining the LLM prompts. ***References:*** 1. Hirata K, et al. A Preliminary Study to Use SUVmax of FDG PET-CT as an Identifier of Lesion for Artificial Intelligence. Front Med (Lausanne). 2021 Apr 28;8:647562.

EP-0855

Automated Deep Learning-based Segmentation of Cardiac PET Images: Addressing Challenges in PET/CT Mismatch and Low Dose CTAC Scans

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Aim/Introduction: Quantitative cardiovascular PET/CT imaging is useful in the diagnosis of multiple cardiac pathologies. Methodologies were developed for deep learning-assisted segmentation of cardiac substructures on CT images (1, 2). However, in most of the cases, there is a mismatch between PET and CT images and the performance of these models is not consistent over low-dose CTAC images commonly used in clinical practice, thus leveraging the need for robust PET image segmentation methodology to address these challenges effectively. ***Materials and Methods:*** This study included 406 cardiac PET images from 147 patients (43 ^{18}F-FDG, 329 13N-NH3, and 37 82Rb images). Previously trained models were used to segment heart cavities, including the left myocardium (LM), left ventricle (LV), and right ventricle (RV) from CT images. The segmentations were resampled to PET resolution, after visual assessment of the first 50 images, only 8 cases presented with good registration accuracy between the CT LV myocardium and corresponding PET uptake, and as such correction of the segmentation output was necessary. The segmentation masks were corrected using a combination of thresholding on PET images (empirical threshold of 1.3 SUV) and dilation of the CT segmentation mask with multiple conditions for image processing. All images were visually checked and edited if necessary. The refined PET and segmentation pairs were fed to a nnU-Net model (3) in a five-fold data split strategy making sure that multiple images from the same study (stress and rest) are all in the train or test split. Dice coefficients were calculated to evaluate the segmentation performance. ***Results:*** The average Dice coefficient was 0.86 ± 0.01, 0.79 ± 0.13, and 0.86 ± 0.08 for LV myocardium, LV cavity, and RV, respectively (Table 1). The Dice coefficient was consistent over all folds and there was no statistically significant difference between the Dice values for the three radiotracers. ***Conclusion:*** We developed an automated deep learning-based segmentation pipeline to segment cardiac PET images from various radiotracers with acceptable accuracy in terms of achieved Dice coefficient. Initial visual assessment on some cases indicated reduced potential for CT cardiac segmentation in the context of cardiac PET quantification. This methodology is particularly suited for CT-less PET imaging or hybrid PET/CT imaging where there is significant misregistration between CT and PET images. ***References:*** 1.Wasserthal J, et al. TotalSegmentator: Robust Segmentation ... . Radiol AI. 20232.Salimi Y,etal. Deep learning-assisted multiple organ segmentation.medRxiv. 20233.Isensee F, et al. nnU-Net: a self-configuring method.... Nat Methods. 2021.

EP-0856

Evaluating 2D and 3D nnU-Net auto-segmentation performance on metastases in differentiated thyroid carcinoma patients from FDG-PET/CT images.

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Aim/Introduction: Differentiated thyroid carcinoma (DTC) is one of the most common malignant tumors of the endocrine system. Whole-body FDG-PET/CT is an important tool for diagnosing DTC, and accurate segmentation of tumor is a key part for the subsequent treatments. However, manual segmentation of tumors on FDG-PET/CT is a task that is time-intensive and subject to variation between different observers. Although deep learning (DL)-based methods for automated segmentation are currently widely investigated, specialized DL methods are needed to build for each research. For general application, we used nnU-Net, which refers to a robust and self-adapting framework based on 2D and 3D vanilla U-Nets, to automated segmentation of metastatic lesions in DTC patients from FDG PET/CT images. In addition, compare the segmentation performance of the 2D and 3D nnU-Net models. ***Materials and Methods:*** We retrospectively analyzed 169 patients (Age ranging 8-86 years, male:female = 66:103) who had DTC and showed FDG-avidity before undergoing I-131 treatment at Hokkaido University Hospital from 2009 to 2022. Ground truth masks were manually obtained from a researcher who used Metavol software to segment FDG-avid metastatic lesions (SUV>3) on FDG-PET/CT, and the segmented lesions were modified and confirmed by an experienced nuclear medicine physician. The dataset was used for training using a 5-fold cross validation scheme. All PET images in DICOM image files transformed and saved as NIfTI image files. We trained the 2D and 3D nnU-Net models via Python. All available ground truth masks were cropped, resampled, and normalized into multiple types of voxel size (2-4 x 4 x 4 mm3). The pre-processing of nnU-Net included cropping, resampling, and normalization. The training parameters were as follow: optimizer stochastic gradient descent with momentum (Momentum SGD), maximum training epochs 200, mini-batch size 250. The segmentation performance was assessed by the Dice similarity coefficient (DSC). ***Results:*** The mean DSC (± standard deviation) of the 2D nnU-Net model in the validations dataset was 0.68±0.28, while that of the 3D nnU-Net model was 0.64±0.32. For the sub-analysis, the 2D and

3D nnU-Net models each accounted for 53% and 47% of DSC >0.75, respectively, which did not reach statistical significance (P=0.33). ***Conclusion:*** The nnU-Net is a promising tool for auto-segmenting the metastatic lesions of DTC patients on FDG PET/CT images. Additionally, the 2D nnU-Net model achieved a relatively higher DSC compared to the 3D nnU-Net model, although more data are necessary to improve the accuracy of nnU-Net model.

EP-0857

Development of Quality Assurance System for Amyloid PET using Artificial Intelligence for Anomaly Detection

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Aim/Introduction: Lecanemab, a new medicine for Alzheimer's disease, developed and is beginning to be used around the world [1]. Amyloid PET imaging is required for selecting patients for this new medicine. Therefore, quality assurance is necessary for each hospital to perform precision amyloid PET imaging. The Japanese Society of Nuclear Medicine is in charge of Quality Assurance of amyloid PET at hospitals all over Japan. Physical and visual evaluation for checking for the presence of Gibbs artifacts and other abnormalities of a large amount of phantom imaging data sent from all over Japan. Visual evaluation is effort-intensive because it is necessary to observe all slices of phantom data to check for the presence of artifacts. In addition, a small number of people are currently qualified to analyze submission data from hospitals all over Japan, and each investigator is in charge of a large number of hospitals. This trend may occur outside of Japan as well. Therefore, visual evaluation was automated by developing and applying a deep-learning model for anomaly detection. ***Materials and Methods:*** We employed 434 normal and 129 abnormal images. Anomaly detection was achieved using Autoencoder, a model that extracts features, and reconstructs the original input data based on the extracted data. By training Autoencoder with only phantom imaging data with no artifacts, it can reproduce the input image as an artifact-free image regardless of the presence or absence of artifacts in the input image. In other words, the output images are subtracted from the input images, and the sum of the values can be defined as the abnormal. Based on this abnormal score, a threshold value was set and the true positive rate and false positive rate associated with the threshold change were calculated. ***Results:*** As a result of receiver operating characteristic analysis, an area under curve value of 0.902 was achieved. It was possible to determine abnormalities including Gibbs artifacts with 90.1% accuracy. The normal and abnormal score were obtained, and it was found that a difference existed between the scores. ***Conclusion:*** We developed a system to automate quality assurance before amyloid PET is performed. This study may provide a milestone in the implementation of quality assurance for the introduction of quality assurance for amyloid PET in the world in the future. ***References:*** [1]Pemberton HG, et al. Quantification of amyloid PET for future clinical use: a state-of-the-art review. Eur J Nucl Med Mol Imaging. 2022, 49(10):3508-3528.

EP-0858

Prediction of 123I-FP-CIT SPECT results from the first acquired projection using a convolutional neural network

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Aim/Introduction: Dopaminergic imaging with 123I-FP-CIT is commonly used for the diagnosis of parkinsonian syndromes in clinically challenging cases. At least 30 minutes of immobility are required for SPECT acquisition, which can be difficult to achieve in this particular patient population. This study aimed to develop a convolutional neural network (CNN) model able to predict the examination result with a high sensibility from the first acquired projection alone, i.e. detect normal patients with high reliability. ***Materials and Methods:*** All 123I-FP-CIT SPECT performed in our center were retrospectively included from June 2017 to February 2024 and divided into a training (70%) and a validation (30%) set. A total of 100 additional SPECT were used as an independent testing set. All images were labelled by two independent physicians. A VGG16-like CNN model was trained on the first acquired projection (anterior and posterior view at 0°). A threshold to maximize sensitivity while maintaining good accuracy was then determined. The model was validated in the independent testing set. Saliency maps were generated to visualize the most impactful areas in the classification. ***Results:*** A total of 982 123I-FP-CIT SPECT were retrieved and labelled (training set: 618 ; validation set: 264; independent testing set: 100). The trained model achieved a sensibility of 98.0 %, with 1 false negative prediction, resulting in a negative predictive value of 96.3% while maintaining an accuracy of 78.0 %. The saliency maps confirmed that the areas with the greatest impact on the final classification corresponded to the basal ganglia and the background noise. ***Conclusion:*** Our results suggest that this trained CNN could be used to exclude presynaptic dopaminergic loss with high reliability, using only the first acquired 123I-FP-CIT SPECT projection. It could be particularly useful when dealing with compliance issues. Confirmation with images from other centers will be necessary.

EP-0859

Fully automatic lesions segmentation on whole-body [18F]FDG PET/CT using maximum intensity projections images and deep-learning: a novel approach

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Aim/Introduction: Maximum intensity projections (MIP) images of whole-body [18F]FDG PET investigations are commonly used for first-instance visual interpretation, enabling fast hotspot detection. Our aim is to evaluate the feasibility of using 2D MIP images with deep-learning to obtain automatically segmented whole-body/total-body [18F]FDG PET images. ***Materials and Methods:*** A dataset of 489 staging whole-body/total-body [18F]FDG PET/CT scans with corresponding manually segmented lesions from patients with melanoma (n=177), lung cancer (n=168), and lymphoma (n=144), published by autoPET MICCAI challenge [1,2], were included. Approximately 80% of the patients of each primary cancer were randomly chosen to train (N=391), and the remaining to test. A 2D U-Net was trained based on MIP images of different view angles (coronal, sagittal, and obliques). Twenty (20) out of 391 patients from the training set were left aside from network training and later used to optimize a post-processing methodology to convert

2D into 3D segmentation. For benchmarking, the same training dataset was used to train a 3D U-Net. To train both networks, the state-of-the-art nnU-Net framework was used [3]. To evaluate the segmentation in the test set, voxelwise Dice coefficient (DC), sensitivity, and predictive positive value (PPV); and lesion detection sensitivity score (LDSS) and lesion detection error score (LDES) were computed against the ground truth (manual segmentation). LDSS represents the proportion of the lesions on the ground truth that were segmented/detected by the network. LDES represents the proportion of regions segmented by the network that were not in the ground truth. ***Results:*** MIP-based segmentation achieved a voxelwise median DC, sensitivity, and PPV of 0.70 (interquartile range [IQR]:0.59-0.82), 0.65 (IQR]:0.50-0.87), and 0.88 (IQR:0.71-0.95), respectively. The median LDSS and LDES were 0.73 (IQR:0.55-1) and 0.04 (IQR:0-0.34), respectively. The benchmark 3D segmentation achieved a median DC, sensitivity, PPV, LDSS, and LDES of 0.80 (IQR:0.70-0.88), 0.78 (IQR:0.63-0.89), 0.88 (IQR:0.77-0.95), 0.80 (IQR:0.60-1), and 0.11 (IQR:0-0.33), respectively. The metrics' differences between MIP and 3D-based segmentations were statistically significant for the DC and sensitivity ($p<0.05$). ***Conclusion:*** This novel experimental approach using 2D MIP images achieved excellent results in the segmentation of whole-body/total-body [18F]FDG PET/CT images, with potential for further improvement. At the moment, the current implementation had slightly inferior results compared to the state-of-the-art 3D U-Net. This MIP-based approach may be useful when no special GPU capabilities are available, since 2D networks run faster on the CPU than 3D. ***References:*** Clark et al., https://doi.org/10.1007/s10278-013-9622-7; Gatidis et al., https://doi.org/10.1038/s41597-022-01718-3;Isensee et al., https://doi.org/10.1038/s41592-020-01008-z.

EP-0860

ML-models built using clinical parameters and radiomic features extracted from ^{18}F-choline PET/CT for the prediction of biochemical recurrence after metastasis-directed therapy in patients with oligometastatic prostate cancer

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Aim/Introduction: [18F]F-Fluorocholine (18F-choline) PET/CT is mainly used in biochemical recurrence (BCR) of PCa. Oligometastatic patients at 18F-choline PET/CT may be treated with metastasis-directed therapy (MDT). Aim of this retrospective study was to combine conventional and radiomic parameters extracted from 18F-choline PET/CT and clinical data to build machine learning (ML) models able to predict MDT efficacy. ***Materials and Methods:*** oligorecurrent patients (up to 5 lesions) at 18F-choline PET/CT and treated with MDT were retrospectively retrieved. A per-patient and per-lesion analysis was performed, using BCR after MDT as standard of reference. Clinical parameters (i.e. PSA value and ISUP grade) and conventional PET parameters (i.e. SUVmax and SUVmean and volumetric parameters) were collected. The sites of recurrence were manually segmented on 18F-choline PET/CT images and 854 radiomic features (RFts), including original, first order, texture and wavelet based were extracted using an open-source software on both PET and CT datasets, according to IBSI. The most robust and non-redundant RFts correlated with the outcome of MDT were selected using Wilcoxon-Mann-Whitney U test ($p<0.05$). Five different ML models were trained and tested for both CT and PET RFts using Orange data-mining. Ten-fold cross validation was performed on the training dataset (70% of the whole dataset) and the performance metrics were calculated (i.e. area under the curve - AUC; classification accuracy - CA). Validation was performed on the remaining 30% dataset to evaluate the model's performance to predict MDT efficacy. ***Results:*** Overall, 46 pathological uptakes at 18F-choline PET/CT were selected and segmented in 29 patients. After a median follow-up of 3.5 (1-6.5) years, BCR after MDT occurred in 19 (65.5%) patients corresponding to a total of 35 (76%) lesions. Clinical and conventional PET parameters failed to accurately predict the outcomes of MDT. Seventy-three and 33 robust RFTs, were selected from CT and PET dataset, respectively. PET models showed better performance than CT model to discriminate BR after MDT. Random forest (RF) was the most accurate CT-based ML model (AUC=0.92; CA=0.85). The best PET model was stochastic gradient descendent (SGD) (AUC=0.95; CA=0.90). ***Conclusion:*** ML-models built using clinical parameters and CT and PET RFts extracted by 18F-choline PET/CT can accurately predict BR after MDT in oligorecurrent PCa patients. The best performances were obtained using SGD model trained with PET RFts. If validated externally, our results could contribute to improve the selection of oligorecurrent PCa patients to be referred to MDT or to systemic therapies.

EP-0861

Artificial Intelligence to evaluate metabolic tumor burden in primary staging of rectal cancer with ^{18}F-FDG PET/CT

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Aim/Introduction: To evaluate the performance of Artificial Intelligence (AI) software to determine metabolic tumor burden in the primary staging of rectal cancer. ***Materials and Methods:*** A cross-sectional retrospective analysis was conducted on 51 histology-proven rectal cancer patients (35% females; mean age = 61 years) who underwent a staging ^{18}F-FDG PET/CT. Whole-body metabolic tumor burden parameters (wbMTV and wbTLG) were quantified semi-automatically and through AI algorithm. The AI software's ability to correctly identify and classify the primary lesion, regional lymph nodes, and distant metastases was evaluated. In addition, the intraclass correlation coefficient (ICC) was applied to evaluate concordance between the AI-based software and the semiautomatic software in determining wbMTV and wbTLG. Values above 0.7 were considered to indicate substantial agreement. ***Results:*** The AI and semiautomatic tumor burden metrics correlated strongly for both wbMTV (ICC=1.00; 95% CI=0.94 - 0.99; P <0.0000) and wbTLG (ICC=1.00; 95% CI=0.80 - 0.90; P<0.0000). Additionally, the AI software's ability to correctly identify lesions compared to the documented staging was better for the identification of distant metastasis (78,57% of patients), mildly adequate to identify regional lymph nodes (50,00%) and had poor performance for identification of the primary lesion (5,76%). On the other hand, the time spent calculating these metrics was less by AI than by the semiautomatic method,

especially in patients with advanced disease. ***Conclusion:*** The determination of whole-body metabolic tumor burden on ^{18}F-FDG PET/CT with AI software is challenging because of the physiologic bowel activity. However, deep learning may have the ability to overcome these challenges and may, therefore, improve the primary staging of rectal cancer. ***References:*** 1.Fonseca J, Etchebehere E. et al. Assessment of Metabolic Tumor Burden in Primary Staging of Rectal Cancers Using Fdg PET/CT. https://doi.org/10.21203/rs.3.rs-3229037/v1 2.Bi WL et al. Artificial intelligence in cancer imaging: Clinical challenges and applications. CA Cancer J Clin 2019; 69: 127-157. doi: 10.3322/caac.21552. 3.Visvikis D et al. Application of artificial intelligence in nuclear medicine and molecular imaging: a review of current status and future perspectives for clinical translation. Eur J Nucl Med Mol Imaging 2022; 49: 4452-4463. doi: 10.1007/s00259-022-05891-w. This study was supported by Fundação de Apoio ao Ensino e à Pesquisa do Estado de São Paulo - Cancer Theranostics Innovation Center - CEPID, Proc. 2021/10265-8).

EP-0862

Automatic Lesion Detection On Whole Body ^{18}F-FDG PET-CT Using A Cluster-Corrected Statistical Method

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Aim/Introduction: Automated lesion segmentation in [18F] FDG-PET/CT images poses a significant challenge, currently tackled by various AI-based strategies. The aim of this study is to accurately delineate lesions within individual organs through a statistical analysis of the Standard Uptake Value (SUV) signal corrected by a clustering algorithm to reduce the incidence of false positives. This abstract describes the first application of this technique, with a specific focus on liver tissue. ***Materials and Methods:*** The dataset used in this study originates from the AutoPET Challenge 2022 [1], comprising 1014 [18]-FDG PET-CT acquisitions, each annotated with lesions. Half of the dataset represents negative controls, while the other half includes cases of lymphoma, melanoma, and lung tumors. The first step involved employing the TotalSegmentator tool [2] to segment organs from CT images. Subsequently, an organ-wise analysis of SUV distribution was conducted on healthy subjects to verify the physiological tracer uptake in each organ and extract the mean and standard deviation of the distribution. The investigation initially focused on the liver. 74 subjects with liver lesions were selected from the dataset. PET images underwent preprocessing involving a smoothing filter. A distribution probability map was then generated for each patient, where individual pixels denote the likelihood that the corresponding pixel in the PET image belongs to the normal SUV distribution. Pixels with low probability values may indicate potential lesions. A clustering algorithm was applied to exclude isolated pixels and identify "uniform" regions, thereby reducing false positive findings. The performance of the detection method was evaluated using metrics derived from the free receiver operating characteristic (FROC) curve to determine the optimal combination of free parameters (smoothing factor and clustering threshold) considering the mean results on all the 74 patients. ***Results:*** The FROC curve attested that the best combination of free parameters across all patients was smoothing factor equal to 1 and clustering threshold 0.98 (Sensitivity of 0.8, False Positive Per Image=4.5). ***Conclusion:*** Preliminary assessment of the performance of our method in a lesion detection task in the liver appears very encouraging. However, further analysis is required, which should include applying the technique across diverse organs and corroborating its effectiveness using a separate, external dataset. ***References:*** [1] Gatidis S, Kuestner T. A whole-body FDG-PET/CT dataset with manually annotated tumor lesions (FDG-PET-CT-Lesions) . The Cancer Imaging Archive, 2022.[2] Wasserthal, J., Breit H-C. et al., 2023. TotalSegmentator: Robust Segmentation of 104 Anatomic Structures in CT Images. Radiology: Artificial Intelligence.

EP-0863

Evaluation of combined or separate automatic segmentation models for ^{68}Ga-PSMA PET/CT and ^{177}Lu-PSMA SPECT/CT.

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Aim/Introduction: Manual segmentation of metastatic prostate lesions on radiolabeled PSMA PET and SPECT images can be time-consuming and tedious. The goal of this work is to determine whether, for automatic segmentation, a nnU-net model trained on these two modalities jointly is at least as effective than two models trained on these modalities separately. ***Materials and Methods:*** The database consisted of 29 patients. For each patient, baseline 98Ga-PSMA PET/CT images and after first cure 177Lu-PSMA SPECT/CT were available. All images were segmented by a nuclear medicine physician as reference. We divided our database into two parts. The first part consists of 23 patients used for training, while the other 6 were used to evaluate the model. We trained 3 nnUNet models. The first model (MPET) with only PET/CT images, the second model (MSPECT) with SPECT/CT images, and the last model (MPET_SPECT) with both PET/CT and SPECT/CT images. For each model, we used the same patients for both training and validation. Automatic and manually segmented volumes were evaluated and compared by using Dice coefficient. ***Results:*** Average manually segmented volume of the lesions per patient was 610cm3 (+/-684cm3) [min 13cm3-max 2568cm3] for PET/CT and 1147cm3 (+/-1139cm3) [3cm3-4140cm3] for SPECT/CT. Automatic segmented volumes of the lesions per patient were 578cm3 (+/- 804cm3) [27cm3-2325cm3] , 663cm3 (+/-942cm3) [8cm3-2687cm3] , 579cm3 (+/- 803cm3) [25cm3-2323cm3] for PET/CT and 2010cm3 (+/-1530cm3) [598cm3-5090cm3] , 1442cm3 (+/-1711cm3) [157cm3, 4951cm3] , 1459cm3 (+/-1678cm3) [178cm3, 4914cm3] for SPECT/CT for MPET, MSPECT and MPET_SPECT, respectively. Mean absolute pourcentage difference between automatic and manually segmented volumes of the lesions per patient were 8.9% (+/-9.2%) [1.1%-27.9%] , 31.5% (+/-20.8%) [5.3%-61.5%] , 8.1% (+/-5.5%) [1.2%-18.8%] for PET/CT and 152.2% (+/-168.1%) [26.8%-495.9%] , 20.1% (+/-15.3%) [1.2%-48.6%] , 16.1% (+/-11.2%) [1.0%-34.6%] for SPECT/CT for MPET, MSPECT and MPET_SPECT, respectively. Concerning Dice coefficients, they were 0.93 (+/-0.03) [0.87-0.96] , 0.75 (+/-0.15) [0.53-0.92] , 0.93 (+/-0.03) [0.87-0.69] for PET/CT and 0.63 (+/-0.21) [0.24-0.87] , 0.84 (+/-0.08) [0.67-0.91] , 0.86 (+/-0.05) [0.76-0.90] for SPECT/CT for MPET, MSPECT and MPET_SPECT, respectively. ***Conclusion:*** The volume of lesions segmented on PET and SPECT images are different, probably linked to the partial volume effect on SPECT, limiting segmentation accuracy. Despite these differences, an nnU-net model trained on both PET and SPECT modalities achieves results comparable to those trained on both modalities separately.

EP-0864

Predictive Power of Radiomics Analysis of Pretreatment Ga-68 PSMA PET/CT in Patients with Metastatic Castration-Resistant Prostate Cancer Treated With Lu-177 PSMA for Treatment Response and Prognosis

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Aim/Introduction: To determine the predictive power of machine learning (ML) methods using radiomics features and clinicopathological parameters obtained from Ga-68 PSMA PET/CT imaging performed before Lu-177 PSMA radioligand theraphy (RLT) in patients metastatic castration resistant prostate cancer (MCRPC) and to investigate factors associated with overall survival (OS). ***Materials and Methods:*** The study included 63 patients with MCRPC who received at least two sessions of Lu-177 PSMA treatment and underwent Ga-68 PSMA PET/CT examination before treatment. Volumetric regions of interest were determined from three different metastatic bone lesions (189 lesions in total) and 129 radiomics features were obtained from each region of interest. The predictive power of three different ML methods, including mean radiomics features and clinicopathological data, was evaluated with reference to the change in prostate-specific antigen (PSA) levels before and after treatment. Kaplan-Meier analysis and log-rank test were used to determine whether there was a statistically significant difference in OS between the RLT-responsive and non-responsive groups. Cox regression analyses were used to determine the factors associated with OS. ***Results:*** The mean age of the patients was 67.27±7.47 years (47-85). Of the 63 patients with MCRPC, 32 were in the treatment-responsive group (%50.8) and 31 (%49.2) were in the non-responsive group. ML models included 9 radiomics features and 6 clinicopathological variables in the prediction of treatment response. In treatment response prediction, the highest correct classification rates of %86.7 were obtained with the naive bayes (NB) model when recursive feature elimination was used as feature selection and with random forest and NB models when select by filter was used. For the whole patient group, the median OS was 17±1.59 (%95 CI: 13.86-20.13) months by Kaplan-Meier analysis, while the median OS was 21±3.27 (95% CI: 14.58-27.41) months in the RLT-responsive group and 14±3.07 (%95 CI: 7.97-20.02) months in the non-responsive group. Cox regression analyses revealed that haemoglobin level measured before treatment was inversely associated with mortality. ***Conclusion:*** ML methods based on radiomix analysis features and clinicopathological data obtained from Ga-68 PSMA PET/CT imaging performed before Lu-177 PSMA treatment in patients with MCRPC have been shown to predict treatment response. This study shows that evaluating patients with prostate cancer who are planned to undergo RLT with ML models predicting treatment response before treatment and enrolling them in the treatment programme can be more cost-effective, as well as contributing to not involving patients in a tiring and time-consuming treatment process.

EP-0865

Is it feasible for a nuclear medicine physician to develop artificial intelligence model permitting to distinguish the whole-body scintigraphy images obtained with two different radiopharmaceuticals?

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Aim/Introduction: To analyze the feasibility of development of artificial intelligence (AI) model by nuclear medicine physician (NMP) without relying on third-party/developer, using a simple, free-web-based application by creating a prototype AI model permitting to distinguish the normal and abnormal whole-body scintigraphy images obtained with two different radiopharmaceuticals ***Materials and Methods:*** Two free-available, well documented frameworks (TensorFlow and Keras), with clear written tutorials were chosen. A series of 287 and 256 whole-body anterior/posterior (AP/PA) scintigraphies with 99mTc-MDP (bone-scintigraphy, BoS) and 99mTc-besilesomab (besilesomab-scintigraphy, BeS) were chosen for their "visual similarity". Images were cropped, all metadata removed. Two classification goals were set: 1. BoS/BeS binary classification, 2. BoS(132/442) and BeS(323/189) negative/positive multiclass classification, with pretrained Xception network. The negative/positive finding was defined by three experienced NMPs. Train to validation split was 70%/30% for both goals. Learning was performed on Google Colab (TPU), with data augmentation to enhance the datasets. TensorBoard was visually analyzed, the epoch with the best validation/training loss to validation/training accuracy was chosen. The simple prototype application was built with PHP, Python and React languages, taking photo with mobile phone and subsequent image analysis. ***Results:*** Models were evaluated against 20(10/10AP/PA) scintigrams not used for the training in BoS/BeS(Goal1) and in Bos/BeS positive/negative(Goal2) group, respectively. For Goal1: The model accuracy (after 52 epochs) was 98,75%. 10/10 AP/PA BoS and 12/12 AP/PA BeS (both visually checked by NMP) with average accuracy 99,50% for BoS and 94,68% for BeS. For Goal2: The model accuracy (after 84 epochs) was 63%, all BoS and BeS were correctly classified, the model correctly identified 95% and 35% positive and negative BoS, and 30% and 90% positive and negative BeS. The estimated time spent on the project was overall 100hours (with 1.76h-average time-per-day). ***Conclusion:*** The results permit to conclude that it is feasible for a NMP to learn and understand the basic principles of deep learning, to create a dataset, to train simple, pretrained neural network model and to use it in a reasonable time, that can be even shorter with appropriate education in the field (e.g. provided as a dedicated course). The limitation of the study is the small size of dataset for the multi-class classification, especially for BeS, no DICOM analysis, no feature extraction, which can explain the false-negative classification rate in BeS-positive group. The complex multiclass classifications, 3D-studies/segmentations will require a bigger dataset, feature extraction and well-educated and trained multidisciplinary team including NMPs.

EP-0866

Predictive Value of Radiomics Analysis of Flor-18 Flurodeoxyglucose Positron Emission Tomography/Computed Tomography In Response to Neoadjuvant Chemotherapy In Breast Cancer Patients

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Aim/Introduction: To determine the role of machine learning methods using radiomics features and clinicopathologic parameters obtained from PET/CT images in predicting pathologic complete response (PCR) in breast cancer (BC) patients undergoing initial staging with F^{18} FDG PET/CT. ***Materials and Methods:*** A total of 132 BC patients who underwent pre-treatment F^{18} FDG PET/CT imaging and neoadjuvant chemotherapy (NAC) between

January 2017 and December 2021 were included in the study. In the LIFEx v7.4.0 application used for radiomics analysis, the primary malignant lesion in the breast was identified on the images of each patient and volume of interest were created by semi-automatic segmentation method. A total of 129 radiomics features were obtained from each segmented region of interest through the software program and feature selection was performed. The selected features were statistically evaluated together with the patient's clinicopathologic data to create combined models. The dataset was randomly divided into training and test groups in a 7:3 ratio. The predictive power of three different machine learning methods, namely "Naive bayes" (NB), "support vector machines" (SVM) and "random forest" (RF), was evaluated for PCR after NAC. Kaplan-Meier analysis and log-rank test were used to determine whether there was a statistically significant difference between the groups in terms of overall survival. Cox regression analyzes were used to evaluate the effects of variables on overall survival. ***Results:*** PCR was observed in 32 of 132 patients with BC. 18 radiomics features and 5 clinicopathological variables were involved in machine learning models in PCR prediction. Among clinicopathological variables, immunohistochemical subtype and Ki-67 value were common features selected by all three machine learning algorithms. When "recursive feature elimination" and "select by filter" were used as radiomics feature selection methods, the highest correct classification rate of 87.2% was achieved with the RF model. When the molecular subtypes were divided into luminal group and nonluminal group, it was found that the risk of mortality was 3.77 times higher in the nonluminal group. The PCR rate of the nonluminal subgroup was significantly higher than the luminal group. ***Conclusion:*** When radiomics features obtained from F^{18} FDG PET/CT imaging performed before NAC in BC patients were combined with clinicopathological data, machine learning methods were able to predict PCR with high accuracy. Thus, by detecting insufficiently effective NAC early, toxicity can be avoided, cost burden can be prevented and other treatment options can be taken into consideration.

EP-0867

High-Accuracy Prostate Cancer Staging Prediction Using K nearest Neighbour (KNN) Classifier: A Machine Learning Approach

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Aim/Introduction: This study was conducted to see whether a KNN classifier-based machine learning model can prognosticate patients of prostate cancer, when given input about primary and metastasis detected on Ga-68 PSMA PET/CT scan, Tc-99m MDP bone scan and multiparametric MRI (mpMRI) scan. ***Materials and Methods:*** The retrospective data of histopathologically confirmed prostate cancer patients who underwent Ga-68 PSMA PET scan between October 2022 and January 2024 were analysed. The presence of primary and metastasis detected through PET/CT scan, Tc-99m MDP bone scan and mpMRI scan were recorded. Following European Association of Nuclear Medicine (1), based on Gleason score (histopathology report) and PSA levels, Patients dataset was categorized into intermediate (N=30) and high-risk groups (N= 65). This imbalance dataset was balanced using oversampling method resulting in 65 patients in each group. Then the following procedure: "random partition of dataset into training and test dataset in the ratio of 80:20, 10-fold cross validation techniques during training, KNN (K nearest neighbour) algorithm as classifier, creating a confusion metrics by taking High risk group as POSITIVE for testing the performance of the trained model on test dataset" was repeated fifty times, creating fifty different machine learning model. The model with the best performance was selected. All experiments were performed on a personal computer (Intel(R) Core (TM) i3-10105 CPU @ 3.70GHz, and 8.00 GB RAM) in R statistical program using the "ROSE" and "CARET" package. ***Results:*** There were ninety-nine patients (30 patients in intermediate risk and 65 patients in high-risk) having age: 67.6 ± 8.07 years. The machine learning model was capable of prognosticating patients of prostate cancer based on their imaging results of PET/CT scan, Tc-99m MDP bone scan and mpMRI scan with high accuracy (80%), sensitivity (77%) and specificity (100%). The execution time for training KNN classifier-based machine learning model was 0.170986 ± 0.021754 seconds. On training dataset, the best performing model was found to have 76% accuracy, 65% sensitivity and 96% specificity. ***Conclusion:*** A KNN classifier-based machine learning model when supplied inputs about primary and metastasis detected on Ga-68 PSMA PET/CT scan, Tc-99m MDP bone scan and mpMRI scan, can prognosticate patients of prostate cancer with high accuracy, sensitivity and specificity. ***References:*** 1. Cornford P et al. EAU-EANM-ESTRO-ESUR-ISUP-SIOG Guidelines on Prostate Cancer-2024 Update. Part I: Screening, Diagnosis, and Local Treatment with Curative Intent. Eur Urol. 2024 Apr 12:S0302-2838(24)02254-1.

EP-0868

Artificial Intelligence Based CT-free Attenuation Correction in Adolescent and Young Adult Mandibular Condylar Hyperplasia Patients

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Aim/Introduction: Mandibular condylar hyperplasia is a condition in which one of the mandibular condyles is growing faster than the one on the other side resulting in facial asymmetry. It might be accompanied by chewing dysfunction or dental malocclusion. The cornerstone of diagnosis is 99mTc-MDP bone scan and SPECT/CT. Quantitative analysis of the uptake values can further improve diagnostic accuracy, however, standardized uptake values (SUV) can only be generated with CT-based attenuation correction (AC) which gives unnecessary radiation exposure to patients. AI-based AC could help us eliminate unnecessary radiation while providing sufficient data for quantification. Our aim was to compare the SUV values of patients with condylar hyperplasia using CT-based attenuation correction (CT-AC) and an AI-based synthetic CT attenuation correction (SynCT-AC). ***Materials and Methods:*** SUVmax and SUVmean values of 13 patients (12 female, 1 male + mean age 24) were measured using both CT-based and AI-based attenuation correction. 600MBq 99mTc-MDP iv. administered and 120view, 128matrix size SPECT and Low-Dose CT were done. The reconstruction method was OSEM-3D-RR with attenuation and scatter correcton based on original CT and SynCT. Reference SUV values (clivus, calvaria, vertebra) were also measured. SUV values were measured using 2 cm diameter volume of interests (VOIs). Correlation between CT-AC and Sy-CT-AC was measured in all

reference areas and in the mandibles as well. Significance of the differences between CT-AC and Sy-CT-AC based uptake values were analyzed using paired t-test (in case of Gaussian distribution) and Wilcoxon signed rank test. To visualized the difference in the parameters of Sy-CT-AC and CT-based AC, Bland-Altman plots and box-and-whiskers plots were created. ***Results:*** The CT-AC and SyCT-AC based uptake values correlated well (r2 is above 0.93) in all cases. Mandibular and vertebral SUVs turned out to be biased since both SUVmax and SUVmean values were higher with AI-based AC. SUVmax values of the mandibles and vertebrae had a proportional error with AI, meaning the difference in SUVs from CT-based AC is greater at higher SUV values. The relative mandibular uptakes were not biased. Ratios of SUVmax values resulted in less deviation from the CT-based values. ***Conclusion:*** AI-based attenuation correction can be a promising tool in patient evaluation for mandibular condylar hyperplasia, since it provides appropriate quantitative analysis while avoiding unnecessary CT dose We detected high correlation between CT-based and AI-based SUV values. Further studies need to be conducted to elucidate the difference at higher SUV values.

EP-0869

Delayed PET Generation of ^{64}Cu-DOTA-rituximab PET for Internal Dosimetry by Deep Learning-based Generative Model

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Aim/Introduction: Internal dosimetry of the radiopharmaceuticals requires obtaining their multi-time biodistributions to estimate the cumulative activity. They are non-invasively acquired as the functional imaging, including positron emission tomography(PET). However, obtaining functional imaging several times causes inconvenience. In this context, we propose the dosimetry method that generates the PET images at delayed time point from PET image scanned earlier using deep learning. ***Materials and Methods:*** We obtained PET image of the six cancer patients by administering 8 mCi of 64Cu-DOTA-rituximab and scanned them at 1, 24, and 48h post-injection. The study was approved by the Institutional Review Board of KIRAMS, and all patients provided written informed consent. The intensity normalized constant was adjusted by the amount of the exponential decay of the radioisotope at scanning time. The paired generative model was based on generative adversarial network. The generator was aimed to generate 64Cu-DOTA-rituximab PET image from one scanned earlier. In training, we used sum of two loss functions, least square GAN and L1-loss between generated PET image and its ground-truth. 64Cu-DOTA-rituximab PET image at 24 and 48h post-injection was generated from 1h post-injected one by the generative model. The 2D axial slices was used in training and whole number of slice was 1,794. Images of five patients were used as tranining set and rest was used as test set. ***Results:*** The generated images were evaluated with respect to the image similarity and dosimetry. As similarity metrics, we used structural similarity index(SSIM) and Fréchet inception distance(FID). At 24 and 48h post-injection, SSIM of test set was 0.80 and 0.77. Moreover, FID was estimated as 62.9 and 74.4, respectively. On the other hand, we compared the organ-wise dosimetry results generated by generative model and the ground-truth. The time-integrated activity coefficient(TIAC) of heart, lung, liver, and kidneys was 0.582, 0.238, 0.506, and 0.107 MBq·h/MBq for acquired PET and 0.519, 0.251, 0.465, 0.0766 MBq·h/MBq for the generated PET. The relative errors were 0.108, 0.0546, 0.0810, and 0.284, respectively. ***Conclusion:*** In this study, we suggested dosimetry method that generates 64Cu-DOTA-rituximab PET images at delayed time points from early-scanned PET images using deep learning. It was found that the model effectively predict the TIAC of the heart, lung, and liver but relative less accurate to predict TIAC of kidney. It is expected that the generative model can alleviate the inconvenience of internal dosimetry, by enabling to conduct internal dosimetry by scanning the subject only once.

EP-0870

CT-guided Deep Learning Denoising of Low-Dose Micro-PET for Intraoperative Breast Cancer Specimen Imaging

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Aim/Introduction: Recently, micro-PET/CT imaging emerged as a promising technique for intraoperative margin assessment in curative breast cancer surgery. During oncological surgery, a direct assessment of resected specimens ensures complete tumour removal and absence of residual cancerous tissue. Intraoperative application requires preoperative radiotracer administration to the patient. To limit exposure to patient and surgical staff, the injected dose should be minimal. However, noise is inherent to low-dose scans, consequently degrading the image quality. We investigated whether deep learning (DL) techniques can be used to improve image quality and whether anatomical guidance, leveraged from CT images, boosts the PET image denoising performance. ***Materials and Methods:*** We acquired micro-PET/CT images of resected breast cancer specimens from 27 patients, who were preoperatively injected with 4 MBq/kg of 18F-FDG 142±52 minutes before acquisition. To simulate low-dose PET acquisitions, 2-min time frames were extracted from the obtained 10-min list-mode scan, resulting in five statistically independent replicates. The data was randomly split into a 17/5/5 ratio for training, validation, and testing. Three different 2D U-Net based DL models were trained to predict the 10-min micro-PET image from different inputs: (1) a PET-only model, taking only the low-dose micro-PET as input, (2) a 2-Channel CT-guided model, taking the low-dose micro-PET, concatenated with the micro-CT, as two-channel input, (3) a 2-Branch CT-guided model, taking the low-dose micro-PET and micro-CT as separate inputs to two encoder branches. To quantify model performance, we defined regions of interest in both tumour and benign tissue to calculate the average and standard deviation of SUVmean across five replicates, as well as the contrast-to-noise ratio (CNR) between the tumour and benign regions. ***Results:*** The SUVmean stayed consistent between the 10-min image (10.6), the low-dose images (10.7±0.4) and the images obtained by the PET-only (10.2±0.3), the 2-Channel CT-guided (10.6±0.3) and the 2-Branch CT-guided DL models (10.8±0.3). The CNR improved for the PET-only (2.9±0.1), 2-Channel CT-guided (2.9±0.1) and 2-Branch CT-guided models (3.2±0.1) compared to the low-dose PET images (1.4±0.1) and the 10-min image (2.1). We plan to evaluate the clinical performance of our models by comparing the PET-signals with the true histopathological tumour segmentation. ***Conclusion:*** Our results show that DL denoising of low-dose micro-PET/CT images of breast specimens is possible with or without CT-guidance and leads to comparable

image quality. The proposed methods enable to reduce the injected dose by a factor of five, optimising the implementation of intraoperative PET/CT in the clinic.

EP-0871

Explainable AI and Alzheimer's: A Comparative Study of Regional vs. Global Uptake Values for Diagnostic and Prognostic applications

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Aim/Introduction: Dementia impacts 55 million people across the globe, Alzheimer's Disease being the most common. Generally, patients with Alzheimer's exhibit biomarkers such as Amyloid-beta plaques deposited within the brain. AI techniques have proven successful in predicting Alzheimer's diagnoses using Standard Uptake Value ratios (SUVrs) through PET imaging of Amyloid-beta plaques. Previous research has used SUVrs averaged across larger regions of the brain. Clinicians are hesitant to implement these techniques due to lack of model transparency. In this study we compare the use of individual region and global SUVrs to determine if they provide improvements in diagnostic/prognostic accuracies as well as better model understanding. ***Materials and Methods:*** 748 [18F] Florabetapir PET scans obtained from the Alzheimer's Diseases Neuroimaging Initiative (ADNI) were normalised to Montreal Neurological Institute (MNI) space using Statistical Parametric Mapping 12 (SPM12). We follow a technique of robust PET-Only-Processing (rPOP) as MRI template scans are often unavailable clinically. Segmentation using the Automated Anatomical Labelling Atlas 3 (AAL3) allows for the quantification of these plaques across 166 individual brain regions. A minimum Redundancy Maximum Relevance (mRMR) feature selection algorithm is used to select the most important regions and patients were classified using a random forest classifier. Explanations of the model predictions are provided by Local Interpretable Model-agnostic Explanations (LIME). ***Results:*** We find using uptake values from individual regions show slight diagnostic improvement and significant prognostic improvement in comparison to global uptake values. Comparing Alzheimer's, Mild Cognitive Impairment and CN patients we find 61.8% and 52.7% prognostic accuracy for individual and global SUVrs respectively. These results are attributed to the individual region's better separation for subjects with MCI to healthy individuals (62.2% and 31.1% MCI sensitivity for individual and global regions respectively). Additionally, LIME explanations produce clearer understanding for individual SUVrs due to the precise region locations and weights provided. ***Conclusion:*** Individual regions show promise in addressing the lack of trust between clinicians and diagnostic AI tools for Alzheimer's Disease. The increased accuracy in detecting early stages of Alzheimer's, as well as prognosis, are well aligned with the current prospects for AI in this field. The classification techniques used are relatively basic and comparison with the use of more sophisticated models is required to better understand the applications of this method. Although this model is not a finished product, individual region SUVrs have shown to address many of the hurdles limiting the implementation of AI in a clinical setting.

EP-0872

Assessment of machine learning models as predictors of radioiodine thyroid ablation outcomes

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Aim/Introduction: The aim of this study was to explore the potential of machine learning to identify factors predictive of successful radioiodine ablation and to develop a model based on multi-centre clinical data. The resulting model could be utilised for early identification of patients at risk of ablation failure. ***Materials and Methods:*** Data from 106 patients from 4 clinical centres recruited to the MEDIRAD project [1] were included. Out of the 106 patients, 84 achieved complete, 14 indeterminate, and 5 incomplete responses at follow-up, 3 patients were lost to follow-up. Successful outcome was defined as thyroglobulin < 2.0 ng.ml-1 at 9 to 12 months after treatment as per the ATA 2015 guidelines. The data comprised of demographic and physical data, diagnosis, biochemistry results before and after TSH stimulation, haematology data, administered activity, thyroid remnant dosimetry, and treatment outcome. In preparation for statistical analysis (univariate and multivariate logistic regression) and machine learning modelling, the missing values were imputed and initial feature selection performed based on feature correlations. The following basic machine learning models were applied: logistic regression, k-nearest neighbours, decision tree, random forest, gradient boosting, Naïve Bayes, support vector machine. The most important predictive factors were selected using global forward inclusion approach and 4-fold cross-validation. Each algorithm was optimised using Bayesian optimisation. Logistic regression models created in SPSS were evaluated for comparison. All models were validated internally and externally using the weighted F1-score (F1w) as the primary evaluation metric. ***Results:*** During the feature selection process, stimulated thyroglobulin was identified as the strongest predictive factor, followed by stimulated FT3 and thyroid remnant absorbed dose. Most models achieved the highest performance with the first two factors. However, both feature selection and hyperparameter tuning were affected by high uncertainties of the evaluation metrics due to the small imbalanced dataset, which was insufficient to optimise most of the models. The tentative best-performing model was the decision tree with F1w of 0.81. The model outperformed standard statistical models, although its predictive capacity remains limited. ***Conclusion:*** Despite the size of the dataset, machine learning modelling achieved better performance compared to standard logistic regression. However, more data are needed to develop and validate a reliable model with sufficient performance and good generalisability. ***References:*** [1] Taprogge J et al. Eur J Nucl Med Mol Imaging. 2023 Jun 10;1-10.

EP-0873

ML-models trained on clinical data and ^{18}F-FDG PET/CT radiomic features to predict pathological complete response after neoadjuvant chemotherapy in breast cancer patients

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Aim/Introduction: [18F]FDG PET/CT is an emerging tool in the baseline assessment of BC patients before neoadjuvant chemotherapy (NAC). In these patients, pathological complete response (pCR) after NAC is a strong prognostic factor. Aim of this work is to combine clinical data and conventional and radiomic parameters extracted from ^{18}F-FDG PET/CT to build machine learning models (ML_models) able to predict pCR after NAC. ***Materials and Methods:*** [18F]FDG PET/CT performed in newly diagnosed BC patients prior to the start of NAC were retrospectively collected. Primary tumor (T) and the most significant lymph node metastasis (N) were manually segmented. Data related to clinical parameters (grade, subtype), NAC and conventional PET parameters (SUVmax, SUVmean and volumetric parameters) were collected. The standard of reference considered was surgical pCR after NAC (ypT0;ypN0). 854 radiomic features (RFts), including original, first order, texture and wavelet based were extracted using 3D-Slicer on both PET and CT datasets, according to IBSI. Synthetic Minority Over-Sampling Technique (SMOTE) was used to balance data. The robust features (RFts) were identified using Mann-Witney U-test (p-value<0.05) and Spearman's coefficient (|Rs|>0.8). The cohort was split in training (70%) and validation (30%) sets. Two independent ML_models (PET and CT) using three different algorithms (Random Forest (RF), Neural Network and Stochastic Gradient Descendent) were trained and tested using clinical data and conventional and radiomic PET/CT features in Orange data-mining. 10-Fold-Cross-Validation was used on training set after Bootstrap. Validation set was used to evaluate performances to predict pCR after NAC (area under the curve - AUC; classification accuracy - CA; True Positive - TP; True Negative - TN). ***Results:*** 72 pathological uptakes at [18F]FDG PET/CT were selected and segmented in 52 patients (52 T; 20 N). After NAC, pCR occurred in 23 (44.2%) patients corresponding to a total of 33 (45.8%) lesions. Patients achieving pCR after NAC showed lower median SUVmax (16.16±13.58 vs 10.51±6.90; p=0.023;|Rs|=0.98) and SUVmean (9.94±8.27 vs 6.30±4.27; p=0.024;|Rs|=0.86). Fifty-seven and 141 RFts were selected from CT and PET dataset, respectively. Overall, PET_ML_models showed better performance than CT_ML_models. The best performances were obtained by RF algorithm (PET_model: AUC=0.83; CA=0.74; TP=78%; TN=72%. CT_model: AUC=0.60; CA=0.61; TP=60%; TN=62%). ***Conclusion:*** SUVmax, SUVmean and PET_ML_models built using clinical parameters and RFts extracted by [18F]FDG PET/CT can accurately predict pCR after NAC. The suboptimal accuracy of the CT_ML_ models might be related to the restricted number of RFts in our population. PET_RF_model could improve BC management if validated in larger cohorts. ***References:*** PMID:36497351.

EP-0874

Fast Brain SPECT Imaging: Leveraging Cross-Tracer Transfer Learning for deep learning Denoising of ^{99m}Tc-ECD Images

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Aim/Introduction: SPECT brain imaging using various radiopharmaceuticals plays an important role in the diagnosis and monitoring of multiple pathologies. Reducing acquisition time can be beneficial, especially for paediatrics and patients with lower body control, such as epileptic patients referred for 99mTc-ECD scan at ictal phase. However, faster imaging translates to noisier images and lower image quality and diagnostic confidence. Deep learning has shown promising results recovering image quality from faster and low injected activity scans. However, its performance is affected by the availability of large and diverse training data. In this study, we explored the possibility of using cross-tracer transfer learning to train deep neural networks for denoising brain 99mTc-ECD images. ***Materials and Methods:*** This study included 80 123I- ioflupane and 16 99mTc-ECD SPECT images acquired in list mode format on a CZT-based multi-pinhole SPECT camera. Using lister option, the images were reconstructed once using 4 minutes of fast time (Fast) and once with 15 minutes full time (FT). A SwinUnetR transformer network was used for all training scenarios to generate the FT images from Fast images using ADAM optimizer, 1000 epochs,128×128×64 patches and 2.4 mm voxel size. In the 1st scenario, 99mTc-ECD brain SPECT images were used to train models in a three-fold data split strategy. In the second scenario, previously trained models on 123I- ioflupane images were used as initial weights to train models in the same data split through transfer learning. The network output were compared with FT images in terms of voxel-wise and region-wise errors. ***Results:*** The average voxel-wise PSNR, SSIM, relative error(%), and absolute relative error (%) for scenario #1 were 36.45±2.39, 99.26±0.25, 3.71±6.15, and 13.07±3.08, respectively. These metrics improved to 38.15±3.30, 99.40±0.26, 1.23±4.94, and 9.96±1.97, respectively, when transfer learning was used in scenario #2. The region-wise absolute relative error (%) in CSF, grey matter, and white matter was 12.39±2.21, 12.41±2.07, and 13.01±3.27 in scenario #1. These reduced to 7.41±2.05, 7.78±2.00, and 8.41±3.18, respectively, when using transfer learning. ***Conclusion:*** The lack of diverse and big data limits the application of deep learning in medical imaging tasks. We demonstrated the potential advantage of using transfer learning from different radionuclides/ligands in SPECT brain imaging. Despite the different uptake patterns between 99mTc-ECD and 123I- ioflupane, the transformer network initialized by the pretrained weights outperformed the model trainrf from scratch. Faster 99mTc-ECD imaging with comparable image quality may help to diminish patient motion and improve patient comfort.

EP-0875

Construction of a Deep Learning Model for Thyroid Scan Classification

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Aim/Introduction: Thyroid scintigraphy offers a visual representation of thyroid tissue functional activity that is proportional to the selective absorption of radionuclides like iodine or 99mTc-pertechnetate. However, this method's interpretation remains complicated and depending on radiologist's experience. This study aims to construct a deep learning model to classify thyroid scintigraphy data and categorize patients based on suspected diagnoses, thereby augmenting diagnostic processes. ***Materials and Methods:*** Retrospective analysis of 703 thyroid scintigrams (TS) was performed for the time period 2014 — 2023. Experimental group consisted of 576 (82%) women and 127 (18%) men. Median age was 48 years [IQR 37, 61]. TS was performed in accordance with EANM Guidelines for thyroid uptake measurements [1]. Protocol consisted of intravenous injection of approx. 200 MBq of 99mTc-pertechnetate followed by a static acquisition of a scintigram 20 min p.i. TS were categorized into

eight subgroups based on the following factors: shape alterations, pyramidal lobe presence, nodal characteristics, and uptake level. Subsequently, datasets were formulated for training several neural networks.Convolutional neural networks (CNNs) were employed to build models using the Python programming language. The initial model comprised two convolutional and pooling layers each, employing the ReLu activation function. The second model was an adaptation of the ResNet50 CNN architecture. ***Results:*** The diagnostic accuracy of the CNNs ranged from 85% to 96% when utilizing the ResNet50 architecture. Obtained weighted accuracies (WA) and sensitivities (WS) are presented in the Table 1. Unfortunately, the smaller CNN did not yield significant results.Hence, the ResNet architecture emerges as the most promising for TS evaluation, based on our findings. The achieved accuracy of 85-96% aligns with similar studies [2,3]. ***Conclusion:*** We developed a model that offer decision support to clinicians by providing a presumptive diagnosis utilizing data from TS. Future enhancements may involve integrating additional parameters (hormones and history) a pursuit to be explored in subsequent research endeavors on this subject. ***References:*** 1. Giovanella, L., et al., EANM practice guideline/SNMMI procedure standard for RAIU and thyroid scintigraphy. EJNMMI, 2019. 46(12): p. 2514-2525.2. Yang, P, et al. Automatic differentiation of thyroid scintigram by deep convolutional neural network: a dual center study. BMC Med Imaging. 2021 Nov 25;21(1):179. 3. Currie GM, Iqbal BM. Re-Modelling 99m-Technetium Pertechnetate Thyroid Uptake; Statistical, Machine Learning and Deep Learning Approaches. J Nucl Med Technol. 2021:jnmt.121.263081.

EP-0876

Generalizing Deep Learning Denoising for Novel PET Radiotracers to improve image quality

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Aim/Introduction: While [18F]FDG has long been the reliable workhorse of nuclear imaging, there is an increasing need for more sensitive and specific radiotracers to improve diagnosis and treatment planning. An interesting avenue is the use of Zr-89 labelled monoclonal antibodies, as the longer half-time of Zr-89 matches the slow pharmacokinetics of these antibodies. However, such less established tracers typically suffer from high costs and varying image quality, impeding broader adaptation. The use of deep-learning based denoising algorithms could help remediate these challenges, but generally require many scans for training, which are not commonly available for new tracers. This study aimed to evaluate the generalizability of deep learning-based denoising algorithms, trained on conventional, short-lived radiotracers, to less common tracer types and radioisotopes that were not encountered during model training. ***Materials and Methods:*** First, a deep-learning model with a Unet architecture was trained on matching low-count and standard-count PET scans from two Belgian hospitals (AZ Groeninge and CHU Liège). During training, only matching pairs of two commonly available tracers were seen by the model, [68Ga]Ga-PSMA-11 and [18F]FDG . The model was then validated on 89Zr-labelled durvalumab PET scans from Radboud UMC and a phantom filled with 89Zr that was acquired at different acquisition times, ranging from 60s to 1200s, by downsampling the list-mode data. Image quality was assessed using the coefficient of variation in relevant regions and through visual inspection comparing the original scans with their enhanced counterparts. ***Results:*** The deep learning model could significantly improve image quality of the [89Zr]Zr-DFO-durvalumab scans, strongly reducing the variation in SUV for several organs across different patients. The algorithm also removed some unrealistically high SUVmax that were observed in certain tissues and overall resulted in a visually more appealing scan. Additional validation on the IEC NEMA phantom, confirmed that the matching enhanced images had a lower variance in SUV, both in the spheres and in the background. At the same time, the recovery coefficient for the SUVmean and SUVmax improved in all spheres, for the 10 and 20 minute scans. ***Conclusion:*** In silico denoising by our deep-learning-based model seems to at least partially generalize to 89Zr-labelled radiotracers as shown by this study on [89Zr]Zr-DFO-durvalumab. Strategies for post-hoc enhancement of PET-scans may help to harmonize scan quality, which facilitates pooled analyses of multi-center studies using less commonly used radiotracers.

EP-0877

New standard of Bone Scan study report- appropriate for AI training

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Aim/Introduction: Artificial Intelligence (AI) algorithms could be trained to analyze medical images, but first a large number of images with their medical interpretation must be used for training. Medical reports with medical images description are created by qualified physicians in the form of sentences readable to other physicians, but not suitable for AI algorithms training. Therefore, it is necessary to convert medical reports (readable for humans) to a set of digital parameters (suitable for AI learning). Considering the constantly increasing usefulness of AI methods, it seems reasonable to develop a method of creating standardized medical reports that are coded in the form of digital parameters simultaneously. ***Materials and Methods:*** 40 consecutive medical images of Bone Scan studies were examined independently by two experienced physicians, one of them was using a newly developed method and the other one was creating report in standard way. The new method uses a specially designed interface which requires buttons and image surface clicking as an interaction and generates reports in the form of sentences and digital code at the same time, allowing the addition of manually written notes if necessary. ***Results:*** When using dedicated method and interface, parametrized report suitable for AI analysis was successfully created in all 40 examined cases. The process of creating Bone Scan study reports using the new method was not significantly longer than using traditional methods. Moreover, the method produces very standardized reports that are much more structured. ***Conclusion:*** Developed method of creating structured study reports allows the creation of coded reports suitable for machine learning, without disrupting or slowing down the routine work of qualified physicians.

EP-0878

Impact of Data Diversity Across TOF and Non-TOF PET Scans on UNET Performance for Attenuation and Scatter Corrections

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Aim/Introduction: Precise analysis of Positron Emission Tomography (PET) requires post-acquisition corrections, including attenuation and scatter corrections (ASC). Common ASC involve using Computed Tomography (CT) attenuation maps and model-based scatter corrections. However, CT increases radiation exposure and can introduce artifacts and PET/CT mis-registration. Deep learning (DL) applications lead to using these algorithms for simultaneous translating non-attenuation scatter corrected (NASC) images to measured attenuation scatter corrected (MASC) images. Specifically, our study focused on training a model using PET scans with and without Time-of-Flight (TOF). This allowed us to compare the performance of models trained with diverse and homogeneous data. By integrating data diversity, we aimed to enhance the model's ability to address the complexities inherent in PET imaging and improve accuracy in ASC processes. ***Materials and Methods:*** The UNET algorithm was employed to convert NASC brain ^{18}F-FDG PET images to MASC images. Transfer learning was implemented to exploit pre-trained vgg16 (ImageNet) weights. Training was conducted using three datasets: first comprising data from 40 patients with TOF (Train-TOF), second from 40 patients without TOF (Train-NON-TOF), and third a combination of both (20 TOF and 20 non-TOF images (Train-MIX)). Finally, all three models' performances were evaluated on 3 TOF and 3 non-TOF patients scans, using following quantitative metrics: Peak Signal-to-Noise Ratio (PSNR), Structural Similarity Index (SSIM), and Mean Square Error (MSE). ***Results:*** The results indicate that diversifying the composition of a training dataset, while maintaining a constant total number of data enhances model performance. Upon evaluation, the model trained with Train-MIX dataset demonstrated marked improvements in various metrics compared to models trained exclusively on either Train-TOF or Train-NON-TOF datasets: PSNR (Train-TOF=35.24, Train-NON-TOF=33.68, and Train-MIX=37.7), SSIM (Train-TOF=0.86, Train-NON-TOF=0.86, and Train-MIX=0.96), and MSE (TOF=0.0004, Train-NON-TOF=0.0005, and Train-MIX=0.0001). Furthermore, when the Train-MIX model was tested separately on TOF images and NON-TOF images on test dataset, it outperformed models trained on their respective homogeneous datasets—by 1.3 and 4.2 in PSNR, by 0.09 and 0.11 in SSIM, and by -0.0002 and -0.0001 in MSE, respectively. ***Conclusion:*** Incorporating data diversity in DL model training for medical imaging tasks is crucial. By including a more diverse dataset of TOF and NON-TOF PET scans in the training dataset, the study reveals a considerable enhancement in model robustness and generalization capabilities. This comprehensive training approach empowers the model to effectively handle varying image characteristics encountered in clinical settings, thereby yielding superior performance across a range of image quality metrics.

EP-0879

Can a ChatBot Write a Systematic Review? Large Language Models versus Humans

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Aim/Introduction: Large Language Models (LLMs) promise to impact human activities, particularly in tasks related to text generation. These tools are increasingly utilised worldwide, not only to handle textual content, but also to assist data analysis and creative processes. As a result, publishers of scientific journals started to ask to declare their use. However, the capability of LLMs to generate a scientific article has not been proven yet. This study aimed to assess the ability of LLMs to generate a systematic literature review. ***Materials and Methods:*** We conducted a comparative analysis of systematic literature reviews produced by LLMs (OpenAI ChatGPT 4.0, Google Gemini, and Microsoft Bing Copilot). The reference standard approach consisted of two human scientists unassisted by such tools. The process involved different tasks of this workflow: (1) literature search and article extraction from databases, (2) article selection based on predefined inclusion and exclusion criteria, and (3) production of the final article. The focus was on experimental studies on the isotope terbium-161, with the search query "terbium-161" OR "161-tb", excluding articles outside the research scope, and those not in English. We minimised human intervention in the LLM workflow, providing the same initial inputs to each model, while allowing for variances in subsequent interactions due to their distinct architectures and outputs. Descriptive statistics and qualitative assessments were used to evaluate LLMs' performance. ***Results:*** The human query yielded 81 papers, while ChatGPT 4.0, Gemini, and Bing retrieved 28 (35%), 21 (26%), and 13 (16%) articles, respectively. Gemini and Bing also fabricated non-existent references in the known phenomenon of "AI hallucination". As for the task of article selection, human experts included 24 papers, while all LLMs yielded no autonomous result explicitly requiring assistance. The final article texts produced by all LLMs were brief (all under 700 words), not compliant to systematic reviews standards, uninformative and uninspiring. ***Conclusion:*** While LLMs represent a revolutionary tool for writing, their role in the field of medical research remains supplementary, reliant on the direction and supervision of human expertise. LLMs can provide timesaving and enriching assistance, but cannot replace the nuanced and critical role of human researchers in the production of systematic reviews. Our results highlight the current limitations of LLMs, particularly in tasks requiring abstract reasoning or deep domain expertise. The aspiration of generating a scientific article from scratch with the bare minimal human supervision remains too optimistic - at least, for the time being.

EP-0880

The use of Machine Learning to predict 68Ga-PSMA-11 PET/CT result in different clinical settings of biochemical relapse after radical treatment for prostate cancer: comparison with a published nomogram.

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Aim/Introduction: Gallium-68 prostate-specific membrane antigen positron emission tomography (PSMA PET) is valuable for detecting prostate cancer. Its cost-effectiveness and long-term treatment outcomes based on PSMA PET results are uncertain. Correct patient selection for this imaging technique, especially in biochemical recurrence (BCR), is crucial for resource allocation and therapy planning. Machine learning (ML) algorithms show promise results in predicting outcomes, surpassing traditional nomograms.This study compares a published nomogram and a ML model for PSMA PET prediction in various BCR clinical settings. This comparison is essential to offer clinicians a comprehensive, practical, and highly accurate tool in the field of explainable Artificial Intelligence (exAI) for predicting PSMA PET result. ***Materials and Methods:*** The dataset included 703 prostate cancer patients with confirmed BCR post-radical therapy. Various ML algorithms were evaluated based on receiver-operating characteristic (ROC) curve AUC and accuracy. We also explored whether ML, with a Logistic Regression with penalty equal to L1 (LR-L1) analysis can identify different variables, than the current ones used for the nomogram, to develop an alternative ML predictive model. ***Results:*** Logistic Regression emerged as the top-performing model (78.87% accuracy) compared to the nomogram (76.00%). LR-L1 analysis highlighted influential features, including PSA doubling time, PSA value at PSMA PET, clinical stage, and ISUP group, and the subsequent ML model developed showed an accuracy of 80.28%. The DeLong test did not show a statistical significance of the differences of AUC between the two ML models compared with the nomogram. ***Conclusion:*** Although Logistic Regression didn't significantly outperform the nomogram in PSMA positivity prediction, ML methods hold promise as complementary tools for medical applications, particularly in developing exAI for routine clinical use.

EP-0881

Siamese based CNN Bone Lesion Tracking in PSMA-PET/CT Scans

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Aim/Introduction: One of the main applications of PET/CT is the assessment of tumor response to systemic therapies. Routinely, only a small subset of index lesions out of multiple lesions is analyzed.1 The operator dependent selection may bias the results due to possible significant inter-metastatic heterogeneity of response to therapy. Automated, AI based approaches for lesion tracking may enable the analysis of many more lesions providing a better assessment of tumor response. This work introduces a CNN approach for lesion tracking between PET/CT scans. ***Materials and Methods:*** Our approach is applied on the laborious task of tracking a high number of bone lesions in full-body baseline and follow-up [68Ga]Ga-PSMA-11- or $^{[18F]}$F-rhPSMA-7-PET/CT scans after two cycles of [177Lu]Lu-PSMA-I&T therapy of metastatic castration resistant prostate cancer patients. Data preparation includes lesion segmentation and affine registration of baseline and follow-up scans. Ground truth lesion pairs were manually assigned by an experienced nuclear medicine physician. Based on the PET data, our algorithm extracts suitable lesion patches around the lesion and neighboring anatomical structures for each possible lesion pair. It forwards them into a Siamese CNN trained to classify the lesion patch pairs as corresponding or non-corresponding lesions. The dataset consisted of 36 patients with 2111 baseline and 2658 follow-up lesions. ***Results:*** Experiments have been performed with a 2D and 3D Siamese CNN network and corresponding patch dimensions. Training and testing were performed with four different patch types with either CT one-channel input or two-channel inputs of CT combined with information from PET, binary lesion segmentation, or masked CT. As a reference, a non-trainable model classifying lesion assignments merely by the mean subtracted CT pixel intensities was used, which has been outperformed by all network and patch variations. The CNN model successfully learned to classify lesion assignments. In its best configuration of a 2D Siamese network trained with CT patches, it reaches a lesion tracking accuracy of 83% with an AUC=0.91. For remaining lesions, the pipeline accomplished a re-identification rate of 89%. ***Conclusion:*** We proved that a CNN may facilitate the tracking of multiple lesions in PSMA-PET/CT scans. It could also be applied on other types of PET/CT scans. Future clinical studies are necessary if this improves the prediction of the outcome of therapies. ***References:*** 1. Wahl et al. From RECIST to PERCIST: Evolving Considerations for PET response criteria in solid tumors. JNuclMed 2009; 50Suppl1: 122S-50S. https://doi.org/10.2967/jnumed.108.057307.

EP-0882

AI-Assisted Simplification of PET/CT Reports: Enhancing Medical Communication and Accuracy

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Aim/Introduction: Patients often receive their PET/CT reports and, instead of waiting for their oncologist appointment, turn to their general practitioners (GPs) for clarification. However, GPs might not possess the specialized knowledge needed to interpret these reports accurately, which can elevate patient anxiety. As AI technology advances, patients and GPs could potentially use AI tools for help in interpreting reports. This study evaluates the effectiveness of AI to simplify PET/CT reports while ensuring the information remains accurate. ***Materials and Methods:*** In this initial investigation, we randomly selected 10 anonymized PET/CT reports. Utilizing ChatGPT version 3.5, we simplified these reports with the prompt: "Compose a version of the following PET/CT report suitable for non-oncologist physicians." Subsequently, two nuclear medicine physicians evaluated the accuracy of the simplified reports using a Likert scale (ranging from 'strongly accurate' to 'not accurate at all'). Additionally, a GP physician assessed the comprehensiveness of the simplified reports. ***Results:*** Ten anonymized PET/CT reports from our institutional

database were rewritten by ChatGPT. Among these reports, seven were FDG PET/CT, two were Ga68-DOTATOC PET/CT, and one was an ^{18}F-PSMA PET/CT report. Nine out of ten reports were rated as strongly accurate or accurate based on the four-point Likert scale, with only one report rated as not accurate at all. The agreement between the two nuclear physicians was high, with a kappa value of 0.90. The GP found nine out of ten reports written with ChatGPT to be simplified and easier to understand. Notably, the report identified as non-simplified by the GP was the same one flagged as inaccurate by the nuclear physician specialists. ***Conclusion:*** AI has the potential to facilitate the comprehension of complex PET/CT reports, thereby improving communication between patients and healthcare providers. However, it's crucial for patients and healthcare provides to recognize the potential for inaccuracies in information provided by AI systems.

EP-0883

Enhancing image quality of preclinical PET scanners through gap correction using Deep Learning method.

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Aim/Introduction: One of the important challenging problems in PET imaging is the gap between adjacent detector blocks, which introduces partial projection data loss. The missed data can lead to errors in quantitative data analysis. In this research, we use Pix2Pix conditional generative adversarial network (Pix2Pix cGAN) to retrieve and fill missing data in preclinical PET sinograms. ***Materials and Methods:*** The Pix2Pix conditional generative adversarial network (cGAN) was trained on a total of 4000 raw (uncorrected) mice sinograms. The 15 mice (28±10 g) with an average activity of 280±60 µCi of 18F-FDG were scanned using the small animal Xtrim PET. The gap of sinograms were filled with interpolation method and modified as the target. Artificial gaps similar to the original gaps were added at different places except the interpolated areas and modified as the input of network. To test the proposed network, the set of 200 original sinograms was used. The ordered subset expectation maximization (OSEM) algorithm was used to reconstruct the predicted gap-filled sinograms. The reconstructed images were compared quantitatively by computing the contrast-to-noise ratio (CNR) and signal-to-noise (SNR). ***Results:*** Filling the gap in the sinogram domain is possible through this approach. The predicted images of the proposed network (pix2pix) were reconstructed via OSEM method (4 iteration, 6 subsets) and compared to the original images. The star-shape artifact that was created by gaps between inter-block detector was depicted in the original images, but it was not identified in the predicted images. For one of the predicted image's axial slices, the SNR and CNR values were calculated 17.31 and 24.65 respectively. These parameters were also calculated 13.35 and 19.71 for the same original image respectively. These values showed an increase in the quality and quantity of predicted images with less noise, which indicated the proper performance of the proposed network. ***Conclusion:*** This proposed approach can retrieve missing data in sinograms before reconstruction, improve image quality and quantity, and eliminate significant artifacts caused by gaps between adjacent detectors. ***References:***
1. Amirrashedi M, Sarkar S, Ghadiri H, Ghafarian P, Zaidi H, Ay MR. A deep neural network to recover missing data in small animal pet imaging: comparison between sinogram-and image-domain implementations. In2021 IEEE 18th International Symposium on Biomedical Imaging (ISBI) 2021 Apr 13 (pp. 1365-1368). IEEE.

EP-0884

Exploring Generalizability of a fine-tuned Large Language Model for Impression Generation in PET Reports

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Aim/Introduction: In a previous study, the feasibility of using large language models (LLMs) to generate clinically relevant impressions for PET reporting was considered (Tie et. al. JIIM 2024). This study sought to explore the generalizability of the fine-tuned model on an external PET clinical report dataset in accurately summarizing PET findings and generating clinically valuable impressions. We applied the PEGASUS model that was fine-tuned on PET reports (PEGASUS-PT), to primary mediastinal large B-cell lymphoma (PMBCL) PET reports as an external test dataset. ***Materials and Methods:*** We collected 202 PET reports retrospectively, dictated by 14 physicians, from our institution between September 2005 and January 2020. Performance of PEGASUS PT was assessed by the reference-dependent metrics: Bleu Score (the precision between generated and reference texts with a brevity penalty) and ROUGE-N that assesses the similarity between generated and reference texts by measuring overlapping textual units, where N represents the length of the units. ROUGE-L evaluates the overlap of the longest common subsequence. We also assessed the model's performance in predicting the Deauville score (DS) by measuring 5-class accuracy on cases where both the clinician's and the generated impression contained DS. We randomly chose 13 reports for expert assessment. These reports included the original findings, clinician's impression, and model-generated impression. Three nuclear medicine physicians (NMP), excluding those who authored the original impressions, and three trainees independently evaluated the LLM model. To assess the usability of the generated impressions, a 5-point Likert scale is used (5: Clinically acceptable impressions, 4: Nearly acceptable impressions, 3: Moderately acceptable impressions, 2: Unacceptable impressions, 1: Unusable impressions). ***Results:*** The performance of PEGASUS-PT model on our external test set are: Bleu Score of 6.97 [0.5, 21.21], ROUGE-1 of 38.41 [14.47, 57.52], ROUGE-2 of 16.02 [3.53, 34.19], and ROUGE-L of 24.61 [7.05, 44.08]. Evaluation conducted by NMP and trainees revealed that 71.8% of the impressions produced by the PEGASUS-PT were considered clinically acceptable, achieving an average usability score of 3.41 and 3.03 out of 5. PEGASUS PT performance on DS prediction, measured by 5-Class Accuracy, is 48.0% [26.1%, 69.6%], with a Weighted Cohen's κ of 0.5467 [0.3394, 0.7376]. ***Conclusion:*** For generalizability evaluation, we applied PEGASUS PT to reports with different patient characteristics and diseases, report styles, and report templates. Model performance dropped in terms of reference-dependent metrics, DS prediction, and usability metrics evaluated by NMP and trainees.

EP-0885

Novel Methods for SPECT Scatter Estimation Using Gaussian Blurring and Deep Image Prior

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Aim/Introduction: Detection of scattered photons degrades quantitative accuracy in SPECT imaging. The SPECT scatter is usually estimated via the triple energy window (TEW) method using the noisy(real) projection data. This method works well for higher counts (or higher projection time, dT) but suffers from a systematic bias for lower dT. In this work, we propose two methods for estimating noiseless scatter, which outperforms traditional methods especially for smaller dT. The first method Gaussian blurs the noisy scatter prior to scatter-correction, while the second method exploits a deep-learning framework called the DeepImagePrior (DIP) for personalized network training on a single data. ***Materials and Methods:*** In this work, we used SPECT projection data simulated via SIMIND. The ground truth (noiseless) and noisy (a single Poisson noise realization) scatter was generated using TEW method for various dT=[1,2,5,15] s. First, 1D Gaussian filters with carefully chosen variances and kernel sizes for each dT were applied in r, theta and z directions to the photopeak and noisy scatter to obtain blurred photopeak and blurred noisy scatter. Furthermore, we trained a UNet under the DIP framework to predict noisy scatter using the blurred photopeak as input. The (i) noiseless, (ii) noisy, (iii) DIP-predicted, and (iv) blurred scatters were used during OSEM (4 iterations,8 subsets) reconstruction. All reconstructions were performed in PyTomography[1]. The counts/dT was computed within the liver, lungs, kidneys, salivary glands and bladder for methods (i)-(iv) for all dT and the %error was evaluated for (ii)-(iv) with respect to (i). ***Results:*** Both DIP-predicted and blurred scatter estimation methods arrived at counts/dT within organs closer to the one obtained from noiseless scatter as compared to noisy scatter, especially for lower dT. In particular, for dT=1s, %error for noisy, DIP and blurred scatter estimation methods were (10.1%,1.7%,1.2%), (30.7%,0.2%,0.8%), (3.7%,1.7%,2.4%), (9.2%,2.6%,3.1%), and (4.5%,1.5%,1.6%) for liver, lungs, kidneys, salivary glands, and bladder respectively. A similar trend was observed for dT=2s and 5s, while the %errors were similar for the three methods for dT=15s. ***Conclusion:*** Preprocessing scatter via Gaussian blurring and DIP might be promising routes for scatter estimation during image reconstruction, thereby enhancing the utility of SPECT images. Having better scatter estimates at smaller dT can also potentially help reduce the scan time for patients. ***References:*** [1] Polson, L., et al, PyTomography: A Python Library for Medical Image Reconstruction, arXiv:2309.01977v3.

EP-0886

Machine Learning Using Baseline Clinical Biomarkers for the Prognostic Stratification of Patients with Neuroendocrine Tumours Teceiving ^{177}Lu oxodotreotide Therapy

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Aim/Introduction: Prognostic stratification of patients with advanced neuroendocrine tumours receiving 177Lu oxodotreotide therapy enables the identification of those most likely to benefit from treatment, improving cost effectiveness. Previous work at our centre[1] using statistical methods, identified baseline circulating biomarkers associated with 1-year treatment failure and developed a predictive scoring mechanism. However, numerous machine learning (ML) algorithms exist providing the opportunity to explore these biomarkers' predictive nature further. This work is an initial investigation into the predictive potential of a range of ML algorithms applied to this data. ***Materials and Methods:*** 188 patients each with Progression Free Survival (PFS), Time to Treatment Failure (TTF) and 20 baseline circulating biomarker and demographic data were analysed. PFS and TTF data were each converted to binary classes using equal frequency binning to avoid class imbalance. Classification modelling was performed for both PFS and TTF independently using 20 different ML algorithms. Model training was performed on all features and separately on selected feature sets using the "Minimum Redundancy Maximum Relevance" (MRMR) algorithm with "Searching for Uncorrelated List of Variables" method (SULOV) and recursive extreme gradient boosting. Accuracy, sensitivity, specificity, positive predictive value, negative predictive value and F1-score performance metrics were obtained using leave-one-out cross validation. ***Results:*** Using all features, a random forest classifier performed best at predicting PFS (accuracy=0.628, sensitivity= 0.622, specificity=0.632) and an extreme gradient boosting classifier at predicting TTF (accuracy=0.633, sensitivity=0.613, specificity=0.653). For PFS, feature selection identified 10 features (alkaline phosphatase, platelets, lymphocyte, neutrophils, erythrocyte sedimentation rate, monocytes, creatinine, chromogranin A, alanine aminotransferase and haemoglobin) with an extra trees classifier performing best (accuracy=0.702, sensitivity=0.678, specificity= 0.724). For TTF, feature selection identified 9 of the 10 features selected for PFS, excluding chromogranin A, with a decision tree classifier performing best (accuracy=0.676, sensitivity=0.699, specificity=0.653). ***Conclusion:*** These initial results demonstrate certain ML algorithms have the potential to contribute to prognostic stratification of patients with advanced neuroendocrine tumours receiving 177Lu oxodotreotide therapy. Improved model performance arising from biomarker selection highlights the importance of this and our results support the identification of these predictive circulating biomarkers. Further gains in accuracy could be achieved through hyperparameter tuning of the identified models and training on larger datasets. Additionally, separate validation datasets would allow for assessment of generalisability. ***References:*** [1] Chen L, Gnanasegaran G, Mandair D, Toumpanakis C, Caplin M, Navalkissoor S. Prognostic stratification for patients with neuroendocrine tumours receiving 177Lu-Dotatate. Endocr Relat Cancer. 2022 Jan 20;29(2):111-120. doi:10.1530/ERC-21-0248. PMID:34932018

EP-0887

Deep Learning on Enhancing Quality Recovery for Low-dose PET Imaging with Auxiliary Multiple Lower-dose Repetitions

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Aim/Introduction: Despite the advancements in deep learning-based methods for quality recovery in low-dose PET imaging, it remains challenging to further improve the quality of synthetic full-dose PET and reduce the impact of noise on it. This study

aims to enhance generated PET image quality by exploiting the incoherent nature of noise, maximizing the input information of PET, and proposing a strategy of estimating full-dose PET from low-dose PET and its sampled multiple independent lower-dose repetitions. ***Materials and Methods:*** For proof of concept, this new strategy was trained with 3D U-Net from scratch using low-dose total-body [18F]FDG PET subjects (n=30) paired with their full-dose counterparts from uExplorer, and then preliminary tested on data from two different scanners of uExplorer (n=7) and Biograph Vision Quadra (n=1). The input data consists of one low-dose PET and four auxiliary lower-dose PET images. Each low-dose PET with a dose reduction factor (DRF) of 9 was reconstructed through ordered subset expectation maximization algorithm by resampling a 40-second time window during the 6-minute full-dose acquisition. For each low-dose PET, four auxiliary lower-dose PET images with a DRF of 36 were produced by dividing the 40-second sample evenly into four repeated segments. A comparative analysis was conducted to measure the quality enhancement of synthetic full-dose PET, compared with the method only using 40-second low-dose PET. Normalized root mean squared error (NRMSE), peak signal-to-noise ratio (PSNR), and structure similarity (SSIM) are selected as evaluation metrics. ***Results:*** The full-dose PET generated from multiple low-dose PET shows a significantly lower mean NRMSE (0.134%±0.048%, P=0.006), a higher mean PSNR (58.17±4.13, P=0.018), and a higher mean SSIM (0.99963±0.00028, P=0.035), compared with those from single low-dose PET. The mean NRMSE and PSNR improvements are enhanced from 22.14% to 24.98% and from 4.83% to 5.36%, respectively, by adding four lower-dose repetitions as input. Visual assessment by two nuclear radiologists showed no significant differences in image quality between real and synthetic test samples, and neither false positive nor false negative was generated by this method. ***Conclusion:*** The proposed strategy of using low-dose PET with its multiple lower-dose repetitions to estimate full-dose PET through deep learning can significantly enhance the quality of synthetic full-dose PET. Further transfer learning on 1500 patients from ultra-low dose PET Challenge, and systematic optimization and clinical evaluation on more than 200 patients imaged from 4 different scanners with 5 different tracers are ongoing.

EP-0888

Validation of an AI-Based Noise Reduction Filter on Bone Scan Images

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Aim/Introduction: Artificial intelligence (AI) is a promising tool in helping physician workflow and raise the effectiveness of their reads. Our work focuses on the validation of an AI based tool developed by Kovacs et al., 2022. In our validation, we aimed to evaluate the performance of an AI-based noise reduction filter. ***Materials and Methods:*** The AI bone scan filter (BS-AI) was validated retrospectively on 99mTc-MDP whole body images. The examinations were performed according to the institutional routine protocol. Validation was done using 47 planar bone scans of different patients which form a representative group of the training set. 3 nuclear medicine experts scored AI-filtered and original images for image quality and contrast. The performance of the BS-AI filter was tested on artificially degraded noisy images - 75-50-25% of total counts - which were generated by binominal sampling. For quantitative analysis, we used an automatic lesion detector (BS-annotator). The total number of lesions detected by the BS-annotator in the BS-AI filtered low-count images were compared to the original filtered images. The total number of pixels in the filtered low-count images relative to the number of pixels in the original filtered images were compared with one-way ANOVA. ***Results:*** Based on visual assessment, observers agreed that image contrast and quality were better in the BS-AI filtered images, increasing their diagnostic confidence. In addition, no new or disappearing lesions were detected in the filtered total-count and in the images degraded to counts of 75% and 50%. However, new and disappearing lesions were detected in images degraded to a count of 25%. The similarities of lesions detected by BS-annotator compared to filtered total-count images were 89%, 83%, 75% for images degraded to counts of 75%, 50% and 25%. There was no significant difference in the number of annotated pixels between filtered images with different counts. ***Conclusion:*** Our results showed that this BS-AI noise reduction filter is able to improve image quality and contrast not only on images with conventional protocol but also on low-count images. The use of this filter may provide an opportunity to reduce acquisition time or decrease the injected dose. ***References:*** Kovacs A, Bukki T, Legradi G, et al. Robustness analysis of denoising neural networks for Bone Scintigraphy. Nuclear Instruments and Methods in Physics Research Section A: Accelerators, Spectrometers, Detectors and Associated Equipment. 2022;1039:167003.

EP-0889

Evaluation of a deep learning based partial volume correction on a simulated patient-based ^{177}Lu SPECT/CT dataset

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Aim/Introduction: Partial volume errors (PVE) pose a significant limitation to SPECT/CT imaging, and current partial volume corrections (PVCs) are insufficient. Recently, a new methodology for deep learning-based PVC of 177Lu SPECT/CT imaging, called DL-PVC, was presented [1]. The aim of this study was to test DL-PVC on a generic patient-based data set and compare it with iterative Yang PVC (IY-PVC). ***Materials and Methods:*** Two datasets were utilized in this study: dataset (i) consisted of 10,000 pairs of random activity distributions placed inside artificially generated XCAT body phantoms and corresponding SPECT images, created using the Monte Carlo program SIMIND [2]. Compared to the previously used dataset [1], SPECT projections of smaller pixel size (2.4 mm) and thus larger matrix size (256x256) were simulated. SPECT reconstructions were performed using PyTomography ([3], OSEM, 6i6s, AC, SC, with resolution modelling). Dataset (i) was divided in 9000/500/500 for training/validation/testing, respectively, and DL-PVC(i), a u-shaped CNN (u-net), was trained (40 epochs, L1 loss function, input: SPECT images, target: activity distributions). A generic patient-based dataset (ii) was created by generating activity distributions for 717 peri-therapeutic 177Lu SPECT/CT images (429 [177Lu]Lu-PSMA-I&T, 288 [177Lu] Lu-DOTATATE, 202 patients) using a threshold-based approach to avert PVE. SPECT simulations and reconstructions were carried out as for dataset (i) and divided in 617/50/50 for training/validation/testing. Based on dataset (ii), two different u-nets were trained: DL-PVC(ii) trained with random weight initialization; and DL-PVC

(i⟶ii) for which transfer learning based on DL-PVC(i) was performed prior to training. Performance of all u-nets was assessed based on SSIM, NRMSE and voxel activity accuracy (VAA, [1]) against the ground-truth activity distributions. ***Results:*** For SSIM and NRMSE, DL-PVC(i) yielded comparable results to IY-PVC without the need for manual segmentation, and better results for VAA (DL-PVC(i): 0.88/9.6%/52.8%; IY-PVC:0.90/8.5%/12.0% for SSIM/NRMSE/VAA). Both PVC methods provided better results than applying no PVC (0.79/11.7%/10.6%). The same observations were made for dataset (ii) with DL-PVC(ii): 0.90/3.9%/18.0%; DL-PVC(i⟶ii): 0.91/3.6%/19.7%; IY-PVC: 0.94/2.9%/9.2%; no PVC: 0.85/4.5%/4.7%. Notably, transfer learning leads to a significant improvement in performance (paired Wilcoxon test, $p<0.01$). ***Conclusion:*** This study demonstrates the functionality of DL-PVC for patient-based SPECT/CT data. While the image quality (SSIM, NRMSE) was comparable to IY-PVC, the new method clearly outperformed IY-PVC at voxel level; without the need for manual segmentation. ***References:*** [1] Leube J et al. J Nucl Med 2024. Online ahead of print. [2] Ljungberg M, Strand SE. ComputMethProgBio 29(4);1989:257-272 [3] Polson et al., arXiv:2309.01977.

EP-0890

Deep Learning for CT-Free Attenuation and Scatter Correction in Ga-PSMA PET Imaging: A Comparative Study

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Aim/Introduction: Accurate quantification in positron emission tomography (PET) imaging is essential, which can be determined after attenuation and scatter correction. To achieve this, a computed tomography (CT) scan is used. Redundant radiation dose, especially in repeated PET/CT scans and child cases, CT-related artifacts such as halo artifact which is common in Ga68 imaging, and imaging with stand-alone PET can be the challenges of CT-based attenuation and scatter correction. Implementing a direct deep learning-based attenuation and scatter correction method in image space could be beneficial to eliminate additional CT radiation exposure and probable artifacts. This study aims to investigate the ability of deep learning in performing joint attenuation and scatter correction on Ga68-PSMA images. ***Materials and Methods:*** In this study, 51 whole-body Ga-PSMA PET/CT studies (mean body mass index 26.41 kg/m^2 ± 3.43) were selected to train the SwinUNETR model implemented in the monai platform. heavey bueden metastatic cases were excluded from the training dataset but included in the test samples to assess the model's performance with metastatic samples. Test samples were divided into two groups: 18 cases with zero or low metastatic tumor volume, and 15 individuals with widespread metastases. Prior to training, voxel values were converted to standardized uptake values (SUV). The training was continued for 500 epochs using L1Loss and initial learning rate of 1e-3 reduced piecewise and ADAM optimizer. For assessing the results, the evaluation metrics such as mean absolute error (MAE), relative error (RE), relative absolute error(RAE), peak signal-to-noise ratio (PSNR), and structural similarity index (SSIM) were measured. ***Results:*** Considering the small number of images in the training dataset, this method showed comparable results to the reference PET-CTAC images. In the non-metastatic group, MAE(SUV), RE(%), RAE(%), PSNR, and SSIM of whole body images are 0.02±0.005(SUV), 5.42%±3.96%, 7.95%±3.82%, 52.43±2.60, and 0.99±0.004, respectively. In the metastatic group, they are 0.02±0.006(SUV), 5.66%±4.79%, 8.48% ±4.82%, 50.70±3.52, and 0.98±0.008, respectively. p-values resulting from Mann-Whitney U test of these metrics of two groups are 0.27, 0.67, 0.98, 0.16, and 0.14, respectively. ***Conclusion:*** The proposed deep learning-based CT-free approach could yield reasonable results with minor errors, we compared our model in two groups of external datasets with and without widespread metastasis and it showed robust and comparable performance in both groups with no statistical difference in measured metrics. The proposed methodology may be used to tackle CT related artifacts in Ga-PSMA imaging or remove the unnecessary CT radiation dose and risk.

EP-0891

To evaluate the performance and accuracy of AI-based automated lesion segmentation tool using fully automated deep learning model for [68Ga] PSMA whole body PET/CT scans.

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Aim/Introduction: To evaluate the performance and accuracy of AI-based automated lesion segmentation tool using fully automated deep learning model for [68Ga] PSMA whole body PET/CT scans. ***Materials and Methods:*** This is a single center study conducted to test the AI-based lesion segmentation software. This study included 30 patients with newly diagnosed adenocarcinoma prostate. All patients underwent staging workup by 68Ga-PSMA PET/CT performed on digital PET-CT scanner uMI550 (United Imaging). The DICOM data of whole-body PET/CT scans were uploaded onto the AI-based lesion segmentation platform (developed by UIH and available for research use only) using orthanc. The lesions that were then automatically segmented by the software. The lesion segmentation threshold was based on AI algorithm and SUVmax of liver, parotid and blood-pool. The results were reduced to binary scores and were compared with the manual segmentation (conducted by experienced board-certified nuclear medicine physicians). The false positives and false negatives are reported if any. The two methods were compared using dice coefficients. ***Results:*** We segmented the whole-body PET/CT scans in different organs and regions including head & neck region, lung, liver, lymph nodes, bones and so forth. It was observed that AI segmentation tool accurately segmented the primary prostate lesion in 70% of the scans and the rest of the scans reported false negatives. AI-based lesion segmentation tool performed well for bone metastases, where the tool automatically segmented lesions in 93% scans. This tool only demonstrated false negatives in 7% of the scans demonstrating a high accuracy in segmenting PSMA-avid bone metastases. Further, the tool demonstrated its capability in detecting lymph node metastases in 90% of the scans, with false negatives in 6.7% of cases and false positives in 3.3% of cases. The detection accuracy for lesions in other organs including lung and liver was 90% and with 97% in head & neck region. The dice coefficient for lung, liver and bone was 0.92, head& neck region was 0.96, lymph nodes was 0.88 and for pelvis was 0.63. ***Conclusion:*** The AI-based lesion segmentation tool has demonstrated high accuracy in automatically segmenting PSMA-

avid lesions although the detection of primary prostate lesions needs further improvement and training of deep neural network.
References: Zhang, Jia, et al. "Whole-body lesion segmentation in ^{18}F-FDG PET/CT." arXiv.

EP-0892

DEBI-NN Architecture Evaluation: Implications of Dataset Imbalance and Spatial Dropout on Performance

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Aim/Introduction: This study focuses on the optimization and parameterization of a new neural network (NN) architecture called DEBI-NN [1] that achieves similar accuracy as conventional NN while requiring significantly fewer trainable parameters. DEBI-NNs assign 3D coordinates to neurons, where neuron distances determine weights. DEBI-NNs also employ distance-based spatial dropout (SD) regularization. We aimed to evaluate the impact of data imbalance in small real and synthetic datasets with/without SD on DEBI-NN performance. ***Materials and Methods:*** Our study contained 4 dataset configurations for training. The first was the HECKTOR [2] challenge dataset (patients with H&N cancer and PET/CT images). The second used 500 synthetic samples of HPV-positive (HPV+) and HPV-negative (HPV-) cases, generated with a Conditional Tabular GAN (CTGAN) [3] trained on HECKTOR. The third and fourth datasets introduced an 80% class imbalance to the second dataset, to favor the HPV+ class and the HPV- class, respectively. These 4 datasets were employed twice with and without SD, resulting in 8 experiments. Spatial dropout removed the farthest 50% of neurons in each connecting DEBI-NN layer during training to confer task-specific network abilities. Assessment of balanced accuracy (BACC) utilizing a test set of the HECKTOR dataset was done 10-times in each execution to manifest an independent test-retest scheme. ***Results:*** In both with/without SD experiments, consistent performance was obtained across all configurations (~80% BACC). The use of a balanced dataset contributed to a slight improvement in learning stability and the highest BACC (85.5±2.3 vs 82.3±3.89 for balanced and unbalanced respectively). The implementation of spatial dropout led to slightly lower performance with the synthetic data (84.9±2.0 vs 86.2±2.5 with and without dropout respectively), unlike with the original HECKTOR data. ***Conclusion:*** The effectiveness of SD appears dependent on the properties of the dataset. The synthetic dataset's lack of response to SD suggests potential complexities: either the dataset may have been insufficiently challenging for the network to necessitate SD, or conversely, overly complex, demanding additional neurons to compensate for those omitted. Further investigation is required to understand SD's role in shaping task-specific network structures and its interplay with addressing class imbalance through different methods such as SMOTE-EEN.
References: [1] Papp, L., et al. (2023). DOI: 10.1016/j.neunet.2023.08.026[2] Andrearczyk, V. et al. (2023). DOI: 10.1007/978-3-031-27420-6_1[3] Xu, L., et al. (2019). DOI: 10.48550/arXiv.1907.00503.

EP-56

e-Poster Area

D: Technical Studies -> D3 Radiation Protection -> D31 Radiation Exposure and Protection

EP-0893

Radiation Safety Considerations for Introducing a High-Resolution Mobile PET/CT Camera into Operating Rooms

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Aim/Introduction: We tested a mobile high resolution PET/CT-camera for imaging surgical specimens in the operating room. It provides submillimeter resolution images of tissue specimens of patients injected with FDG. Upon implementation of this device at the surgical department of our hospital, we monitored the dose rates in close proximity to the patients. ***Materials and Methods:*** For new indications 4 MBq/kg FDG was injected iv 1h prior to removal of the tumor (thyroid, bladder, renal and skin cancer). For breast cancer 0.8 MBq/kg was prescribed. We conducted dose rate measurements with a Geiger-Mueller from injection till transfer to the recovery ward. Fixed geometries were used: at the level of the trunk and feet at the bedside as well as at 1m distance from trunk and feet. Surgeons, nurses and anaesthesiologists were monitored by an electronic dosimeter during the entire procedure. A 10 min acquisition of the tissue was performed on the PET/CT-camera in the operating room. The results were confronted with the final reports of the pathologists concerning the resection margins. ***Results:*** The median duration of surgery was 75 (range 32-256) min. For 11 procedures performed with 4 MBq/kg we obtained the following measurements:Median (min-max) doserates at bedside trunk level were at 10, 30 60 and 90 minutes respectively 98 (68-111), 85 (40-129), 49 (24-79) and 53 (20-83) µSv/h, Upon arrival at the recovery ward this was 19 µSv/h (4-73).Dose rates dropped by a factor >5 when measured at a the side of the feet instead of trunk. Absorbed dose estimates for the surgeon, assisting surgeon, scrub nurse and anaestesiology team were respectively 57 (10-171), 75 (72-143), 39 (2-144) and 8 (0-17) µSv. Image reconstructions simulating lower injected activities, suggest that -depending on the clinical indication- injected activities can be reduced by a factor 2 to 4. ***Conclusion:*** We successfully introduced the use of a mobile high resolution specimen PET/CT camera in the surgical ward of a general hospital, a process that required significant efforts to inform and train the involved nurses and physicians regarding radiation safety. The use of the standard diagnostic activity (4 MBq/kg) of FDG resulted in absorbed doses for the surgeons ranging from 10 -171 µSv/procedure. Simulating lower injected activities (1-2 MBq/kg FDG) resulted in acceptable image quality of the resected specimens during retrospective analysis. This finding suggests a considerable potential for further reducing doses for both patients and staff.

EP-0894

Impact of patient and staff shielding on staff's radiation dose for frequently used isotopes in nuclear medicine: A GEANT4 Monte Carlo simulation

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Aim/Introduction: To evaluate the deposited dose to the staff in nuclear medicine services for different diagnostic and therapeutic radioisotopes from a patient as an external source of gamma radiation comparatively in different shielding options (, staff-only, patient-only, both, and none shielded). ***Materials and Methods:*** Female MIRD anthropomorphic phantoms are utilized for staff and patient positioned 1.5 m apart. A lead 5-mm-thick semi-cylindrical-shaped shell is used as a protective shield that covers the entire of trunk. Tc99m and F^{18} (positron-emitting Fluoride) as diagnostic and I131 and Lu177 as therapeutic isotopes are determined as the sources. For each source, 4 simulation experiments (each simulation with 50 million particles) are conducted according to shielding of the staff and patient (none, staff-only, patient-only, and lastly, patient-and-staff). Total energy deposited in the trunk and organs is calculated. Deposited dose (in Gray) is computed by dividing by the corresponding mass, and root mean squared error is then determined. The GEANT4 Monte Carlo software is used to run simulations. Afterward, data of deposited dose and amount of dose reduction are comparatively analyzed and plotted using MATLAB software. ***Results:*** The highest dose deposited in the trunk is for F^{18} and followed by for I131 sources. Liver, small and large intestines received the highest dose compared to other organs. The dose deposited is dramatically decreased from no shielding to staff-only and patient-only shielding. The values of dose are almost similar in staff-only and patient-only shielding and then decline more slowly to the situation of both staff and patient shielded. The slope is higher for high-energy gamma sources (isotope of F^{18}). The amount of reduction in trunk dose is greater than 99% for Tc-99m and Lu177 in staff-only, patient-only as well as in both patient and staff shielding. The values of dose reduction for I131 are 81.2%, 81.3%, and 93.9% in staff-only, patient-only as well as in both patient and staff shielding respectively, while the values for F^{18} are 66.7%, 66.8%, and 86.4%. ***Conclusion:*** The benefits of shielding are different for low and high-energy gamma photons. In low-energy radioactive sources, like Tc99m and Lu177, shielding of either staff or patient is sufficient and shielding of both adds little benefit to dose reduction. Conversely, in high-energy gamma sources, F18 and I131, the benefits of concomitant shielding of staff and patient are not negligible, more notably with F18 or other positron-emitting sources, and thus, add a greater reduction in dose.

EP-0895

Calibration in terms of activity per unit volume of the stack monitor at a PET cyclotron centre using Monte Carlo technique

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Aim/Introduction: In PET centres with cyclotrons, it is common practice to install a radiation detector on the expelled air stack, to measure the possible presence of radioactivity prior to release into the atmosphere. However, given the intended purpose and location, it is complicated to calibrate such systems in terms of activity per unit volume of air released. The aim of this work is to illustrate the method used to calibrate a simple and relatively inexpensive system installed at our centre. ***Materials and Methods:*** FLUKA is a well-known general purpose code for modelling particle transport and interaction with matter, covering a wide range of applications. We used FLUKA.CERN 4-2.2 and its graphical interface Flair. The model includes the main expelled air duct, a cylindrical PVC pipe with a diameter of 40 cm. The inserted probe, also in PVC, houses an energy compensated Centronics ZP1202 type GM tube. The geometric model we created describes in detail the dimensions and materials of the components. For validation, irradiation of the detector probe model with a point source of 137Cs was simulated, reproducing the situation for which the manufacturer expresses the detector specifications. To simulate the operational situation, the filling of the expulsion duct with air uniformly contaminated with 18F was reproduced, for overall lengths of 100, 200 and 300 cm of duct. The cut-offs for electron and photon transport were set at 30 and 15 keV respectively and several high-statistics simulations were repeated and the results scored using the USRBIN and DETECT cards of FLUKA. ***Results:*** In the model validation simulations, the estimated environmental dose rate was 0.99 µSv/h with an uncertainty of 1.5%, to be compared with the expected value based on the gamma emission constant of 0.97 µSv/h. The simulated counting rate was 1.88 cps +/- 4%, against the expected value of 1.97 cps. The model was therefore able to reproduce within error the expected performance of the detector. Tests simulating the contaminated duct showed that the essential part of the response was provided by the first 100 cm of contaminated air around the detector. The average calibration factor was 1.12 +/- 0.09 cps per 1 Bq/cm3 . ***Conclusion:*** A simple and relatively inexpensive stack monitor may be sufficient in many cyclotron PET centres. Monte Carlo simulation techniques allow the detectors to be calibrated with satisfactory accuracy, even under "bad geometry" conditions. ***References:*** Infantino A et al. doi: 10.1093/rpd/ncw302.

EP-0896

Evaluation of shielding provided by hot cells used for theranostics in a clinical setting using Mote Carlo method

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Aim/Introduction: Hot cells to house 68Ge/68Ga generators, for the synthesis of products or the labelling of kits and subsequent dispensing are widely used. The increasing availability of Lutetium-177 has allowed a theranostic approach to be implemented. This work aims to guide the selection of the most appropriate shielding for the hot cells intended for this type of work. ***Materials and Methods:*** Monte Carlo simulation using FLUKA.CERN 4.2 and its graphical interface, Flair, were used. We modelled a hot cell with lead thickness from 30 mm to 50 mm or more in 10 mm layers. Sources were modelled as a small water cylinder, or a volumetric source of 30x40x30 cm, representing e.g. synthesis modules or dispensing systems. The simulations were performed with the source without shielding, and with different thicknesses of lead shielding. 1 GBq sources were considered centered in the hot cell or at 10 cm behind the front wall. ***Results:*** Our FLUKA model was cross-validated by estimating the specific gamma ray emission constants of 68Ga and 177Lu. Gallium-68: In a 30 mm hot cell, an unshielded central point source still causes a dose-rate of 5.5 µSv/h at 10 cm from the outer surface of the hot cell, which is reduced to 3.4 µSv/h with an added 10 mm vial shield. For a volumetric source, the dose-rate at 10 cm from the cell surface is 4.5 µSv/h and 1.3 µSv/h at 50 cm. These values are reduced to 0.8 and 0.26 µSv/h respectively in a 50 mm hot cell. Lutetium-177: The shielding of 177Lu is not a problem in a

30 mm hot cell, even with 0.1% 177mLu impurity. ***Conclusion:*** Our simulations are conservative, providing dose rate values for 1 GBq 68Ga in a single moment, which does not represent the actual situation during radiosynthesis, kit labelling or dispensing. From a radiation safety perspective, in a busy department with a high activity 68Ge/68Ga generator, a 50 mm Pb hot cell would be optimal, 30 mm Pb would require some additional shielding of the source. Working with 177Lu in a hot cell set up for PET work is safe, but aspects of Good Radiopharmacy Practice should also be taken into account if a single hot cell is used for preparing and dispensing both radiopharmaceuticals of a theranostic pair. A simple Monte Carlo model of a hot cell allows accurate estimates of the dose present in working environments.

EP-0897

Effective dose measurements of workers in the Radiopharmaceutical Production Unit at the University of Costa Rica

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Aim/Introduction: According to Costa Rican national authorities effective dose measurement must be provided for each worker when ionizing radiation is present. Since May 2022 workers at the cyclotron unit at the University of Costa Rica are producing ^{18}F-FDG, initially because it was necessary to perform different test to all equipment present in the facility. Since May 2023 first oncologic patients were received to perform ^{18}F-FDG studies. In December 2023 ^{18}F-FDG radiopharmaceutical was exported to Guatemala. Then, different amounts of activity were prepared according to our needs. ***Materials and Methods:*** Cyclotron and modules are used to produce ^{18}F-FDG. Hot cells are used for synthesis and dispensing the final product. At all times, five people are in place when radiopharmaceutical is produced, as follows, one at the cyclotron operator room, one at the hot cells, one at the QC Laboratory, one for cross-check/validation of the radiopharmaceutical product and one radiation protection officer. The ^{18}F activity produced can vary from 3Ci to 8Ci. Workers used TLD detectors for whole body (Hp(10), Hp(3), Hp(0.07)), eyes (Hp(3)) and extremity (writs (Hp(0.07), ring (Hp(0.07)) measurements. One a month TLD detectors are returned to the CICANUM TLD Laboratory for its lectures. ***Results:*** Twenty lectures have been received from the CICANUM TLD laboratory. For all data average, minimum and maximum results in mSv are reported. For Whole body Hp(10) = 0.166, 0.01, 2.97. Hp(0.07) 0.182, 0.015, 2.98. Hp(3) 0.174, 0.015, 2.98. For eyes Hp(3) 0.361, 0.01, 1.66. For extremity (writs) Hp(0.07) 1.254, 0.01, 21.28. For extremity (fingers) Hp(0.07) 5.09, 0.04, 65.31. The effective dose limit for extremities is 41.67 mSv per month. In four occasions workers have lectures above the limit for extremities. For all four cases, an investigation occurred to understand why the limit was exceeded. For these four cases an improvement of the manipulation protocols was implemented, then, for those workers no more lectures above the limit occurred. ***Conclusion:*** For more than 20 months workers at the cyclotron unit at the University of Costa Rica has been received radiation protection surveillance. On few occasions effective dose limits were exceed, however, an investigation occurs to understand how this occurred. After implementation of corrective actions, no more lectures above the limit occurred. ***References:*** Mora, P. Acuña, M. Assessment of medical occupational radiation doses in Costa Rica. DOI:10.1093/rpd/ncr341

EP-0898

Determination of the deposited activity of 99mTc in ventilation and perfusion lung scintigraphy

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Aim/Introduction: Diagnostic reference values are used to ensure and control radiation protection during nuclear medicine examinations. Especially, for lung scintigraphy ventilation scans with 99mTc-Technegas, the diagnostic reference values today refer to the prepared amount of ventilation and perfusion activity. Currently, the eluted and injected activity is estimated on the base of biokinetic models according to ICRP80. The aim of this study is to determine the amount of inhaled and injected activity deposited in the lung in order to establish reliable diagnostic reference values. With more precise knowledge of the deposited activity, the scintigraphic examination might be optimised and at the same time an improved estimation of the radiation exposure for the patient can be achieved. ***Materials and Methods:*** A SPECT phantom was homogeneously filled with 99mTc-MAA to calibrate both applied SPECT/CT devices. To determine a device-specific calibration factor (MBq/counts) for each operating mode, half-life corrections were performed and acquisition parameters and sensitivities of both SPECT/CTs were considered. The phantom measurement was analysed using the 3D lung lobe quantification software QLUNG (Q. Lung: Xeleris 4.0, GE Healthcare), considering the different operating modes. A study cohort of 146 patients (59 male, 87 female, age 65.3±15.5 years) underwent ventilation/perfusion single photon emission computed tomography (V/Q-SPECT/CT) to exclude acute PE on two SPECT/CT devices (n=74 on OPTIMA NM/CT 640, GE Healthcare and n=72 on Symbia T16, Siemens Healthineers). A 3D lung segmentation was performed with QLUNG for each patient. The measured counts of all lung lobes for ventilation and perfusion were normalised individually with the corresponding calibration factor to determine the deposited activity in MBq. ***Results:*** For ventilation, 3.6 % ± 1.6 % of the eluted and offered radioactivity was inhaled by all patients and 59.5 % ± 14.2% of the injected perfusion activity remained in the pulmonary circulation. This resulted in the following deposited activities: For ventilation, the deposited activity was (13.7±6.0) MBq and for perfusion the deposited activity was (105.2±27.4) MBq. Prior to the start of the measurement, 389.1 MBq±62.7 MBq Technegas was provided and 176.7 MBq±16.9 MBq 99mTc-MAA was injected to each patient. ***Conclusion:*** Based on the results of this study, the biokinetic models for dose estimation can be verified and refined. This allows an improved estimation of the patient's radiation exposure for lung scintigraphy.

EP-0899

Annual radiation exposure dose of surgeons involved in radio-guided sentinel lymph node biopsy in endometrial cancer

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Aim/Introduction: Sentinel lymph node biopsy (SLNB) utilizing radiocolloids is associated with radiation exposure of the involved medical workers. This study aimed to investigate the radiation exposure doses of surgeons during radio-guided SLNB procedures in endometrial cancer patients. ***Materials and Methods:*** A prospective study was undertaken to measure the annual radiation exposure of two surgeons during 20 SLNB procedures conducted from September 2022 to August 2023. All patients received a cervical injection of 4mCi Tc99m albumin nanocolloid on the day of the surgery. Radiation exposure was monitored using thermoluminescent dosimeters in the form of badges and bracelets, both during local radiocolloid application and throughout the surgical procedure. ***Results:*** The surgeon and the surgeon's assistant received an annual whole-body dose of 0.52 mSv and 0.57 mSv, respectively. The annual extremity doses were 0.40 mSv and 0.44 mSv, respectively. The average dose per intervention to the whole body was 0.03 mSv, while for extremities, it was 0.02 mSv. ***Conclusion:*** The radiation exposure to the surgeons involved in radio-guided SLNB in endometrial cancer was found to be low and safely below the permissible limits, according to the ICRP (International Commission for Radiological Protection). Based on the above results, approximately 700 SLNB per year would be required for the surgeon to reach the whole-body exposure limit for a radiation worker. Therefore, routine radiation monitoring may not be deemed mandatory.

EP-0900

Radiation Safety in Selective Intravascular Radiotherapy

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Aim/Introduction: The purpose of the study was to investigate practices related to the selective intravascular radiotherapy (SIRT). This covers the lifespan of the isotope entering the hospital all the way to the waste processing. The aim of the project was to improve the radiation safety of workers and patients. In particular, the aim was to develop a documented method for ensuring radiation-safe operation suitable for regulative inspections and self-assessments. ***Materials and Methods:*** The study material consists of instructions from the hospitals, post operation surveys and on-site inspection reports. Operational instructions were collected from all Finnish hospitals holding license for SIRT. Observational studies were performed in hospitals during SIRT procedures. Surveys (N=27) were conducted immediately after operations covering multidisciplinary personnel related to SIRTs. ***Results:*** The level of radiation safety in SIRT activities was good. Based on the study multi-professional collaboration is a critical factor in radiation safety during SIRT. A documented inspection method for ensuring radiation safety during in SIRT was introduced. The development of more detailed and possibly national guidelines gained impetus. ***Conclusion:*** Regulatory body for radiation safety can and should inspect SIRTs. Self-assessment is also warranted. The documented method will be suggested for international use. In addition, it is applicable for self-assessments in interventional radiology and nuclear medicine units. In complex processes multi-professional collaboration is paramount. ***References:*** Weber, M et al. "EANM procedure guideline for the treatment of liver cancer and liver metastases with intra-arterial radioactive compounds." European journal of nuclear medicine and molecular imaging vol. 49,5 (2022): 1682-1699. doi:10.1007/s00259-021-05600-zRadiation and Nuclear Safety Authority Regulation on Radiation Practices Subject to a Safety Licence, STUK S/6/2019, (2019)

EP-0901

Diagnostic reference levels for ^{18}F-FDG whole body PET/CT procedures in Costa Rica

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Aim/Introduction: Diagnostic reference levels are well-established for radiopharmaceuticals in general nuclear medicine. In Central America data for positron emission tomography/computed tomography (PET/CT) results are limited due to the limited amount of equipment available in the region. The aim of this study is to report initial data for ^{18}F-FDG whole body PET/CT procedures performed in the first digital PET/CT Unit available in Central America. ***Materials and Methods:*** In our clinical protocol patients who underwent in ^{18}F-FDG whole body also has a CT image from the thorax. Data was analyzed by checking on DICOM files. Parameters considered were body weight, height, CT dose index volume (CTDIvol), dose-length product (DLP) and administrated activity. ***Results:*** In this study data from 67 patients, 51 male and 16 female were considered with an age range between 25 and 82 years old. The height varies from 1.54 to 1.85 m and the weight from 80.4 to 156 Kg. Administrated activity varies from 353.35 to 714 MBq (7.32 - 19.3 mCi) and the 75th percentile is 480.63 MBq. CTDIvol for thorax CT images varies from 4.45 to 30.87 mGy and the 75th percentile is 14.6 mGy. DLP varies from 148.10 to 1115.80 mGy*cm and the 75th percentile is 526.55. CTDIvol for whole body CT images varies from 7.26 to 46.11 mGy and the 75th percentile is 20 mGy. DLP varies from 546.8 to 5991.60 mGy*cm with a 75th percentile of 2289.8 mGy*cm. ***Conclusion:*** Initial results show the large variation in CT dose values highlights the need for optimization in our studies, then, DRLs are justify in hybrid imaging clinical studies. Further data will be included considering children. ***References:*** Sagara, H., Inoue, K., Yaku, H. et al. Optimization of injection dose in ^{18}F-FDG PET/CT based on the 2020 national diagnostic reference levels for nuclear medicine in Japan. Ann Nucl Med 35, 1177-1186 (2021). https://doi.org/10.1007/s12149-021-01656-x.

EP-0902

Tin Filter Allows Large CT Dose Reduction for SPECT Attenuation Correction with Negligible Impact on SPECTQuantification at Soft Tissue and Trabecular Bone Equivalent Densities

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Aim/Introduction: The CT tin filter has demonstrated large CT dose reductions for attenuation correction (AC) in PET-CT with negligible influence on PET quantification. The tin filter was recently introduced to SPECT-CT systems, but available tube voltage settings differ, as do linear attenuation coefficients for PET and SPECT radionuclides. The aim was therefore to determine by how much dose can be reduced with tin filter CT for SPECT AC, without significantly impacting SPECT quantification. ***Materials and Methods:*** The NEMA image quality phantom underwent SPECT-CT under two conditions: firstly water-filled, mixed with Tc-99m-pertechnetate; and secondly with the cylindrical insert containing a homogenous mix of water, sand and flour with Tc-99m-pertechnetate (W-S-F, approximately 300HU), with water

background. The former represented soft tissue density, and the latter trabecular bone density. Each underwent 1 SPECT and 12 CT acquisitions. CT acquisitions used tube current modulation at: 130kV/50mAs (reference standard); 110kV (mAs range 13-50); Sn130kV (13-50mAs) and Sn100kV (13-300mAs), and 24cm CT scan range. SPECT data were reconstructed with AC using attenuation maps generated from each CT dataset. Reconstructions used ordered subset expectation maximisation with resolution recovery (30 updates, 9mm Gaussian post-filter). Volumes-of-interest were assigned to the volumes containing Tc-99m, and total counts measured. Differences in reconstructed SPECT counts were determined relative to the 120kV/50mAs reference, and relative differences in CT dose length product (DLP) compared. ***Results:*** For the water phantom, there was no measurable difference in reconstructed SPECT counts between use of reference CT settings for attenuation map creation, and other CT settings without tin filter. When scanned with tin filter, the greatest relative difference in reconstructed SPECT counts was 0.4% compared with the reference. For the W-S-F phantom scanned without tin filter, the greatest relative difference in SPECT counts was 1.3%, and 1.0% when scanned with tin filter. For both phantoms, for the lowest available tin filter exposure setting of Sn110kV/13mAs (water phantom DLP 4.2mGy.cm), DLP was reduced by 94% compared with the reference , and by 80% compared with use of 110kV/13mAs without tin filter. ***Conclusion:*** The tin filter provides ultra-low CT doses for AC with negligible impact on SPECT quantification at soft tissue and trabecular bone equivalent densities. This will allow dose reduction in SPECT examinations where CT is already performed for AC, or allow the addition of CT for AC for optimised reading of SPECT images in current SPECT-only examinations where the CT dose had previously not been justified.

EP-0903

Feasible correction of personal dosimeters for their response to internally deposited radionuclides or their surface contamination in nuclear medicine

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Aim/Introduction: Using personal dosimeters for radiation workers presumes that their response will primarily express the contribution to the total personal dose equivalents due to external radiation. In some cases where unsealed radioactive sources are used, workers may be contaminated due to the inhalation, which may also contaminate the body surface or cloth worn by the personnel. Then, personal dosimeters also react to radiation emitted from the body and radiation from the contaminated body's surface or cloth. Since the personal dosimeters are calibrated for external exposure, the contribution from other radiation is detected, but the response does not correspond to the quantity measured since the dosimeter has not been calibrated for such geometry. Therefore, the dosimeter reading will correspond to two different geometries: response to radiation striking the body from outside and response to radiation from other directions. ***Materials and Methods:*** An attempt was made to assess the sensitivity of the personal dosimeter to other than external radiation to find out to which extent contribution from inside the body and from its surface may affect the reading of the dosimeter calibrated under different geometry. The contribution from the internal radiation may be compensated using another dosimeter equipped with some shielding against external radiation. The dosimeter will mainly be sensitive to radiation emitted by the deposited radionuclide. Its response to external radiation will be significantly suppressed. ***Results:*** The situation reflects the complexities involved in measuring radiation exposure for workers who may be exposed to both external and internal radiation. The use of personal dosimeters is a standard practice in nuclear medicine, where workers are potentially exposed to radiation. Still, their effectiveness can be compromised when these dosimeters are exposed to internal radiation. The total reading of personal dosimeters could sometimes be affected by their exposure to radiation from other directions. Normally, the contribution to the response of a personal dosimeter is almost negligible, but in the case of internal contamination of the worker (corresponding to about 10 microSv/h on the surface), the contribution to its response cannot be neglected). ***Conclusion:*** It has been proven that personal dosimeters, primarily calibrated for external radiation exposure, may not accurately measure radiation emitted from the body or its contaminated surfaces. This limitation can lead to inaccurate readings, as the dosimeter's response may not correspond to the actual radiation dose received by the worker. This study was partially supported by EU Horizon programme No. 101121342.

EP-0904

Suggested recommendations for bystanders after lutetium therapy

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Aim/Introduction: During lutetium therapy, workers caring for the administered patient in the medical facility and other hospitalized patients in the same room or persons accompanying the discharged patient home or sharing a household with him are exposed to a certain external radiation. ***Materials and Methods:*** Between April and September 2023, 13 measurements were taken of persons who came into contact with the applied patients (for some people, the measurements were conducted repeatedly). Monitoring persons such as drivers transporting the applied patient and family members living with the applied patient was carried out using coats on which pairs of TLDs were placed in 29 positions (20 positions on the chest, abdomen and small pelvis, four positions on each upper limb and one position on the back between the shoulder blades). In addition, an electronic dosimeter was placed at the reference point (upper left side of the chest). TLDs were calibrated to show reading in terms of Hp(10). ***Results:*** Approximately 20 % of the maximum exposure was measured in a location where personal whole-body dosimeters are routinely worn. The maximum exposure in approximately 45 % of cases was in the abdominal region, where the dosimeter placement would have an average correction factor value of approximately 1.5 relative to the reference site. If we were to consider other areas (back of the neck, upper chest, sleeve) where the maximum exposure was measured relative to the reference site, the correction factors ranged from 1.1 to 6.8. In one case, casing contamination was detected. This local exposure from the contamination was estimated to be approximately 30 times higher than the exposure at a distance of roughly 25 cm from the contamination site. ***Conclusion:*** It is advisable to pay attention to

the spatial distribution of radiation for people in close proximity to the patient after lutetium therapy, which can be administered repeatedly (several times a year). Based on the knowledge of the direction of the dominant radiation, it is possible to recommend a suitable geometry of the treating person towards the patient (sufficient distance from the abdominal area, where, in most cases, the highest radiation level was found) or to suggest the use of a suitable correction factor in the event that the person is monitored with a personal dosimeter on the reference place. This paper was partially supported by the project SGS24/072/OHK4/1T/17.

EP-0905

Lens dose assessment in nuclear medicine- multicentric study

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Aim/Introduction: The main purpose was to measure the lens dose of in-duty workers in three nuclear medicine sites. ***Materials and Methods:*** A total of 23 workers in nuclear medicine departments joined this work. 6 out of 23 were SPECT/ CT technologists, 6 PET/CT technologists, 3 PET/MRI technologists, 5 radiopharmacists, 2 physicists, and 1 physician. EXTDOSE Hp(3) OSL dosimeter with tissue equivalent beryllium-oxide crystal was used for lens dose measurement. All participants were asked to wear the lens dosimeter for 2 months as near to the eye level as possible. ***Results:*** the dose measures yielded an average lens dose of 1.48 ± 0.77 mSv for the radiopharmacy team, 1.44 ± 0.26 for PET/ CT technologists, 0.86 ± 0.45 mSv for SPECT/ CT technologists, 0.38 mSv for the sole physician administered 177Lu, and 0.45 ± 0.02 mSv for the physicists conducting 131I therapy. Moreover, normalizing the lens dose to the labeled activity led to a lens dose of 2.2 ± 1.4 µSv/GBq for the radiopharmacy team. Likewise, per administered activity: 23.8 ± 7.3 µSv/GBq for PET/CT and PET/MRI technologists, 12.2 ± 10.5 µSv/GBq 99mTc for SPECT/CT technologists, 6.0 ± 0.81 µSv/GBq 131I for physicists, and 3.0 µSv/GBq 177Lu for the physician. ***Conclusion:*** It was concluded that the annual occupational lens dose of the nuclear medicine workers varied from 2.3 to 11.5 mSv/year; however, one radiopharmacist showed 17.9 mSv/y annual lens dose close to the lens equivalent dose limit (20 mSv/year).

EP-0906

Evaluation of the wipe test effectiveness of $^{223}RaCl_2$ and $^{99m}TcO_4$ contaminations with ethylenediaminetetraacetic acid (EDTA), 2-propanol and H_2O

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Aim/Introduction: 223RaCl2 therapy of osseous metastatic prostate cancer has increasingly become the focus of clinical routine in recent years. The 223RaCl2 transport shielding (TS) must be free of contamination before being returned to the manufacturer. Due to the geometry of the surfaces of the TS, wiping tests are required. Wipe-test effectiveness (WE) also depends on the properties of the liquid being wiped with. Aim of this study was to evaluate the WE of EDTA solution for 223RaCl2 and 99mTcO4 contaminations in comparison to 2-propanol and H2O. ***Materials and Methods:*** 90 TS were contaminated with 2.1 or 7.6 kBq 223RaCl2 or with 8.7 kBq 99mTcO4- on an area of 17 cm2. After 4 hours of exposure, the wipe samples were carried out on 30 TS each using a standardized procedure with EDTA, 2-propanol and H2O. The activity of the wipe samples taken was determined using a calibrated well counter with a connected multi-channel analyzer. The decay-corrected WE for 223RaCl2 and 99mTcO4- were evaluated from the measured activities. ***Results:*** For both radionuclides, the highest WE were found for water (83 ± 3.5% for 99mTcO4-; 66 ± 15% for 223RaCl2). The lowest WE were found in both cases with 2-propanol (61 ± 12.3% for 99mTcO4-; 59 ± 33% for 223RaCl2). In addition, the highest fluctuation range of the measured WE were found when taking 2-propanol. For EDTA, the WE were 74 ± 9.9% for 99mTcO4 and 63 ± 17% for 223RaCl2. ***Conclusion:*** There was no significant difference in the WE of 223RaCl2 between pure water and a liquid solution of the chelator EDTA. Due to the lowest WE and the highest fluctuation range, 2-propanol is the least suitable for taking wiping samples. The polarity of the liquid used appears to be crucial for reliable WE. It can therefore be recommended to carry out the wiping samples with the polar solvent water.

EP-0907

Measuring $^{223}RaCl_2$ contaminations: Comparison of well-counter, contamination monitor and NaI(Tl) sample changer

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Aim/Introduction: The approval of 223RaCl2 has brought radiation protection into the focus of nuclear medicine interest when dealing with radiation. Aim of this work was to combine wipe sample measurement as a measurement methodology for absolute quantification of contaminated transport shieldings (TS) with surface measurement using a portable contamination monitor (CM). ***Materials and Methods:*** Contaminations of known 223RaCl2 activity were created to calibrate various devices, evaluate different measurement methods and design a measurement methodology. A well counter (WC) (Dr. Westmeier GmbH), a sample changer (SC) (WIZARD, Wallac-1470) and a CM (Berthold LB124-scint) were examined. Wipe-samples were taken with cotton swabs moistened with EDTA. Effectiveness of the devices, extraction factors (EF) and practical use of the devices were compared. ***Results:*** Efficiencies were 66 cpm/Bq (WC), 58 cpm/Bq (SC), 1.6 cpm/Bq (bottom of the TS) (CM) and 14 cpm/Bq (top of the TS) (CM). Detection limits (DL) were 0.53 Bq (WC), 0.091 Bq (SC), 5.1 Bq (bottom of the TS) (CM) and 0.58 Bq (top of the TS) (CM). EF for the different extraction times were 68 ± 10 % (bottom of the TS) and 81 ± 6 % (top of the TS). There was no significant influence of the exposure time on the EF. Practical feasibility was evaluated by quantifying 1,200 wipe-samples. ***Conclusion:*** All devices examined are suitable for reliably determining 223RaCl2 contamination of 1 Bq due to their DL (3σ). The effectiveness of the WC and the SC were consistently in a comparable range. Due to the relatively large detector-source distance, the CM does not directly measure the α-particles ot the 223Ra but rather the volatile decay product 219Rn. There was a strong dependence on the exposure time of the contamination. When the contamination

is dried, less 219Rn emerges, so the effectiveness of the CM decreases with increasing exposure time.

EP-0908

Occupational radiation dose management in a single cyclotron facility

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Aim/Introduction: In the Industrial Zone of Lamia, located in the province of Phthiotis in Central Greece, there is a medical cyclotron that produces 500 GBq of ^{18}F radiopharmaceuticals every day. This radiopharmaceutical is used in the production of various medical products. However, there are high radiation risks during different stages of production due to the cyclotron's 16.5 MeV (PETtrace800, GE) and heavy workload (3-4 times per day). This work describes the precautions and practices implemented to limit radiation exposure to very low levels. ***Materials and Methods:*** To ensure safety and reduce risks associated with radioactive materials, the cyclotron was constructed with a 270 cm thick concrete shield that protects the surrounding area. The hot cells were further shielded with 75 mm of lead, while the hot lab's cabinet was shielded with 50 mm of lead. All vehicles transporting radioactive packages over long distances were equipped with special lead shielding consisting of 3.0 mm behind the driver's seat and another lead shield of 3.0 mm at a distance of 70 cm to reduce radiation exposure to drivers. To ensure the safety of workers, each worker has been categorized based on their respective activities, which include cyclotron operators, chemists, technicians, and radioactivity transport drivers. Electronic pocket dosimeters and Thermoluminescent Dosimeters have been provided to each worker to monitor their daily radiation dose. Moreover, wall detectors for live measurements and contamination monitors have been installed in each lab. The entrance at each separate lab is strictly controlled and permitted only by authorized workers. These measures ensure a safe working environment for all the workers. ***Results:*** The average whole-body dose to cyclotron operators and chemists was less than 0.65 mSv/y, and their finger dose was less than 3.75 mSv/y. The average whole body dose for technicians was 0.1 mSv/y and for drivers 0.0 mSv/y. ***Conclusion:*** To ensure the safety of workers when dealing with radiation, it is essential to implement strict safety protocols, which include using adequate radiation shielding, conducting regular quality assurance of equipment, and managing human resources effectively. These measures are crucial in ensuring that the radiation doses to workers remain below the International Commission on Radiological Protection (ICRP) limit, which is a fundamental goal in all practices involving radiation.

EP-0909

The crucial role of the different ^{18}F tracers biodistributions: the optimization of the radioprotection of caregivers in nuclear medicine (NM)

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Aim/Introduction: A correct evaluation of the dose rate of patients injected with different ^{18}F-fluorine radiopharmaceuticals is essential to optimize the radioprotection of caregivers. The aim of this work was to analyze how using measured dose rate of patients not considering the biodistribution to evaluate radiation exposure of caregivers can lead to an underestimated dose to third party. ***Materials and Methods:*** Dose rate of 90 patients injected with FDG,PSMA1007,Choline were measured with an ionization chamber. Dose rates were measured in patients immediately before the acquisition at 30cm and 1m from patient's thorax with the patient upstanding, Average dose rates were reported. All PET images were analyzed and percentage of activity in four macro-areas, head-neck, thorax, abdomen, and pelvis, were evaluated to assess the different bio-distribution. The measurements performed were compared with the calculated values obtained starting from specific gamma considering the retention functions obtained from the IRCP53, considering a self-absorption factor of 0.65 with and without taking into account biodistributions.Then total dose to public after 2 hours from the injection was calculated following Broggio's model using measurements at 30cm and 1 m. ***Results:*** The percentage of counts in the four districts were 29%, 23%, 24%, and 20% for FDG, 10%,22%,55%, and 12%for PSMA and 11%, 22%, 49%, and 16%for choline. A maximum differences of 25% between calculated and measured dose rates were found for PSMA and Choline and at 1m for FDG. In FDG an underestimation of 54% of the dose rate@30cm compared with the calculated one is reduced to 35% taking into account biodistribution. Effective dose to partner, pregnant woman and work colleagues for FDG were 0.34mSv and 0.02mSv and 0.03mSv using 30cm measured dose rate and 0.8mSv, and 0,05 mSv and 0,07 using 1m measured dose rate dose rate respectively. ***Conclusion:*** Biodistribution analysis shows relevant differences between the several ^{18}F tracers.Good agreement between calculated without biodistribution percentage correction and measured dose rates were found for PSMA,Choline and 1m for FDG.The characteristic biodistribution of FDG injected patient means that the dose to third party starting from 30cm measured dose rate of an can lead to underestimate dose up to 55%. ***References:*** Broggio, D., Célier, D., Michel, C., & Isambert, A. (2023). Contact restriction time after common nuclear medicine therapies: spreadsheet implementation based on conservative retention function and individual measurements. Journal of Radiological Protection, 43(2). https://doi.org/10.1088/1361-6498/acc4d1.

EP-0910

Establishing a methodology for evaluation of 68Ga Intakes in a Radiopharmaceutical Production Facility

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Aim/Introduction: Radionuclides intakes are one of the associated risks in their production practice, also handling of radiopharmaceuticals may have a risk. 68Ga it is proposed as an isotope to be used for diagnostic of neuroendocrine and prostate tumors, linked to different radiopharmaceuticals. The aim of this work is to develop a methodology to evaluated intakes when 68Ga is produced when a cyclotron is used. ***Materials and Methods:*** In a previous work a methodology was developed to determine the monitoring type that best describes the needs of the radiopharmaceutical production facility at the University of Costa Rica when ^{18}F is produced. In that work calibration and quality control procedures were created when an uptake probe is used. Due to the knowledge acquired from the facility, equipment and radioactive sources available a methodology is proposed when 68Ga is produced. Also, procedures for estimating the effective dose for the occupational workers exposed are defined considering different international references. ***Results:*** Confirmatory monitoring programme is selected for the synthesis

area, the QC and dispatching areas. Measurement geometries and calibration procedures were created. In addition, the procedure for estimating the committed effective dose was described. ***Conclusion:*** With the methodology established assessment of effective dose for occupational exposed workers can be achieved in accordance with guidelines and recommendations when 68Ga from a cyclotron in a radiopharmaceutical production facility. ***References:*** Bonilla-Araya A.A., Salas-Ramirez M., Astúa-Rodriguez K., Mora-Ramirez E. "Internal occupational dosimetry for the occupational worker exposed to [18F] FDG from the Cyclotron-PET/CT Laboratory of the Universidad de Costa Rica", J. health med. Sci, 9(3):3-9, 2023. Castellani, C., Marsh, J., Hurtgen, C., Blanchardon, E., Berard, P., Giussani, A., & Lopez, M. (2013). IDEAS Guidelines (Version 2) for the Estimation of Committed Doses from Incorporation Monitoring Data. EURADOS.Sandgren, K., Johansson, L., Axelsson, J., Jonsson, J., Ögren, M., Ögren, M., . . .Widmark, A. (2019). Radiation dosimetry of [68 Ga]PSMA-11 in low-risk prostate cancer patients. European Journal of Nuclear Medicine and Molecular Imaging. ICRP. (2022). Occupational intakes of radionuclides: Electronic Annex of ICRP. Publications 130, 134, 137, 141, and 151.

EP-0911

Occupational exposure in a Nuclear medicine department: six years follow-up and analysis

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Aim/Introduction: Nuclear medicine (NM) staff is among the most exposed to ionising radiation. The aim of this study is to provide an overview of the radiation exposure of NM personnel to commonly used tracers, such as technetium-99m, fluorine-18 and iodine-123, 68-gallium and 177Lu, to identify the most exposed staff members and, based on an analysis of specific work habits, to propose improvements in radiation protection practices. ***Materials and Methods:*** Routine occupational monitoring results provided by an accredited dosimetry service with passive thermoluminescent dosimeters were retrospectively collected for six years period and analysed. The whole-body dosimeter is placed at chest level. In addition, radiochemists and nurses were equipped with a ring dosimeters and radiochemists: with eye lens dosemeters. The ring dosimeter is positioned at the base of the index finger with detector facing the palm side of the dominant hand. The occupational doses were normalized to the activities used. Data for the staff working habits and use of protective means were also analyzed. ***Results:*** The average annual occupational exposure in terms of effective dose by type of profession, is: physicians: < 0.1mSv (<0.10-0.30), radiochemists 1.53 mSv (0.43-3.18), medical physicist: 0.15 mSv (<0.10-0.58), nurses: 2.5 mSv (1.09-3.99), NM technicians: 0.31 mSv (<0.1-0.92). The average skin dose, min and max is presented in parenthesis, is: radiochemist 25.0 mSv (9.25-40.93), nurses: 22.30 mSv (2.85-41.88) and the average eye-lens dose (radiochemists) is 0.86 mSv (<0.10-1.3). ***Conclusion:*** The annual occupational exposure dose values are below the annual limits, according to the Bulgarian legislation. The most exposed staff members are the radiochemists, followed by nurses. The reason is in the type of work, involving generator elution, quality control of the labeled radiopharmaceuticals, activity dispensing and injection. When protective aprons are not regularly used, the effective dose is twice higher compared to protected staff in the same position. Although the individual exposure is below the recommended annual dose limits, additional efforts to optimize the practice in the NM department should be focused on discussions to improve the radiation protection practices by periodic radiation protection trainings, following the ALARA principle.

EP-0912

Insights fromn the AMS SPRB Collaboration: Recent Advances in Space Radiobiology

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Aim/Introduction: This presentation introduces the latest discoveries resulting from the collaboration between the Alpha Magnetic Spectrometer Roma Sapienza group and the IRCCS S.Orsola Bologna medical physics division with a primary focus on key aspects of space radiobiology. The collaboration aims to leverage the extensive clinical expertise of the IRCCS S'Orsola and the specialized knowledge of ionizing radiation components expected in space. These investigations hold significant importance in light of the planned resumption of human space exploration by national space agencies in Beyond Low Earth Orbit space areas, such as the Moon and Mars.[2]. ***Materials and Methods:*** It begins by examining advanced dose effects models and assessing the current state of knowledge[3]. This evaluation aims to identify areas requiring further investigation, both to enhance the accuracy of existing models and to pinpoint effects that are most relevant for crew health and mission success. For instance, a dose effects model has been explored to determine tumor prevalence concerning expected exposure to protons in deep space. ***Results:*** The analysis underscores the increasing importance of further investigation, particularly in the realms of cardiovascular disease, the central nervous system, and potentially carcinogenic effects. Furthermore, it demonstrates how models can benefit from the values of space radiation measured by astroparticle experiments like the Alpha Magnetic Spectrometer.[4]. ***Conclusion:*** Through these advancements, the AMS SPRB Collaboration enhances the precision of depth dose estimations by integrating Alpha Magnetic Spectrometer (AMS) data. This refines our understanding of space proton behavior and strengthens the reliability of modeling techniques in radiation dosimetry. Ultimately, these efforts position the collaboration at the forefront of deciphering the radiobiological complexities of space, advancing knowledge to facilitate safer and more informed space exploration. ***References:*** [1] M. Aguilar et al., The Alpha Magnetic Spectrometer (AMS) on the international space station: Part II — Results from the first seven years, Phys.Rept. 894 (2021), 1-116, DOI: 10.1016/j.physrep.2020.09.003[2] A. Bartoloni and, L. Strigari, Can high energy particle detectors be used for improving risk models in space radiobiology? On proceedings of the Global Exploration Conference 2021 — IAF Digital Library (iafastro.directory), 62186, International Astronautical Federation.[3] Strigari, L., Strolin, S., Morganti, A. G., Bartoloni A. (2021). Dose-Effects Models for space radiobiology: an overview on dose effect relationships, Front. Public Health 9, 733337. 10.3389/fpubh.2021.733337. [4] A.N. Guracho et al . (2023) Space radiation induced bystander effects in estimating the carcinogenic risk due to galactic cosmic ray , JMMB Vol 23 n.6 , doi:10.1142/S0219519423400237.

EP-57

e-Poster Area

D: Technical Studies -> D4 Dosimetry and Radiobiology -> D41 Preclinical Dosimetry and Radiobiology

EP-0913

Biodistribution of Actinium-225 (Ac-225) and Bismuth-213 (Bi-213) in the kidney and liver in Ac-225 labeled PSMA and octreotate (DOTA TATE) treatment and the effect of 2,3-Dimercapto-1-propanesulfonic acid (DMPS) on biodistribution.

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Aim/Introduction: Ac-225 undergoes decay, producing three daughter radionuclides (Fr-221, At-217, Bi-213), which are then separated from the radiopharmaceutical. The separated Bi-213 tends to be retained in the kidneys and could potentially elevate renal dosages. This study aims to ascertain whether the daughter radionuclides (Fr-221 and Bi-213) resulting from Ac-225 decay expose the kidneys to additional radiation during Ac-225-PSMA and Ac-225-TATE treatments. It also aims to investigate whether DMPS prevents accumulation in case daughter nuclides build up in the kidneys. ***Materials and Methods:*** Our study consists of 2 steps. In the first step, the biodistribution of Ac-225-PSMA and Ac-225-TATE in the kidney and liver and the presence of free Bi-213 in the kidney were examined. In the second step, if there was free Bi-213 in the kidney it was planned to determine whether DMPS prevents this accumulation. Sixteen female Wistar albino rats were divided into two groups. The animals were euthanized 2 and 4 hours after receiving the radiopharmaceutical injection. Kidney and liver tissues were promptly excised following euthanasia. The tissues underwent immediate analysis and were re-evaluated after 24 hours by being exposed to autoradiography film for 1 hour. As Bi-213 was not detected in the kidneys, step 2 was not executed. ***Results:*** There was no uptake in the livers for all animals. The amount of activity in the cortex and medulla was shown in Table-2 ***Conclusion:*** It was determined that there was no difference in renal uptake of Ac-225 radiopharmaceuticals at the 1st and 24th hours ($p<0.05$). Since the cortex/medulla ratio in the kidneys was very similar in the autoradiography performed at the 1st and 24th hours in the sacrificed animals in both groups, it was concluded that the uptake in the kidneys was entirely caused by Ac-225.This research was supported by Tübitak with number 222S291.

EP-0914

Investigation of the long-term micro-distribution, cellular dosimetry, and radiobiological effect of ^{177}Lu-PSMA in LNCaP cells

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Aim/Introduction: Clinical dosimetry considers the activity uptake at a scale of several millimetres, which is accessible via imaging devices such as SPECT or PET. However, understanding the heterogeneous uptake distribution at the cellular and subcellular level and the associated effect on dosimetry can be an essential tool for understanding response to radionuclide therapy. This study aimed to investigate the prolonged uptake kinetics of 177Lu-PSMA-I&T in LNCaP cells to determine cellular absorbed doses and to correlate them with treatment effects. ***Materials and Methods:*** For the uptake assay, 50,000 LNCaP cells were seeded in 6-well plates and incubated at 37°C / 5% CO2 for 48 h. Cells were treated with 300 kBq/mL of 177Lu-PSMA-I&T solution for 3, 6, 18 and 24 h. The membrane-bound and internalized activities were measured in a calibrated gamma counter. Cell counting was conducted using flow cytometry on untreated PI-stained cells. Time-activity-curves were derived from the prolonged uptake measurement and cellular S values were calculated using MIRDcell using the measured fractions of internalized and membrane-bound activity. For the clonogenic assay 50,000 cells were treated for 3 h and 24 h with varying activity concentrations of 177Lu-PSMA-I&T, ranging from 0 to 1.0 MBq/mL. The cell suspension was diluted, and 1000 cells were seeded into 6-well plates and incubated for 14 days. Imaging was performed after cell staining with crystal violet. Immunofluorescence staining was performed after treatment over 3 h with different activity concentrations to determine the number of DSB foci, marked by colocalization of the two repair 53BP1 and γH2AX. ***Results:*** Changes in cellular uptake were observed over 24 h, with peak internalized uptake at 18 h (3.9±1.6 %AA/100.000 cells) and significant differences between 3 h and 24 h. The absorbed dose in the cell determined to be 10.0 Gy with an added activity of 0.3 MBq, using the average time-integrated-activity for all uptake measurements. The clonogenic assay demonstrated a dose-dependent linear decrease in clonogenic survival, with an α value of 0.3 after 24 h of incubation treatment. DNA damage induction increased linearly with the absorbed dose in the nucleus. ***Conclusion:*** The prolonged uptake measurements indicated different kinetics of the membrane-bound and internalized 177Lu-PSMA-I&T component over 24 h. Clonogenic survival and DNA damage were found to be dose-dependent following treatment with 177Lu-PSMA-I&T in vitro. These findings establish a correlation between therapy response and dosimetry on the cellular level, which may assist in understanding treatment effects in vivo.

EP-58

e-Poster Area

D: Technical Studies -> D4 Dosimetry and Radiobiology -> D42 Clinical Dosimetry

EP-0915

Radiation Dosimetry analysis of ^{99m} Tc-Hynic-PSMA-11 in prostate cancer patients for diagnostic scintigraphy

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Aim/Introduction: The aim of this study was to estimate the dosimetry of organs such as Kidneys, Liver, Spleen, Salivary

gland and Urinary Bladder from diagnostic images of 99mTc-Hynic-PSMA-11 in prostate cancer patients. ***Materials and Methods:*** Dosimetry of 99mTc-Hynic-PSMA-11 was investigated in 5 prostate cancer patients. Whole-body planar imaging with scattered window was acquired in GE Discovery SPECT-CT system at 1, 2, 3, 4 and 6 h after tracer injection. One series of SPECT/CT was also acquired at 3 h after tracer injection. GE dosimetry toolkit was used to process the data and contours of organs were drawn on all acquisitions to determine organ activity at each time point. Residence time was calculated using GE provided Dosimetry Toolkit. Absorbed dose was calculated with the help of OLINDA/EXM software (version 2.0) using the time residence. ***Results:*** The mean injected activity of 99mTc-PSMA-11 was 605 MBq (range 555 MBq-666 MBq). No adverse events related to the injection of 99mTc-Hynic-PSMA-11 were reported. Physiological uptake of 99mTc-Hynic-PSMA-11 was seen in Kidneys, Liver, Spleen, Salivary gland and Urinary Bladder in all patients recruited in this study. Radiation absorbed doses were calculated: 2.12E-02 ± 2.8E-03 mSv/MBq for kidneys, 5.21E-03 ± 3.5E-04 mSv/MBq for liver, 6.34E-03 ± 2.8E-03 mSv/MBq for Spleen,1.32E-02 ± 2.05E-03 mSv/MBq for Salivary Gland and 3.55E-02 ± 5.86 E-03 mSv/MBq for Urinary Bladder. ***Conclusion:*** Radiation doses of 99mTc-Hynic-PSMA-11 were comparable to those known for most of the 99mTc tracers and were lower than for the 68Ga-labeled and 18F-labeled agents. The absorbed doses of 99mTc-Hynic-PSMA-11 in all organs showed that it could be used safely in human body ***References:*** Stabin MG, Sparks RB, Crowe E. OLINDA/EXM: the second-generation personal computer software for internal dose assessment in nuclear medicine. J Nucl Med. 2005;46:1023-1027.

EP-0916

Determination of optimal imaging dose of [^{89}Zr]Zr-DFO-Miltuximab and maximum tolerated therapeutic of [^{177}Lu]Lu-DOTA-Miltuximab

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Aim/Introduction: To determine the optimal imaging dose for [89Zr]Zr-DFO-Miltuximab and the predicted maximum tolerated dose for [177Lu]Lu-DOTA-Miltuximab based on biodistribution data from the first in human trial of [67Ga]Ga-DOTA-Miltuximab. ***Materials and Methods:*** Imaging of patients receiving [67Ga]Ga-DOTA-Miltuximab was performed as described previously (1). Organ and whole body absorbed doses were calculated using the OLINDA program. Raw decay corrected data was fitted to mono or bi-exponetial functions to estimate biological half lines. The physical half life of [89Zr]Zr or [177Lu]Lu was incorporated to generate time integrated activity co-efficients (TIACs) for [89Zr]Zr-DFO-Miltuximab and [177Lu]Lu-DOTA-Miltuximab. Absorbed organ and whole body doses were calculated using OLINDA/EXM1.1. ***Results:*** Whole body effective doses were 0.46 mSv/MBq for [89Zr]Zr-DFO-Miltuximab and 0.27 mSv/MBq for [177Lu]Lu-DOTA-Miltuximab. Based on generally accepted normal tissue toxicity for external beam radiation therapy, the dose limiting organ for [177Lu]Lu-DOTA-Miltuximab is bone marrow, with a dose of 6GBq of [177Lu]Lu-DOTA-Miltuximab resulting in 1.9Gy exposure to bone marrow. When used as a theranostic pair, a dose of 50-75MBq for [89Zr]Zr-DFO-Miltuximab and up to 6GBq of [177Lu]Lu-DOTA-Miltuximab is predicted to be within acceptable exposure limits. ***Conclusion:*** Biodistribution data from the first in human trial of [67Ga]Ga-DOTA-Miltuximab was used to determine an optimal imaging dose of 50-75MBq for [89Zr]Zr-DFO-Miltuximab and 6GBq as the predicted maximum tolerated dose of [177Lu]Lu-DOTA-Miltuximab. ***References:*** 1. Sabanathan D, Campbell DH, Velonas VM, Wissmueller S, Mazure H, Trifunovic M, et al. Safety and tolerability of Miltuximab: a first in human study in patients with advanced solid cancers. Asia Oceania J Nucl Med Biol. 2021;9(2):86-100.

EP-0917

Semi-automatic segmentation of all lesions on SPECT/CT images for personalized dosimetry of ^{177}Lu-PSMA treatments

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Aim/Introduction: Personalized dosimetry for metastatic prostate cancer patients treated with 177Lu-PSMA requires segmentation of lesions, including small volumes. However, this step is time-consuming and is particularly problematic for bone metastases which are often difficult to identify on CT scan. The aim is therefore to semi-automatically segment all lesions on SPECT/CT images for dosimetry purposes, and especially bone lesions. ***Materials and Methods:*** An adaptative threshold algorithm was developed using SPECT/CT images of a NEMA phantom. A calibration Threshold-Volume Curve (TVC) was derived from the unique threshold, based on the local maximum, enabling obtention of the actual volume for every sphere filled with 177Lu. Lesions of 177Lu-PSMA patients were segmented on the post-treatment SPECT images using an initialization volume delimited manually and surrounding roughly each lesion uptake, the calibration curve and the lesion-specific TVC. The resulting segmentations, denoted as global, were then smoothed and upsampled at CT voxel size. Assuming that bone lesions were mainly located inside bones, the volume that intersected with bone contours defined on CT was considered as a refined segmentation. To evaluate this approach, the impact of the choice between global or intersection volumes on dosimetric results was assessed. Moreover, SPECT/CT-based segmentations were compared with those performed on 68Ga-PSMA PET/CT images acquired before and after treatment. Finally, semi-automatic segmentation of non-osseous lesions was validated by comparison to manual segmentation. ***Results:*** Forty-seven bone metastases from two patients were segmented by this adaptative thresholding with intersection volumes ranging from 0.22 to 201 mL (median: 4.75 mL). Although global volumes could be largely (up to 72%) located outside bones, the median of lesion doses for each patient was not significantly affected by constraining lesion volume in bones or not ($p = 0.752$ and $p = 1.000$ respectively). Also, segmentations from diagnostic PET/CT resulted in volumes essentially included within bones and similar to the intersection volumes defined on SPECT/CT. For a third patient with 17 small lesions (< 1 mL) in lungs, comparison between automatic and manual segmentations led to Dice index mostly ranging from 0.9 to 1. ***Conclusion:*** An adaptative threshold algorithm was developed to semi-automatically segment lesions, especially bone lesions, treated by 177Lu-PSMA. It was calibrated for the gamma-camera used to image the patients. It allowed a

consistent segmentation of large and small lesions on SPECT in comparison with a segmentation performed on PET. In addition, it was validated on small non-osseous lesions by comparison to manual segmentation.

EP-0918

Personalized dosimetric workflow for ^{177}Lu-PSMA treatments considering the cross-irradiation from bone metastases to red bone marrow

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Aim/Introduction: This work aimed at developing an innovative workflow for 177Lu-PSMA personalized dosimetry to lesions and organs at risk (OAR) simultaneously, considering the cross-irradiation from bone metastases to red bone marrow. ***Materials and Methods:*** Patients were treated for a metastatic castration-resistant prostate cancer with approximately 7.4 GBq of 177Lu-PSMA. Biokinetics in lesions and OAR was assessed using 3 quantitative SPECT/CT images acquired at about 4 h, 24 h and 6 days post-injection. Segmentation of OAR was performed with an open-source code that uses artificial intelligence on CT (TotalSegmentator [1]) and cortical bone was defined using a 1-voxel margin surrounding bones, whereas lesions were delineated using an in-house adaptative threshold algorithm on SPECT/CT images. Then, cumulated activity was computed by fitting a biexponential time-activity curve for lesions and a triexponential curve for OAR [2]. Absorbed dose was estimated by Monte Carlo simulation with Gate 9.0 in a realistic model of the patient based on segmentations previously described. Cross-fire radiation from bone lesions to red bone marrow was evaluated by computing dose with and without cumulated activity in lesions. ***Results:*** First results were obtained for 47 bone lesions after the the first cycle of 177Lu-PSMA of 2 patients, with volumes ranging from 0.2 to 200 mL. Absorbed doses to lesions ranged from 2 Gy to 172 Gy (median: 21 Gy), while dose to kidneys ranged from 5.1 to 6.4 Gy (mean: 5.5 Gy) and from 5.6 to 9.9 Gy (mean: 7.8 Gy) to parotid glands. These results were in accordance with the literature. In addition, absorbed doses to red bone marrow were estimated for the two patients at 1.72 Gy and 1.80 Gy. In particular, bone metastases cross-irradiation contributed respectively to 5.4% and 3.9% of these dose values. ***Conclusion:*** These results indicate the possibility to carry out a comprehensive and personalized computation of absorbed dose to lesions and OAR. Furthermore, this workflow allows consideration of bone lesion contribution to the red bone marrow dose. This contribution might be non-negligible, especially in presence of a high number of lesions located inside bones as often observed for patients who underwent a treatment for a metastatic prostate cancer.

References: [1]Wasserthal J, et al. TotalSegmentator: Robust Segmentation of 104 Anatomic Structures in CT Images. Radiology: Artificial Intelligence. 2023;5:e230024. doi:10.1148/ryai.230024. [2]Jackson P, et al. Technical Note: Rapid multiexponential curve fitting algorithm for voxel-based targeted radionuclide dosimetry. Medical Physics. 2020;47:4332-9. doi:https://doi.org/10.1002/mp.14243.

EP-0919

Yttrium-90 post-radiomebolization dosimetry: comparison between SPECT/CT and LAFOV PET/CT

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Aim/Introduction: To compare the tumor and whole-liver dosimetry post 90Y-radiomebolization between SPECT/CT and a long axial field-of-view (LAFOV) PET/CT. ***Materials and Methods:*** In this retrospective study, 30 patients with either hepatocellular- or cholangio-carcinoma (median age: 71.5 years, 23 males/7 females) treated with 90-yttrium (90Y) microsphere (TheraSphere®: Boston Scientific, Marlborough, MA, USA) radioembolization, received post-treatment a SPECT/CT and a LAFOV PET/CT (each 20 minutes). Pre-treatment dosimetry was based on 99mTc-MAA SPECT/CT. Using Simplicit90Y™ (Mirada Medical Ltd, Oxford, UK), a commercial dosimetry software, the pre- and post-treatment dosimetry plans were defined. The tumor absorbed dose, and the whole-liver normal tissue absorbed dose as well as the lung dose were measured and compared between the post- SPECT and post-PET images. The median injected activity was 2311 MBq (IQR: 1216-3487 MBq) and the median planned tumor absorbed dose was 300 Gy (IQR: 234-350 Gy). Average predicted lung dose was 4.9 ± 7.4 Gy (median: 2.3 Gy, IQR: 0.9-3.7Gy). The lung dose with post-PET was calculated using HERMIA (Hermes Medical, Stockholm). Wilcoxon signed rank test was used to test statistical significance (p-value<0.05). ***Results:*** The median tumor absorbed dose, based on SPECT, over all 30 patients was measured 237.5 Gy (IQR: 181.8-336.2 Gy). The average was 245.5 ± 109 Gy. Similarly for PET, the median and average tumor absorbed dose was: 267 Gy (IQR: 186.3-367.1 Gy), and 276 ± 120 Gy. For the whole-liver normal tissue, there is a dose limit up to 70 Gy, and the measured average absorbed dose for SPECT / PET was 38.1 ± 20 Gy and 36.7 ± 26.3 Gy, whereas the median was 39 Gy (IQR: 22-51) / 35.4 Gy (IQR: 17-48). In addition, the median lung dose for PET was 1.2 Gy (IQR: 0.9-2.6), while the mean was 2.3 ± 2.9, respectively. There was a difference of statistical significance between the post-SPECT and PET tumor and whole-liver absorbed dose. The PET dosimetry was found closer to the planned dose, and higher than the post-SPECT values for the absorbed tumor dose while the dosimetry for the whole liver did not show any difference. ***Conclusion:*** The study investigated 90Y post-radioembolization dosimetry verification based on SPECT/CT and a LAFOV PET/CT. The PET/CT-based dosimetry showed values closer to the planned dose compared to the SPECT, justifying its use over SPECT for reliable 90Y dosimetry validation. LAFOV PET enabled the quantification of the post-therapy lung dose, which might facilitate therapy monitoring.

EP-0920

Patient-specific compartmental models for [^{177}Lu]Lu-PSMA-617 therapy

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Aim/Introduction: In radiopharmaceutical therapy, individualized pharmacokinetics in tumours and in organ-at-risk are needed to assess patient-specific dosimetry and the therapeutic index. In this study, a comprehensive data set consisting of planar images

at multiple time points and one-time point SPECT image were acquired according to an established protocol in 27 patients during the first cycle of a treatment with [177Lu]Lu-PSMA-617. From these data time-activity curves (TACs) were derived in tumours and different organs, such as liver, kidneys, spleen, lungs, salivary glands, bone. In addition, blood samples were collected at multiple time points and generally one urine sample. Patient-specific compartmental models were built up using these retrospective clinical data, and the time-integrated activity curves (TIACs) among the individual patient were calculated. Furthermore, a population model will be setup based on these established patient-specific compartmental models for estimation of patient dosimetry by adopting the specific pharmacokinetics. ***Materials and Methods:*** Based on the activity data derived for each patient from the acquired images in organs and tumours, blood samples at various time points and the urine excretion sample, five individual compartmental model structures were built up for each group of patients who share the same sets of imaged organs and tumours. Urine was assumed to be excreted through kidneys and the urinary path. Identifiability of each compartmental model structure was tested against the available data. For comparison and quality assurance purpose, the TACs in organs, tumours and in blood were obtained by fitting the activities at multiple time points using exponential functions. The resulting TIACs were compared to those obtained using compartmental modelling. ***Results:*** The calculated TACs and TIACs using the established patient-specific compartmental models demonstrated a great variability among the patients. Preliminary results show large individual variations for the calculated TIACs not only in the tumours but also in total bone and rest of the body, ranging from a 3- up to 14-fold difference. In contrast, smaller variations, around 30% or less, were observed for TIACs in blood and in kidneys. Setting up a population compartmental model using these patient data is planned. ***Conclusion:*** A comprehensive set of pharmacokinetic data from patients treated with [177Lu]Lu-PSMA-617 was retrospectively analysed in this study. The TIACs of some organs showed a large variability. A population analysis approach will be applied to derive a population compartmental model for [177Lu]Lu-PSMA-617 therapy which can identify population-specific and individual specific features.

EP-0921

Variability of Quantitative Values by Organ/Lesion Location in Quantitative ^{177}Lu Imaging

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Aim/Introduction: Dosimetry using high-precision quantitative 177Lu imaging is important for achieving excellent outcomes with radionuclide therapy. The standard imaging methods required for quantitative 177Lu imaging are described in MIRD pamphlet No. 23 [1] and No. 26 [2]. Dickson et al. suggest that the recovery coefficient of the quantitative value depends on the configuration of hot spheres [3]. The purpose of our study is to quantitatively evaluate the variability of quantitative values in 177Lu imaging due to different sphere configurations. ***Materials and Methods:*** The background (BG) region of the NEMA body phantom was filled with 57.9 kBq/mL and the hot spheres (13, 17, 22, 28, 37, 60 mm) with 588.8 kBq/mL of 177Lu solution. Acquisitions of 4 rotations of 360 degrees, 90 views, and 420 s/ 90 views was performed in dynamic SPECT scan mode with detector auto-contouring using a Symbia T16 (Siemens). The main energy window was set at 208 keV ±10%, with a 20% scattering energy window at the bottom. SPECT scan was followed by CT scan (130 kV, 100 mA, 0.5 s/rot). The upper lid was rotated to change the configuration of the hot sphere in six different patterns, and the previously described dynamic SPECT and CT scans were repeated in each configuration. Image reconstruction (Iteration 7, subset 10, Gaussian filter 4.8 mm) was performed using the OSEM method with CTAC, scatter correction, and resolution correction. SPECT images were converted to Bq/mL scale by Bq Calibration Factor using RAVAT (Nihon Medi-Physics Co.,Ltd.). VOIs were set for each hot sphere and BG region (n=12) on the SPECT images, and the variability of the quantitative values due to hot sphere configuration was evaluated by the coefficient of variation (CV). ***Results:*** In SPECT images with a 28-min scan duration, the CVs of the quantitative value of hot spheres were, 9.7%, 19.5%, 7.3%, 6.8%, 4.2% and 1.1% for 13, 17, 22, 28, 37, and 60 mm, respectively. Quantitative values of BG region did not differ significantly by hot sphere configuration. ***Conclusion:*** Quantitative values varied with the configuration of the hot spheres, with smaller hot spheres showing greater variation. For organs/lesions larger than 37 mm, the variation in quantitative values by location would be approximately less than 5%. ***References:*** [1] Dewaraja YK, et al. J Nucl Med. 2012 Aug;53(8):1310-25. [2] Ljungberg M, et al. J Nucl Med. 2016 Jan;57(1):151-62. [3] Dickson JC, et al. Eur J Nucl Med Mol Imaging. 2023 Mar;50(4):980-995.

EP-0922

Investigating Lucy-Richardson deconvolution for partial volume correction for image-based dosimetry after ^{177}Lu radionuclide therapy

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Aim/Introduction: While quantitative SPECT/CT allows for patient specific dosimetry of 177Lu, its limited spatial resolution can underestimate the absorbed dose. Lucy-Richardson deconvolution (LRD) has already been applied for partial volume correction in PET. The aim of this study was to investigate the potential of LRD as a means of a partial volume correction in 177Lu SPECT imaging and dosimetry. ***Materials and Methods:*** The NEMA IEC Body Phantom (foreground-to-background ratio 8:1, 237:30kBq/mL) was measured according to the local imaging and reconstruction protocol. Sigma for LRD was determined by fitting the guassian filtered density map to the original image (OI). Phantom recoveries in the spheres were compared between the OI, and OI with applied LRD as a postprocessing to determine the optimal number of iterations. Furthermore, LRD was applied to the reconstructed SPECT series (24, 48, 72 h p.i.) of five patients receiving 177Lu-DOTATATE treatment to compare its effect on the dose estimates. Absorbed dose to the lesions in the OI and LRD was estimated using MIM software. Lesion segmentation (PETedge+ tool on the OI) and curve fitting was identical in the

absorbed dose calculation in both OI and LRD. The absorbed doses from the two methods were then compared. ***Results:*** Based on the phantom measurement, using the optimal number of iterations (4) and a sigma of 1.25mm, there was on average 16% (3-26%) improvement in the recovery coefficients between the OI and LRD. For patients, as expected the total body absorbed dose was within 1% when the OI was used in comparison to the addition of LRD. The liver lesion (N=22) volume was on average 4.4 mL (1.5 - 17.7 mL). Average dose was 5.29±3.00Gy (OI) vs. 6.98±4.44Gy (LRD). When comparing the OI to LRD there was an average increase in absorbed doses of 25±8% (12 - 43%). Mean improvement per patient was 27±6%(N=5), 22±6%(N=3), 14±4%(N=2), 25±10%(N=5), and 28±9%(N=7) respectively. ***Conclusion:*** LDR consistently led to increasing absorbed doses in all lesions for 177Lu-DOTATATE treatment while maintaining the same total body dose. Future work includes adding more patients having received 177Lu-DOTATATE but also patients suffering from prostate cancer who have received 177Lu-PSMA, in which the tumor to background ratio is different. Additionally, the variation of acquisition and reconstruction parameters is advisable for testing the robustness of the LRD approach. This preliminary study suggests that LRD may be a promising option for partial volume correction in 177Lu-SPECT imaging and dosimetry.

EP-0923

An Analytical Uncertainty Estimator for Monoexponential TAC Tail Fits

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Aim/Introduction: Uncertainty in absorbed dose estimates in molecular radiotherapy depends directly upon time-integrated activity (TIA) uncertainty. This is sensitive to the modelling of the time-activity curve (TAC) tail [1]. Therefore, good choice of tail extrapolator is critical when using non-parametric TAC integration methods. This work aimed to design an estimator of the TIA uncertainty due to random noise in activity measurements in monoexponential tail modelling. ***Materials and Methods:*** Variance estimators for the tail TIA were derived using Taylor series expansions (TSEs) based on monoexponential fitting of the tail and assuming normally-distributed measurement noise. The estimators were empirically validated up to third order using Monte Carlo sampling. We used a previously published TAC model derived from population measurements of kidneys during [Lu-177]-PSMA-617 treatment [2]. The second-to-last timepoint was fixed at 48h, while the last timepoint varied between 60h and 192h. Empirical estimates were calculated with 10,000 samples, with 5 noise levels (NLs) at 0.1%, 1%, 10%, 20% and 40% of the ground truth TAC value at each timepoint.The method was also applied to a clinical example from the SNMMI 2021 dosimetry challenge [Lu-177]-DOTATATE dataset. Activities were measured using a 1 cm^3 spherical ROI in the left kidney at the 100h and 200h timepoints. Empirical uncertainty estimates were obtained using 5 different ROIs. ***Results:*** Theoretical estimates were in good agreement with empirical values within approximately 2% error. For example, at 10% NL the 2nd order estimate at 140h was 1.63 %iA*h, compared to the empirical value 1.66 %iA*h. Results showed higher order estimators were more accurate. Decrease in estimator accuracy was observed in scenarios when simulated measurements were not decreasing with time; this was more likely the case at higher NLs and at shorter time intervals (i.e., between the consecutive measurements). Empirical uncertainty for the 5 ROIs in the SNMMI case (NLs 4.4-10.3%) was 1.20 MBq*h (12.8% of the mean) whereas predicted uncertainty values using TSEs were between [0.94, 1.38] MBq*h. ***Conclusion:*** Analytical tail TIA uncertainty estimators were derived. Monte Carlo empirical validation indicated relative error below 2% at clinically relevant noise levels, particularly for late final timepoints. The underlying modelling assumptions (noise normality and activity measurements decreasing with time) for the analytical derivation may limit its applicability and are open to further investigation. In particular, the derived estimators are not valid when activity measurements used for the tail modelling are less likely to be decreasing. ***References:*** [1] https://doi.org/10.1007/s00259-022-05727-7 [2] https://doi.org/10.2967/jnumed.123.266268.

EP-0924

Qualitative and quantitative SPECT/CT imaging of actinium-225 for targeted therapy of gliomas - phantom studies.

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Aim/Introduction: The use of the Ac-225 in radionuclide therapy has recently become popular. Therapeutic use should involve an attempt to estimate the absorbed dose, which in the case of Ac-225 is not an obvious task. It is related to the decay chain involving many isotopes with different physicochemical properties. However, the first step to calculate the absorbed dose is proper quantitative imaging. The study aimed to confirm the feasibility of SPECT/CT imaging of Ac-225. In particular, to present qualitative and qualitative assessment of the received images. Additionally, to present the SPECT image quantitative calibration method, as well as validation measurements and their accuracy. ***Materials and Methods:*** A collarless Jaszczak phantom with cylindrical sources of various sizes was filled with Ac-225 solution. The initial activity concentration was 235 kBq/ml. SPECT/CT imaging was performed after filling the phantom, using a Siemens Symbia T6 with HE collimators. Three energy windows were considered: I. 440 keV (width 10%, Bi-211), II. 218 keV (width 10%, Fr-221), III. 78 keV (width 20%, Ac-225 with bremsstrahlung X-rays).Five combinations were used: only I, only II, only III, sum I+II, sum I+II+III. DEW or TEW method was used for SC. AC based on CT images was performed. Other imaging parameters were as follows: 64 images per detector, time per image of 30 s, OSEM Flash 3D using 8 subsets, 10 iterations, Gaussian filter (FWHM 4 mm). Additionally, the 3D printed model of the glioblastoma tumour was developed and imaged to evaluate the accuracy of the chosen protocol. ***Results:*** The contrast, signal-to-noise ratio and coefficient of variance in the images will be presented, as well as for quantification - calibration factor CF and recovery coefficients RC. The maximum value of CF was calculated for setting I+II+III (21 cps/MBq). Using the calibration factor and recovery coefficients obtained, the activity in a 3D-printed model of a glioblastoma tumour with uncertainty of no more than 10% and satisfying accuracy for (I+II+III) energy window setting was quantified. ***Conclusion:*** Our results showed the possibility of Ac-225 SPECT/CT imaging with good quality in all combinations of energy windows. Moreover, quantification of Ac-225 SPECT/CT image could be performed with satisfactory accuracy and uncertainty for

multiple energy window settings. There are still many challenges that need to be considered in further research on alpha emitter imaging (including high noise in the image, and other than standard SC scattering correction methods).

EP-0925

A retrospective study investigating dose-response in ^{90}Y SIRT, using PET/CT voxel dosimetry and RECIST 1.1 response criteria to identify overall tumor dose-response, and variations due to patient gender and tumor characteristics such as KRAS mutation status, primary tumor location and tumour size.

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Aim/Introduction: This study was a retrospective analysis of tumour dose delivered from selective internal radiation therapy (SIRT), with the aim to identify a dose-response relationship and factors that affect this, including KRAS mutation, patient sex, tumour size and primary location. ***Materials and Methods:*** This study included 38 patients with a total of 86 well-defined tumours. Administered activity was based on a modified body surface area (mBSA) model, with the dose calculated from post-therapy PET/CT scans taken ~18 hours after administration. The voxel dose-map allowed the mean tumour dose and dose to 70% (D70) to be calculated. The response was determined from CT images using RECIST 1.1 (Eisenhauer et al., 2009). ***Results:*** The results showed the median average tumour dose was 81Gy (Range: 21Gy to 245Gy), with a D70 median dose of 57Gy (range 7.4 Gy to 209 Gy). Overall and KRAS status dose-response differences were not statistically significant. A statistically significant difference was observed between male and female patients. Patients with stable disease or partial response were mostly male (74%), with females much less likely to be in these groups (46%). A Chi squared independence test confirmed this ($X2= 7.449$, $df = 2$, $p = 0.024$). Potential causes of these difference were investigated and tumor volume, tumor burden, age, or presence of lung metastasis were not found to have any difference between the sexes. A difference in the location of the primary CRC tumour was observed, but no difference in dose-response between these tumor locations was seen. The characteristics discussed above were also tested independently with no statistically significant differences in dose-response identified. ***Conclusion:*** The mBSA model was not capable of delivering sufficient tumor dose to match recommendations from EANM guidelines (Weber et al. 2022). The switch to using the partition model of dosimetry is therefore required to deliver higher doses.The statically significant differences in dose-response between male and female patients deserves additional study as it was not explained by differences in other characteristics in this work. ***References:*** Eisenhauer, E. A., et al. (2009). 'New response evaluation criteria in solid tumours: Revised recist guideline (version 1.1)' Eur J Cancer, 45 (2), pp. 228-47. DOI: 10.1016/j.ejca.2008.10.026Weber, M., et al. (2022). 'Eanm procedure guideline for the treatment of liver cancer and liver metastases with intra-arterial radioactive compounds' Eur J Nucl Med Mol Imaging, 49 (5), pp. 1682-1699. DOI: 10.1007/s00259-021-05600-z.

EP-0926

The effect of thionamides on radioiodine-131 bio-kinetics in patients suffering from Graves' disease.

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Aim/Introduction: Thionamides are required in patients suffering from Graves' disease but should be discontinued at least 3 days prior to radioiodine-131 therapy (RIT) to avoid an influence on intra-thyroidal bio-kinetics of iodine. However, the required therapeutic radioiodine-131 activity has to be calculated individually in a radioiodine-131 uptake test (RIUT) one week prior to RIT and may therefore still be performed under thionamides. Therefore, the aim of this retrospective analysis was to evaluate the influence of thionamides on intra-therapeutic uptake. ***Materials and Methods:*** In a retrospective monocentric study, 829 patients suffering from Graves' disease undergoing RIUT and RIT were evaluated. Patients were subdivided into three groups depending on their intake of thionamides (Group A: patients with carbimazole medication (n=312), group B: patients with methimazole medication (n=252) and group C: patients without thionamides (n=265)). The groups A and B were further subdivided depending on the dosage reduction of thionamides. The influence of thionamides was statistically evaluated by calculating the variance of the determined individual intra-thyroidal uptake (EMU) between RIUT and RIT within the single groups and within the subgroups. ***Results:*** No significant differences could be detected when comparing EMU in RIT to EMU in RIUT ($p>0.05$) when administering an equal dose of thionamides or no thionamides in RIUT and RIT. In the subgroups with reduced dosage of thionamides prior to RIT EMU was significantly increased in RIT compared to RIUT (21 % - 80 %) ($p<0.05$) depending on the administered dosage. ***Conclusion:*** Due to the significant dose-dependent increase of EMU in RIT compared to EMU in RIUT, thionamides should be discontinued for at least two days prior to RIUT to achieve the designated target dose more precisely and to minimize radiation exposure of organs at risk.

EP-0927

Correlation Between Longitudinal Dosimetry and PET Follow-Up as Indicator for Salivary Gland Toxicity After Lu-177-PSMA Therapy

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Aim/Introduction: Lu-177 PSMA therapy has been shown to prolong survival in patients with metastatic prostate cancer. However, salivary gland uptake can lead to xerostomia, severly limiting patients' quality of life. Xerostomia is also more likely to develop in consecutive treatment cycles due to the cumulation of absorbed dose. PSMA PET follow-up may be a useful indicator of salivary gland absorbed dose in consecutive treatment cycles, enabling protective means to be taken. Knowing whether major changes in salivary gland absorbed dose are to be expected can also be used to schedule patients for more extensive imaging and dosimetry protocols. The aim of this study is to evaluate the longitudinal salivary gland absorbed dose compared to salivary gland uptake in the initial and follow-up PET exams. ***Materials***

and Methods: Our study included eight patients diagnosed with metastasized castration-resistant prostate cancer, who underwent six cycles of Lu-177-PSMA-I&T therapy (mean injected activity: 7.46 GBq per cycle). After each cycle whole-body SPECT/CT imaging was performed at 24, 48, and 72 hours post administration. F^{18}-PSMA-1007 PET/CT images (mean injected activity: 0.23 GBq) were acquired prior to the first cycle and preceding the third and fifth cycle. Parotid and submandibular glands were segmented in PET and SPECT (24 h) data using PETedge+ in MIM. Dosimetry was performed using MIM SurePlan MRT and a mono-exponential fit model. ***Results:*** The average absorbed doses from cycle one to six were as follows: submandibular glands: 0.29±0.13 Gy/GBq, 0.29±0.18 Gy/GBq, 0.31±0.10 Gy/GBq, 0.28±0.12 Gy/GBq, 0.28±0.09 Gy/GBq, and 0.21±0.09 Gy/GBq; parotid glands: 0.45±0.14 Gy/GBq, 0.46±0.20 Gy/GBq, 0.40±0.17 Gy/GBq, 0.34±0.14 Gy/GBq, 0.33±0.14 Gy/GBq, 0.25±0.15 Gy/GBq. No recovery correction was applied to the data. A strong correlation was observed between the activity uptake of the salivary glands in the first PET and the salivary gland absorbed dose of the first cycle (submandibular glands: r=0.73, p-value=0.003; parotid glands: r=0.71, p-value=0.005). 6/8 patients showed a consistent trend for the uptake in the PET follow-up and the longitudinal dosimetry for the submandibular and the parotid glands (5/6 patients showed constant PET uptake and absorbed dose). ***Conclusion:*** This preliminary analysis suggests that PET may serve as an indicator for the absorbed dose in the salivary glands. This information may also be useful to schedule patients for either single- or multi-time-point imaging. Further evaluation with a larger patient cohort is planned to validate these observations.

EP-0928

Dosimetry from the first-in-human study on [^{68}Ga]Ga-NOTA-PEG$_2$-RM26 - A GRPR antagonist

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Aim/Introduction: Gastrin releasing peptide receptor (GRPR) is overexpressed in several types of malignant tumors making it an attractive target for nuclear medicine diagnostics and therapy. In our study, a new GRPR seeking radiopharmaceutical, [68Ga]Ga-NOTA-PEG2-RM26 has been injected for the first time in humans. The aim of this study is to perform dosimetry of this new radiopharmaceutical. ***Materials and Methods:*** A total of 6 prostate cancer patients and 6 breast cancer patients were injected intravenously with 2 MBq/kg of [68Ga]Ga-NOTA-PEG2-RM26. PET-CT scanning was performed at 5 min, 20 min, 40 min, 1h, 2h and 3h post injection. The voided urine was collected, weighed, and measured in a gamma counter. Organs with significant radiopharmaceutical accumulation were considered source organs (pancreas, spleen, liver, renal cortex, and urinary bladder contents). Segmentation of the PET image determined the total activity of the source organ at each time point. Different segmentation methods were used depending on the characteristics of the uptake. The dosimetry calculation was performed using standardized dosimetry software according to MIRD formalism. A dynamic bladder model was used to determine the time-integrated activity for the bladder content using 1h voiding interval. ***Results:*** An injection of [68Ga]Ga-NOTA-PEG2-RM26 resulted in a sex-averaged effective dose of 14 µSv/MBq (preliminary data on 6 of 12 patients). The uptake of the radiopharmaceutical in pancreas reached a maximum value of 5.0% of injected activity (median, range 2.6-7.3%) at 5 min post injection followed by a fast clearance. The corresponding values for the liver and the kidney cortex were 6.5% (median, range 4.3-12.2%) and 2.9% (median, range 1.6-4.2%) respectively. The pancreas received the highest equivalent dose in both groups, 155 µSv/MBq (range 132-177 µSv/MBq) in the breast cancer group and 128 µSv/MBq (range 87-178 µSv/MBq)) in the prostate cancer group, followed by the urinary bladder wall and the kidneys. ***Conclusion:*** A PET examination of a normal-weighted person with [68Ga]Ga-NOTA-PEG2-RM26, a gastrin releasing peptide antagonist, gives an effective dose of 2 mSv (140 MBq, 2 MBq/kg for a 70 kg patient) and is in the same range as other 68Ga-labelled GRPR targeting radiopharmaceuticals.

EP-0929

Image guided evaluation of ^{212}Pb-VMT-α-NET in metastatic Neuroendocrine tumors: Bio distribution and Dosimetry

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Aim/Introduction: 212Pb-VMT-α-NET peptide is a somatostatin receptor targeted ligand for targeted alpha therapy in patients with Neuroendocrine tumors (NETs). The aim of this study was to assess the biodistribution and image-guided dosimetric estimates of 212Pb-VMT-α-NET peptide used for targeted alpha therapy. ***Materials and Methods:*** Five patients with confirmed somatostatin-expressing neuroendocrine tumors on 203Pb-VMT-α-NET peptide / 68Ga-DOTANOC imaging were administered with 212Pb-VMT-α-NET peptide (130-135MBq). For dosimetric analyses, SPECT/CT images were acquired for the patients on Siemens Intevo 6 with high-energy collimators using dual windows (40% at 79 keV and 20% at 239 keV) and dual scatter windows of 20% for the 79 keV peak centred on 55 keV and 103 keV and 5% for the 239 keV peak centred on 209 keV and 268 keV at 2,10 and 20hrs post administration. A camera-specific calibration factor derived from phantom measurements was used for quantification. Reconstructed images were generated and uploaded into Hybrid Dosimetry Module™. A dosimetric analysis was done for kidneys, spleen, liver, bone marrow and tumor lesions for the single cycle. Since, therapeutic nuclide 212Pb decays further to 212Bi, 212Po and 208Tl, all time activity curves derived from the 212Pb data were recalculated using the replacement nuclide function for Bi-212 and Tl-208, however, Po-212 was disregarded due to its ultra-short half-life (3µs). ***Results:*** Maximum physiological radiotracer uptake was observed in the kidneys as the radiotracer was observed to be predominantly excreted through the renal route in all patients. Liver, spleen, bone marrow were the other organs showing diffuse physiological uptake of the radiopeptide along with the pathological uptake in tumor lesions. The average equivalent doses from a therapeutic activity of 130-135MBq of 212Pb-VMT-α-peptide, when summed for all the daughter radionuclides were 1.5 Sv to the kidneys, 1.0 Sv to the spleen, 1.7 Sv to the liver, 0.38 Sv to the red marrow, and the tumor doses were in the range of 3-8Sv. ***Conclusion:*** The SPECT/CT imaging

with 212Pb-VMT-α-NET showed prompt tumor accumulation, high tumor retention, and rapid renal excretion. Image guided dosimetry of 212Pb-peptide for targeted alpha therapy seems to be an accurate and a straight forward option for dose calculation, however, the dosimetry estimate for clinical translation requires a larger study.

EP-0930

Impact of cross-irradiation on single time-point dosimetry in ^{177}Lu-PSMA therapy

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Aim/Introduction: The Single Time-Point (STP) methods enable dosimetry in 177Lu therapy without requiring extensive image acquisition time. They assume that the total absorbed dose by the volume comes solely from self-irradiation. However, some organs may be affected by cross-irradiation, due to their proximity to high uptake tissues. In this study, we adapted three STP methods to include cross-dose and assess its impact on the total absorbed dose. ***Materials and Methods:*** Twenty-one patients with metastatic castration-resistant prostate cancer received treatment with 177Lu-PSMA. A total of 52 cycles were completed, each involving a single whole-body SPECT/CT acquisition at 24 hours post-injection. For each cycle, absorbed doses to the left (LK) and right (RK) kidneys, liver (L), and spleen (S) were estimated using three different single time-point (STP) dosimetry methods named STP1, STP2 and STP3 [1-3], respectively. For sixteen patients, three SPECT acquisitions are available after the first cycle, providing reference doses (MTP) [4]. These simplified methods were further modified to account for cross-dose by computing dose rate maps with low-statistics Monte Carlo simulations. The obtained absorbed doses were then compared to those estimated using the original methods and those using the reference MTP method. ***Results:*** The means and standard deviations of the percentage dose differences for LK, RK, L, and S between the original (reference) and adapted STP1 and STP3 methods are: -31.7±1.0, -31.6±1.0, -27.1±2.4, -26.7±3.6 and 1.6±1.4, 1.8±1.4, 12.2±3.9, 11.3±5.6. For the sixteen cycles for which reference doses are available,the percentage dose differences between the original STP1, and STP3 methods and the MTP method are: 48.4±23.9, 47.4±27.0, 44.8±39.5, and 30.0±41.6, and 4.8±16.9, 2.1±17.8, -5.9±27.2, and -14.7±28.4 while they are 1.5±15.8, 0.8±17.9, 5.4±27.2, and -4.2±28.4 for adapted STP1 and 6.5±16.4, 3.8±17.5, 4.8±27.7, and -4.8±29.4 for adapted STP3. ***Conclusion:*** Cross-irradiation has minimal impact on the STP3 method, whereas for the STP1 method, the MC based methods yields values much closer to those of the MTP method than the original STP1 method. ***References:*** [1] Hänscheid et al., NuklearMedizin, 2017 [2] Hänscheid et al., JNM, 2018 [3] Madsen et al., Medical Physics, 2018 [4] Vergnaud et al., EJNMMI Physics, 2022.

EP-0931

Is pre-therapeutic dosimetry on dynamic ^{68}Ga-PSMA-11 PET/CT imaging a good estimate of post-^{177}Lu-PSMA-617 therapy absorbed dose in metastatic, castration-resistant prostate cancer?

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Aim/Introduction: In 177Lu-PSMA-617 targeted radionuclide therapy, predicting the absorbed dose based on pre-treatment scans could be a step forward in personalised medicine, by improving patient selection and adjusting the therapeutic dose. The aim of this study was to assess the agreement between mean absorbed dose coefficients extracted from diagnostic dynamic 68Ga-PSMA-11 PET/CT and after the first cycle of 177Lu-PSMA-617 therapy in healthy organs in patients with metastatic, castration-resistant prostate cancer (mCRPC). ***Materials and Methods:*** Seven patients (mean age of 72y) with mCRPC who underwent diagnostic 68Ga-PSMA-11 PET/CT scans followed by a 7.4 (±10%) GBq 177Lu-PSMA-617 therapy were included. Pre-therapeutic mean absorbed dose coefficients in healthy organs (kidneys, liver, spleen, salivary glands and red bone marrow extracted from L2 to L4) were obtained from six passes of 68Ga-PSMA-11 whole-body PET/CT scans performed in continuous bed motion, for approximately one hour. Post-therapeutic mean absorbed dose coefficients of the same organs were extracted from SPECT/CT scans acquired 5h, 24h, 4 days and 8 days after the first injection of 177Lu-PSMA-617 therapy. Healthy organs were manually delineated on the CT images using MIM® software (v.7.3 MIM Inc., Cleveland, OH, USA) and the corresponding organ-specific time-activity curves were generated. Cumulated activities were fitted using a trapezoidal method and considering only physical decay after the last imaging time point. S-value based dosimetry was performed in IDAC-Dose v2.1 using organ time integrated activity coefficients and adjusted masses. Spearman correlation coefficients were calculated between pre- and post-therapeutic mean absorbed dose coefficients. ***Results:*** Two patients had diffuse metastatic bone disease for which red bone marrow analysis could not be performed. The mean (±SD) absorbed doses before and after treatment were 0.35(±0.17), 0.07(±0.05), 0.02(±0.002), 0.11(±0.04) and 0.11(±0.03) mGy/MBq and 0.54(±0.21), 0.17(±0.18), 0.04(±0.05), 0.34(±0.20) and 0.09(±0.05) mGy/MBq for kidney, liver, red bone marrow, salivary glands and spleen respectively. Strong significant correlations were observed between the mean absorbed dose coefficients before and after treatment for kidney (ρ=0.93, p-value=0.007), liver (ρ=0.82, p-value=0.034), salivary glands (ρ=0.93, p-value=0.007) and spleen (ρ=0.86, p-value=0.024). ***Conclusion:*** Strong correlations between pre- and post-therapeutic mean absorbed dose coefficients were observed for kidneys, liver, salivary glands and spleen. These results highlight the potential of a predictive pre-therapeutic dosimetry based on diagnostic imaging. Only red active bone marrow showed no significant agreement between pre- and post-treatment dosimetry. To confirm these results, further investigations are underway by recruiting additional patients, and an extended analysis of tumours dosimetry will be carried out.

EP-0932

Comparison of Organ Dosimetry in ^{177}Lu Theranostics: StarGuide™ vs. Conventional SPECT/CT Camera

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Aim/Introduction: The advent of StarGuide™, a ring-shaped CZT-based SPECT/CT camera, offers promising prospects for optimizing theranostics, particularly for 177Lu-based therapies. Due to its novelty, there is a need to validate its quantitative performance compared to a conventional camera. ***Materials and Methods:*** 177Lu-DOTATATE (7317 MBq) was administered on an off-label compassionate use basis in a patient with advanced multiple myeloma, resistant to all standard therapy lines, and

with intense somatostatin receptor positivity on 68Ga-DOTATATE PET/CT. Subsequently, the patient underwent multiple SPECT/CT scans and blood samples for dosimetry purposes. Four scans were acquired post-injection (at days 0, 1, 3 and 6) on both a StarGuide™ and a Discovery 870 DR. Acquisition durations varied between the systems: 20 min/bed (days 0 and 1) and 40 min/bed (days 3 and 6) on the Discovery, and a fixed 5 min/bed on StarGuide™. Two blood samples were collected within the first hour after the injection, and four additional samples were collected together with the SPECT/CT scans. SPECT data from the 208 keV photopeak were reconstructed using the protocol suggested by the manufacturer for each camera and converted into Bq/ml by applying a previously calculated calibration factor (1). Activity concentration in blood, assumed to be equal to that of red marrow, was measured in a NaI(Tl) well counter. Dosimetry of the liver, spleen, kidneys and red marrow was performed according to the MIRD formalism as described in a previous publication (2). Percentage differences between absorbed doses (ADs) obtained with SPECT/CT data acquired on the Discovery and on the StarGuide™ was computed as Δ(%)=(ADStarGuide-ADDiscovery)/ADmean, with ADmean the mean AD. Treatment and imaging procedures were performed after submission to the local ethics committee and patient informed consent. ***Results:*** ADmean to liver, spleen, kidneys and red marrow were 1.72, 14.0, 6.67, 0.198 Gy, respectively. Corresponding Δ(%) were equal to 7%, -2%, -4% and 1%. ***Conclusion:*** StarGuide™ demonstrated comparable organ dosimetry to the conventional system but with shorter acquisition times. This suggests its potential to streamline therapeutic procedures without compromising dosimetric accuracy. However, it is essential to consolidate these results through a larger sample size and include lesion dosimetry. ***References:*** (1) Danieli et al. Quantitative 177Lu SPECT/CT imaging for personalized dosimetry using a ring-shaped CZT-based camera. EJNMMI Phys 10, 64 (2023). https://doi.org/10.1186/s40658-023-00586-z (2) Marin et al. A dosimetry procedure for organs-at-risk in 177Lu peptide receptor radionuclide therapy of patients with neuroendocrine tumours. Phys Med. 2018;56:41-49. doi:10.1016/j.ejmp.2018.11.001.

EP-0933

Dosimetry comparison of a high affinity FAP imaging agent [Cu-64]LNTH-1363S with other PET diagnostic imaging agents

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Aim/Introduction: Fibroblast activation protein-α (FAP) is emerging as a pivotal target in molecular imaging of cancer as well as inflammatory and fibrotic diseases. FAP-targeted PET ligands have demonstrated improved tumor specificity and sensitivity compared to conventional [18F]FDG across various cancers. Here we report biodistribution and dosimetry estimates from a Phase 1 first-in-human (FIH) imaging study of [Cu-64]LNTH-1363S, a small molecule with an affinity of 21 pM for FAP, including comparisons to other PET diagnostic imaging agents. ***Materials and Methods:*** [Cu-64]LNTH-1363S was prepared in good radiochemical yield (95.8 +/- 1.4%) and radiochemical purity (~100%) for administration to six healthy participants (3M, 3F, age range 24 - 54). Doses ranged from 204 - 222 MBq with administered mass dose ranging from 80 - 97 ug. Whole-body PET/CT (skull vertex to thigh) data were performed at 0.25, 1, 4, and 24 hours post-administration. Whole-blood samples and urine were collected.Time-activity curves for predefined regions of interest (ROIs) were analyzed using exponential models to compute time-integrated activity coefficients (TIACs). A blood-based red marrow TIAC was computed. The voiding bladder model was used for bladder TIAC. Absorbed dose was calculated with OLINDA 2.2.3. The study was conducted in compliance with applicable clinical regulations and ethical standardsPublished data were used to compile dosimetry estimates for [F18]FDG, [Ga-68]FAPI-46, [F-18]DCFPyl, and [Cu-64]DOTATATE. ***Results:*** The effective half-life of [Cu-64]LNTH-1363S was 4.86 ± 0.57 hours with a whole-body effective dose of 0.010 +/- 0.004 mSv/MBq. The organ receiving the highest absorbed dose was the urinary bladder (median 0.068 mGy/MBq, range 0.054 - 0.242 mGy/MBq). All other target organs absorbed doses below 0.025 mGy/MBq, including kidneys at 0.022 +/- 0.007 mGy/MBq.As shown in Table 1, comparative analysis to other PET agents, including [F-18]FDG, [Ga-68]FAPI-46, [Cu-64]DOTATATE, and [F-18]DCFPyl, demonstrated that [Cu-64]LNTH-1363S provides competitive or lower tissue absorbed doses and whole-body effective doses, indicating favorable dosimetry. ***Conclusion:*** The administration of [Cu-64]LNTH-1363S is safe and demonstrates minimal off-target uptake, with primary clearance through the kidneys and bladder. Normal organ absorbed dose and whole-body effective dose were comparable or lower than for several other diagnostic PET imaging agents. The high affinity, low background, and favorable dosimetry of [Cu-64]LNTH-1363S support its further development as a FAP-targeted diagnostic imaging agent. ***References:*** 1. Detectnet [FDA package insert].2. Pylarify [FDA package insert].3. FDG [FDA package insert].4. J Nucl Med 2005; 46:608-6135. FDG [EMA package leaflet].

EP-0934

Optimization in combined radionuclide and external beam radiation therapy using biologically equivalent dose

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Aim/Introduction: Combined planning of radionuclide therapy (RNT) and external beam radiation therapy (EBRT) is currently not done in clinical practice. For the patient regarded in this study, organ at risk (OAR) absorbed dose prognosis showed that the patient may benefit from a combined treatment with EBRT to achieve higher and more homogeneous total doses to the lesions before reaching OAR dose limits, especially kidneys with an assumed dose limit of 23Gy [1]. We aim to investigate EBRT planning based on equivalent dose in 2Gy fractions (EQD2) voxelwise, accounting for delivered RNT-doses in a treatment planning system (TPS). ***Materials and Methods:*** Dosimetry for one 9GBq fraction of 177Lu-PSMA-617 was performed based on 177Lu-SPECT/CT images for one patient with metastatic castration-resistant prostate cancer. Activities were time-integrated using population-averaged effective half-lives. Dose computations were performed using a newly developed GPU based MC which was previously verified against gold-standard Monte Carlo code in phantom geometry [2]. A photon volumetric modulated arc therapy (VMAT) plan and a proton plan with two beams, each 15 fractions, were created to treat lesions located in the spine. Physical RNT-dose was automatically converted voxelwise into EQD2 within the plan optimization and used as background

EQD2 in the optimization. The plans were optimized to achieve an EQD2 for the combined treatment of 60Gy to 99% of the lesion volume (EQD299≥60Gy) while limiting OAR EQD2 using DVH and maximum EQD2 objectives. ***Results:*** The mean absorbed doses were 4.9±0.8Gy (kidneys), 0.18±0.03Gy (bone marrow) and 15.9±4.2Gy with homogeneity index (HI) D5/D95=4.22 (lesions) for the RNT fraction. For combined treatment, mean lesion EQD2 were 60.19±3.69Gy (RNT+VMAT) and 60.21±3.69Gy (RNT+Proton) with HI of 1.14 and 1.10. Mean kidney EQD2 were 6.53±0.54Gy (RNT+VMAT) and 3.53±0.54Gy (RNT+Proton). Spinal cord doses D10=42.27±0.43Gy (RNT+VMAT) and D10=40.57±0.46Gy (RNT+proton) were lower than the dose limit D10=43.68Gy. ***Conclusion:*** The result shows voxelwise MC RNT doses can be combined with EBRT with improved HI and lower OARs doses compared with multiple RNT fractions. To our knowledge, this was the first time that protons were combined with RNT in a retrospective study and that EBRT doses were optimized based on EQD2 without the needed for prior EQD2 conversion within a research version of a commercial TPS. ***References:*** [1]Herrmann K, et al J Nucl Med 2024; 65:71-78, DOI: 10.2967/jnumed.123.265448; [2]Chauvin M, et al J Nucl Med 2020; 61:1514-1519, DOI: 10.2967/jnumed.119.240366.

EP-0935

Comparison of dosimetry results obtained with different software tools in first in-human use of 177Lutetium-labelled HER2 affibody in a patient with breast and lung cancer

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Aim/Introduction: Accurate dosimetry is crucial for optimizing therapeutic efficacy while minimizing toxicities in surrounding healthy tissues, especially in the clinical application of a novel radiopharmaceutical. Different dosimetry calculation methods are now commonly available. This study aimed to evaluate dosimetric results obtained using three distinct software tools with their own dosimetry model - Monte Carlo (MC), Semi-Monte Carlo (SMC) and Voxel S-values (VSV) - in a first in-human use of 177Lutetium-labelled HER2 affibody and to assess how different computational algorithms impact dose calculations for both tumours and Organs at Risk (OARs). ***Materials and Methods:*** An activity of 1.4 GBq of 177Lu-HER2 Affilin was injected in a female patient with metastatic concurrent breast and lung HER2-positive cancers. A SPET/CT tomograph equipped with medium energy collimators was used to perform acquisitions. Dual energy window was used. Three bed positions of 60 frames each, lasting 6.981 seconds, were acquired. A total of 6 SPET/CT acquisitions was performed 28min (t1), 4h, 18h, 42h, 66h and 90h post injection. SPET/CT images were then reconstructed with a dedicated vendor-neutral tool of one of the softwares in order to obtain quantified images (Bq/ml) using the proper tomograph Calibration Factor. Registrations between t1 and subsequent acquisitions were performed and saved as aligned series. Contouring of t1 CT scan was conducted with a physician's assistance. An AI tool was used for OARs contouring (kidneys, liver, spleen and lungs), while primary tumours and metastases were manually contoured in breast, lung and bone. Dosimetry was then performed using the three aforementioned software tools, using MC results as reference. ***Results:*** The difference between mean dose in Gy from SMC and MC was: -0.2 (two lung metastases), 0.1 (lung primary), 0.1 (bone metastasis), 0.0 (breast central and apical); 0.1 (liver), 0.2 (kidneys), -0.5 (lungs), -0.1 (spleen). The difference between mean dose in Gy from VSV and MC was: -0.4 and 0.0 (two lung metastases, respectively), 0.1 (lung primary), -0.1 (bone metastasis), -0.1 and 0.0 (breast central and apical); 0.3 (liver), -0.4 (kidneys), 0.0 (lungs), -0.1 (spleen). ***Conclusion:*** The differences in mean doses calculated by the three software tools were small, with discrepancies mostly ranging from -0.53 Gy to 0.28 Gy across tumours and OARs. This indicates a relatively consistent performance among the used software tools in terms of dosimetric precision. Further studies should be conducted to assess the findings of this study.

EP-0936

How Accurate Should be Dosimetry for Radiopharmaceutical Therapy from a Clinical Perspective?

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Aim/Introduction: Despite the revealed potential of dosimetry in the optimization of radiopharmaceutical therapy (RPT), restriction of clinical implementations leads to the compromised development of simplified protocols to enhance the adoption in clinical routine, which introduces more errors in dosimetry. However, it is still unclear if these errors would influence the impact of dosimetry in clinical practice. ***Materials and Methods:*** In this retrospective study, we analyzed data from 20 patients diagnosed with metastatic castration-resistant prostate cancer (mCRPC) who underwent multiple cycles of 177Lu-PSMA-617 treatment. Cumulative dosimetry of all the treatment cycles were calculated using both the standard multi-time point dosimetry (MTPD) method and the single time point dosimetry (Hänscheid) method. Their correlation with treatment outcome (PSA decline rate and overall survival, OS) and complication risk (anaemia grade) was investigated. The Fisher's Z-Transformed test was performed to statistically evaluate the difference between the correlations. ***Results:*** Compared to MTPD, STPD has introduced a deviation in whole-body tumor dose of a mean percentage error (MPE) of 26.50%, range of (-30.83%, 43.86%). Both STPD and MTPD of whole-body tumor demonstrated non-significant difference in the correlations with PSA decline rate (MTPD: $r = -0.34$, $p<0.001$; STPD: $r= -0.48$, $p<0.001$; $Z= 0.26$, $p=0.80$), and both shown significant impact on OS (MTPD: Hazard Ratio = 1.01, $p<0.01$; STPD: Hazard Ratio = 1.02, $p<0.05$). Additionally, both STPD and MTPD of non-tumor bone shown non-significant difference in correlation with anaemia grade (MTPD: $r = 0.35$, $p<0.001$; STPD: $r= 0.40$, $p<0.001$; $Z= -0.39$, $p=0.70$). ***Conclusion:*** Our preliminary results indicate that, despite an error of up to 43.86% in the simplified dosimetry approach, it still provides a comparable correlation in predicting treatment outcomes and toxicity risks in mCRPC patients undergoing 177Lu-PSMA-617 therapy. Further systematic investigation is needed to determine the acceptable level of accuracy for dosimetry from a clinical perspective.

EP-0937

Determination of a reliable parameter with Monte Carlo Simulation for dosimetry in ^{177}Lu-DOTATATE PRRT

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Aim/Introduction: Monte Carlo Simulation (MC) based on 3D patient images has emerged as a next generation dosimetry tool as it can calculate the absorbed dose distribution from quantitative images using repeated random particle history simulations. The MC enables more accurate predictions depending on the number of histories, but it is problematic for computational processing time. Therefore, we aimed to determine an appropriate and reliable number of histories for the MC in patients after 177Lu-DOTATATE PRRT using two types of MC software. ***Materials and Methods:*** We acquired SPECT/CT images at four time points (4h, 28h, 103h, 124h) from a male patient in 177Lu SNMMI Dosimetry Challenge. Absorbed doses were calculated for the left (LK) and right (RK) kidneys, the liver (L), spleen (S) and two lesions (T1, T2) using RT-PHITS (Japan Atomic Energy Agency) and Voxel Dosimetry (Hermes Medical Solutions). The 3D dose-rate distribution at each imaging point calculated by EGS5 simulation code in RT-PHITS was analyzed using 3D Slicer. For Voxel Dosimetry, the 3D dose-rate distribution was determined based on interactions of electrons and photons using PENELOPE. History numbers from 104 to 109 were repeated three times. The calculated dose rates were integrated over time using an exponential model. We evaluated variations in absorbed dose and statistical error derived by RT-PHITS and Voxel Dosimetry. ***Results:*** Variability improved with increasing numbers of histories for both types of software, and the coefficient of variance (CV) for each lesion and organ excluding T2 was < 1% at 107 for RT-PHITS. The CV in T2 was 9.09% at 107 and 1.49% at 108, respectively. These statistical errors with respect to the history were ~ 95% for 106, ~ 50% for 107 and ~ 5% for 5 ×108 histories. The statistical error was larger for the early time points of 4h. Thus, the derived absorbed dose was stable within 5% for 106 histories and within 1% for 107 histories. The absorbed dose derived by Voxel Dosimetry was constant > 105, and the T2 at 104 was reduced by 75% compared to 108. ***Conclusion:*** Setting > 106 histories for RT-PHITS were stable at ≤ 5%, and the optimal history was 107 in terms of calculation time and accuracy. Voxel Dosimetry affected absorbed doses < 104, and we determined the optimal number was 106. However, statistical errors increased during the early phase and the number of histories must be set considering imaging time.

EP-0938

Use of Voxel Based Dosimetric Parameters for Predicting Early Treatment Response to Y-90 TARE

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Aim/Introduction: The purpose of this study was to determine voxel-based dosimetric parameters in correlation with favorable response based on magnetic resonance (MR) or computer tomography (CT) after Yttrium-90 (Y-90) transarterial radioembolization (TARE) for hepatocellular carcinoma (HCC) to predict early treatment response. ***Materials and Methods:*** 25 patients (21 males, 4 females, mean age 69,5 ± SD 10,4 years) with 25 HCC lesions who underwent radiation segmentectomy (RS) with Y-90-microspheres were retrospectively included between January 2020 and March 2024 at our institution. Multi-compartment dosimetric analysis was performed on post-treatment Y-90 PET-CT images to calculate the average absorbed doses (TAD) and volumes of targeted lesion (TV) and liver parenchyma. The early response of lesions was recorded with initial assessment (1-3 months) after treatment on contrast-enhanced MR or CT reports according to modified Response and Evaluation Criteria in Solid Tumors (mRECIST). Lesions with complete response (CR) and partial response (PR) were deemed dose-tumor responsive group (RG), while lesions that remained stable disease (SD) and progressive disease (PD) were deemed non-responsive group (NRG). The relationship between calculated dosimetric parameters and the response to treatment was statistically evaluated using Mann-Whitney U and ROC analysis. ***Results:*** The average follow-up time was 14,3± SD 9,8 mo and 8 (32%) patients died during this period. In early treatment evaluation, 12 target lesion (48%) were interpreted as PR, 9 (36%) were SD, and 4 (16%) were PD. Average TAD for PR, SD, PD groups was 253,5 ± 117,1 Gy, 239,5 ± 69,1 Gy, 266,5 ± 150,8 Gy respectively. The average TV value was calculated for PR, SD, PD groups (148 ± 192,8 cc, 847,2 ± 836,1 cc, 128,3 ± 82 cc respectively). There was no significant difference in TAD of targeted lesions between RG versus NRG (median, 229 Gy [IQR: 167-300 Gy] vs 219 Gy [IQR: 180-341 Gy], respectively; p=0.936). However, NRG had significantly higher average TV value than RG (respectively median, 408 cc [IQR: 110-863 cc] vs 98 cc [IQR: 22-175 cc]; p=0.026). Optimal cut-off TV value for dose-tumor control success were less than 185 cc (sensitivity 69%, specificity 83%, AUC 0.76). ***Conclusion:*** Although a dose-response relationship in TARE is known for tumoral lesions of liver, definition of standardized dose thresholds between RG or NRG groups could not be demonstrated in our HCC lesions to which RS was performed. However, the average TV value seems to be a more effective parameter for predicting early treatment response.

EP-0939

[^{99m}Tc]Tc-MAA based Predosimetry versus ^{90}Y based Postdosimetry for Resin Microsphere Radioembolization

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Aim/Introduction: The main goal is to find out the relative difference between the calculated patient-specific absorbed doses (ADs) via [99mTc]Tc-MAA SPECT/CT based predosimetry (before treatment) and to find the difference in ADs calculated via 90Y SPECT/CT and PET/CT based postdosimetry. In addition, between 90Y SPECT/CT and PET/CT based postdosimetry were investigated. ***Materials and Methods:*** 35 patients received radioembolization treatment with resin microspheres based on personalised-BSA method. For all patients, prior to the radioembolization treatment, [^{18F}]F-FDG PET/CT scan, MRI scan, [99mTc]Tc-MAA SPECT/CT were acquired. After radioembolization, post-treatment 90Y SPECT/CT scan for all patients and post-treatment 90Y PET/CT scan for 10/35 patients was acquired. For all dosimetry evaluations, patient-specific lung, healthy liver, perfused liver and tumor analyses were performed by using NUKDOS software. Volume and activity quantifications were performed by using CT-or-MRI and SPECT-or-PET guided drawn segments, separately. For 35 patients, pre- and postdosimetry based ADs of lung, healthy liver, perfused area and tumor were compared. For the same regions , 90Y SPECT/CT and 90Y PET/CT based ADs were compared for 10/35 patients. ***Results:*** Calculated mean ADs of healthy liver, lung and tumor based on predosimetry was 69.5 ± 66.7, 9.9 ± 7.5, 345.2 ± 308.6, respectively, whereas ADs of healthy liver, lung and tumor based on postdosimetry (90Y SPECT/CT

imaging) was 26 ± 25, 7 ± 5, 478 ± 439, respectively. Compared to postdosimetry, [99mTc]Tc-MAA SPECT/CT predosimetry based ADs were always higher as a factor of 1.5 ± 0.6 for lung, 7.2 ± 6.6 for healthy liver, 2.6 ± 2.3 for tumor. Concerning postdosimetry based on 90Y PET/CT and 90Y SPECT/CT scans, calculated ADs of healthy liver and tumor significantly varies between patients, especially when the tumor overload is high. In case less tumor overload, the relative difference between SPECT and PET based post dosimetry was 10-15%, however, for the patients with less tumor load, high differences was observed up to factor of 3. ***Conclusion:*** Compared to postdosimetry results, it's observed that predosimetry overestimated the healthy organs ADs; however, still If the treatment was performed based on [99mTc] Tc-MAA SPECT/CT based predosimetry instead of BSA, as a factor of 2.6 ± 2.3 higher treatment activity can be safely administered which directly increase tumor ADs. As a result higher treatment outcome can be achieved. With dosimetry, maximum tumor ADs with safe ADs in healthy liver can be achieved, which decrease the risk of hepatotoxicity and provides longer-term survival.

EP-0940

Comparison Between Different Methods of Red Marrow Absorbed Dose Calculation in Treatments with [^{177}Lu] Lu-DOTATATE. Correlation with Whole Body Absorbed Dose

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Aim/Introduction: This work pursues two objectives: -To compare the results of red bone marrow (RM) absorbed doses obtained by blood samples method and by SPECT images method -Check if the whole body (WB) absorbed dose can de used as surrogate for RM dose in treatments with [177Lu]Lu-DOTATATE. ***Materials and Methods:*** RM activity was quantified in 47 treatment cycles of 27 patients treated with [177Lu]Lu-DOTATATE, in two different ways: (1) blood method: taking eight blood samples and measuring the activity concentration in a well counter and (2) images method: delineating the interior of the vertebrae on 3 SPECT/CT images during the first week post-administration. In both cases, the total RM dose was obtained in two ways: (a) complete method: taking into account the contribution of RM, kidneys, liver, spleen and rest of the body (RoB); and (b) simplified method: taking into account only RM and RoB contribution. Finally, WB dose was calculated from WB activity measurements with an ionization chamber. S factors were obtained from OLINDA. Correlations between RM and WB absorbed doses were analyzed. ***Results:*** Median (first quartile, third quartile) doses obtained are 29(22, 48) mGy/GBq for WB, 15(13, 23) mGy/GBq for RM with simplified blood method, 13(11, 18) for RM with complete blood method, 30(21, 35) mGy/GBq for RM with simplified images method and 25(18, 33) mGy/GBq for RM with complete images method. The RM absorbed dose obtained with blood and images methods show a weak correlation (Spearman's coefficient 0.30). The RM absorbed dose obtained with blood method shows a strong correlation with the WB dose (Spearman's coefficient 0.74). The relationship between the RM absorbed dose obtained from images and the WB dose depends on the hepatic uptake. In patients with low hepatic uptake, both variables show a moderate correlation (Spearman's coefficient 0.49) and do not show significant differences. In patients with high hepatic uptake the correlation worsens (Spearman's coefficient 0.38). ***Conclusion:*** The blood and the images methods yield significantly different values of RM dose. The RM absorbed dose from blood shows a strong correlation with the WB dose, so one could be obtained from the other. In patients with low hepatic uptake, RM dose from images and WB dose do not show significant differences, so the WB dose could be used as a surrogate for the RM dose.In both methods, quantifying only the RM and RoB compartments overestimates the RM dose.

EP-0941

Dosimetry Methodology of Targeted Radiopharmaceutical Therapy with n.c.a. [^{177}Lu]Lu-edotreotide in GEP-NET patients: the COMPETE trial

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Aim/Introduction: Presenting the dosimetry methodology used for assessing the safety and efficacy of radiopharmaceutical therapy (RPT) with non-carrier-added (n.c.a.) [177Lu]Lu-edotreotide (DOTATOC) in treating unresectable or metastatic, progressive, somatostatin receptor (SSTR)-positive, grade 1-2 (Ki-67 ≤20%) gastroenteropancreatic neuroendocrine tumours (GEP-NETs). ***Materials and Methods:*** In the phase 3 COMPETE trial—a global, prospective, randomised, controlled, open-label study comparing the efficacy and safety of [177Lu]Lu-edotreotide with everolimus, 324 participants were enrolled in a 2:1 respective ratio. Although the trial is still ongoing, recruitment and dosimetry evaluations have been completed. The 222 participants allocated to RPT received up to four treatment-cycles (D1 to D4) of [177Lu] Lu-edotreotide (7.5 GBq/cycle) every three months unless a progression was observed. Three additional sub-study groups of approximately 20 participants each were included for: a) initial and repeated assessments at D1-D4, b) full SPECT/CT dosimetry, and c) blood-based bone marrow evaluations. Imaging and calibration protocols were standardised across sites utilising NEMA phantoms. Identical OSEM SPECT reconstruction with scatter and CT based attenuation corrections were performed for all patients' scans. Dosimetry was performed by using QDOSE software. For the dosimetry of tumours and healthy organs, sequential whole-body planar scans acquired nominally at 0.5, 6, 24, 72/96 h post-injection in combination of one SPECT/CT (at 24 h post-injection) was analysed. Organ/tumour segmentations were performed by a medical imaging specialist and confirmed by a board-certified physician. Activity and volume quantifications were carried out separately based on planar/SPECT guided and CT guided segments, respectively. The SPECT guided segments were drawn larger than actual CT-based organ/tumour volumes, to account the spill-out effect. For activity quantification on planar scans, background subtraction correction method was applied. After segmentation, time-activity curves were created, and monoexponential fitting was performed to calculate the resulting time-integrated activity coefficients (TIACs). For absorbed dose calculations, the IDAC-

Dose 2.1 program implemented in QDOSE software was used with organ mass correction based on patient-specific CT volumes. ***Results:*** The comprehensive dosimetry results from the COMPETE trial, which are forthcoming could potentially provide insights into absorbed dose-effect relationship for [177Lu]Lu-edotreotide, potentially contributing to the broader scientific discussion on targeted RPT dosimetry. ***Conclusion:*** The understanding gained from the COMPETE trial's dosimetry sub-studies is thought to enhance [177Lu]Lu-edotreotide treatment optimisation, through standardised absorbed dose determination using simplified protocols, thereby supporting the application of personalised dosimetry in clinical practice.

EP-0942

Streamlining Quantitative SPECT/CT Imaging Protocols for Optimized Lutetium-177 Dosimetry of Radiopharmaceutical Therapies

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Aim/Introduction: With rapidly growing numbers of Lutetium-177 radiopharmaceutical therapies, new challenges for safety and efficacy of the treatments arise. Post-therapeutic dosimetry verification is often hampered by the requirement for long and multiple time points (TPs) quantitative SPECT imaging leading to additional burden for patients and limiting capacity to perform dosimetry per patient due to scanner availability. Aim of this work was to investigate quantification accuracy of an ultra-short Lutetium-177 SPECT protocol compared to a standard SPECT imaging protocol to enable routine dosimetry. ***Materials and Methods:*** Four patients underwent quantitative Lutetium-177-PSMA SPECT/CT imaging at three TPs between 24h and 144h post-injection using the standard SPECT imaging protocol (60 steps, 15s/step; total 15min per bed) and a shortened image acquisition protocol (60 steps, 5s/step; total 5 min per bed), and a single CT scan. SPECT scans were quantitatively reconstructed with attenuation and scatter correction. Volumes of interest (VOIs) for kidneys, liver, and spleen were segmented on the CT images using an automatic segmentation algorithm. VOI statistics were extracted, time-activity-curves were generated and fitted mono-exponentially for both protocols. Organ absorbed doses (ADs) were calculated using IDAC-Dose2.1. Percentage differences (PD) in activities between protocols per TP, and in AD were compared. ***Results:*** The median PD in activity between protocols was -3.0% (min: -8.5%, max: 9.3%) for kidneys, -2.6% (min: -11.0%; max: 5.2%) for liver, and -3.8% (min: -11.9%, max: -0.1%) for spleen for the 24h TP. For 48h TP, median PD of -8.5% (min: -15.7; max:2.1%) for kidneys, -3.4% (min:-8.6%; max: .3%) for liver, and -3.7% (min:-27.7; max:-3.5) for spleen were found. For the TP at 72h or 144h, median PD of -2.4% (min: -15.3%; max: 33.4%) for kidneys, -5.7% (min: -16.7%; max: 0.0%) for liver, and -10.9% (min: -19.2%; max: 0.4%) for spleen were found. The median PD in ADs was -6.6% (min: -20.2%; max: 17.2%) across organs and patients. ***Conclusion:*** The ultra-short Lutetium-177 SPECT protocol showed activity quantification in good agreement with the standard protocol for all patients and TPs. The PD increased towards later imaging TPs, where smaller activity concentrations are present. Small median differences in AD below -7% across organs were found. In general, the reduced overall imaging time by two thirds makes the streamlined protocol a valuable alternative for routine clinical dosimetry. Future analysis will expand on a larger patient cohort and include lesions.

EP-0943

Comparative Analysis of PET-MR and PET-CT Imaging for Post-Therapy Assessment of ^{90}Y-Microsphere SIRT in Hepatocellular Carcinoma

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Aim/Introduction: Selective Internal Radiation Therapy (SIRT) with Yttrium-90 Microspheres has become an important intervention in the management of hepatocellular carcinoma and liver metastases. Following therapy, accurate imaging is required to evaluate whether treatment has been successful and to perform dosimetry. PET is the preferred option for post-treatment imaging and at our centre both PET-CT and PET-MR are available. Each imaging modality has advantages over the other, with PET-CT derived attenuation correction considered the gold standard for quantitative accuracy, and PET-MR facilitating superior soft tissue resolution and lesion delineation. This study aimed to assess and compare the performance of these modalities in imaging following SIRT with 90Y-Microspheres. ***Materials and Methods:*** Six patients with hepatocellular carcinoma underwent 90Y-SIRT, followed by both PET-CT and PET-MRI. PET data was reconstructed using a Bayesian Penalized-Likelihood algorithm (Q-clear). A comprehensive analysis was conducted on 227,804 voxel data points retrieved from the PET images. To ensure spatial congruence, CT images were aligned with MR images via automated rigid registration. PET images from PET/CT were transformed to align with MR space, facilitating direct comparison. Conversion from Bq/ml to Gy was performed to permit dose comparison. A difference image was created by subtracting PET-CT from PET-MR, with doses above 20 Gy segmented in both modalities. ***Results:*** The correlation coefficient between PET-MR and PET-CT was found to be 0.88, indicative of a strong positive relationship. Median difference in dose was observed to be -1.03 Gy, with interquartile range (Q1-Q3) spanning from -8.70 Gy to 5.98 Gy. Bland-Altman analysis revealed a mean difference of -1.16 Gy, with upper and lower limits of agreement (±1.96 SD) at +34.05 Gy and -36.36 Gy, respectively ***Conclusion:*** Our study indicates that PET-MR and PET-CT are comparable for post-therapy 90Y-Microspheres imaging, with the voxel level data demonstrating strong correlation and a small bias. Although not considered the gold standard for quantification, the MR attenuation correction works satisfactorily for the purposes of post-SIRT imaging.

EP-0944

Dose distribution parameters for the prescription in ICC (intrahepatic cholangiocarcinoma) patients undergoing Transarterial Radioembolization with 90Y

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Aim/Introduction: Personalized dosimetry is known to be associated with improved response rate in the treatment of liver tumours through transarterial radioembolization (TARE). In daily practice, tumour response can vary considerably. The reported dose-response relationships are based in mean absorbed dose to tumour remaining unclear the significance of other dosimetric parameters as predictive factors of tumour control. In this study we aimed to determine dosimetric parameters associated with radiological response and evaluate the predictive potential of tumour covering in intrahepatic cholangiocarcinoma (ICC) patients undergoing TARE. ***Materials and Methods:*** We conducted a retrospective screening of patients diagnosed with ICC who underwent TARE using Y-90-loaded glass microspheres in our centre between December 2021 and July 2023. The dosimetric analysis was performed with commercial voxel-based software on PET/CT images performed within 24 hours after treatment. Dose-volume histograms of the tumour volume, segmented manually, were obtained. We calculated the average absorbed tumour dose (Dmean), the percentage of the target volume receiving the prescribed dose threshold recommended by the EANM guidelines1 (D260Gy) and the minimum absorbed dose that covers 90% and 95% of the tumour volume (D95%, D90%). Tumour control was assessed 3 months after treatment by CT or MRI using response assessment criteria in solid tumours (mRECIST). ***Results:*** Eight patients (age, median 68 (IQR 63-70) years) were included in the study. Objective radiological tumour control (TC) was observed in 37.5% of the patients (n=3). The responsive lesions showed a higher average tumour dose and percentage of targeted volume covered. The dosimetric parameters that demonstrated the most prominent differences between responsive and non-responsive lesions were D90% and D95%. For the evaluated parameters, the median (interquartile range) were: D95% 14Gy (7-18Gy) TC and 0Gy (0-0Gy) progressive disease (PD); D90% 34Gy (27-41Gy) TC and 2Gy (0-25Gy) PD; V260Gy 49% (47-56%) TC and 30% (14-51%) PD; Dmean 595Gy (461-615Gy) TC and 307Gy (168-321Gy) PD. ***Conclusion:*** Our findings suggest that tumour covering, defined with D90% or D95%, is also a good predictive factor of tumour control and not only average tumour dose, which does not consider the heterogeneity of dose deposition. These findings, if confirmed by more patients and prospective studies, may contribute to the development of more efficient treatment approaches using glass-based Y-90 microspheres. ***References:*** 1. Weber, M., Lam, M., Chiesa, C. et al. EANM procedure guideline for the treatment of liver cancer and liver metastases with intra-arterial radioactive compounds. Eur J Nucl Med Mol Imaging 49, 1682-1699 (2022).

EP-0945

Dosimetric optimization of therapy of metastatic differentiated thyroid cancer with ^{124}I PET: initial results of an ongoing phase II trial

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Aim/Introduction: To demonstrate that the first treatment with 131I of metastatic differentiated thyroid cancer (MDTC), optimized with dosimetric treatment planning with 124I, provides an objective response rate on soft tissue metastases at 6 months higher than the fixed activity administrations. ***Materials and Methods:*** 124I is produced in Negrar while therapy is delivered in INT. 124I PET is acquired in both centres. Patients are prepared with hormone withdrawal both for dosimetry and therapy. Oral administration of liquid 124I (100 MBq) is followed by blood sampling and whole body counting at 2, 6, 24, 96 h. PET scans are taken at 24 and 96 h. Lesion post-therapy dosimetry is performed on SPECT/CT taken at 48 and 96 h. Response is assessed by comparison with basal 18F FDG PET, contrast-enhanced CT or MRI, 124I PET and thyroglobulin level, 6 months after one or two optimized treatments. ***Results:*** We studied 20 patients with 124I, sent us by 8 different centres. Ten (50%) were dropped out. Nine to remnant ablation since metastases were 124I negative and one to more urgent radiotherapy. Two will be treated in May 2024 with 12 GBq. Eight received 10 optimised treatments (3, 4a, 4b, 7a, 7b, 8, 10, 11, 12, 13). In treatments 3 and 4a we were forced to reduce the usual activity for MDTC (8-9 GBq) to 6 and 4 GBq, to deliver less than 2 Gy to blood. In treatments 4b and 8, seen the presence of bone metastases, we admistered almost the maximum tolerable activity (20 GBq and 16 GBq, respectively). No patient suffered from moderate/severe haematological toxicity nor from sialoadenitis/xerostomia. Abrorbed dose values were in general lower than predicted both lesions and blood. However, patient 7, with diffuse miliariform lesions in lungs, showed a post-therapy lung absorbed dose 3 times higher than predicted, with suspect cough at 3 months, but without breathing capability reduction at spirometry. Patients 3 & 4, with masses of 106 and 33 cm3 at sacrum and skull respectively, previously unsuccessfully treated with external beam, showed complete response at 124I and are still showing Tg complete response after 28 and 12 months. ***Conclusion:*** 124I PET showed higher diagnostic sensitivity than post-therapy 131I SPECT/CT. Predictive lesion dosimetry was less important than blood dosimetry, since heterogeneity of predicted absorbed dose seldom allowed a true optimisation, leading rather to maximization, especially with bone metastases. The study is funded by the AIRC Foundation.

EP-0946

Estimating lung lesion mass for dosimetry purposes using an oversized VOI in CT images

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Aim/Introduction: Mass estimates are important to compute absorbed doses in therapeutic nuclear medicine. Here, we show that an oversized VOI can be used in CT images to measure the lesion volume without delineating its perimeter by inverting the partial volume effect. This "partial volume"-based method is evaluated for CT lung lesions in an anthropomorphic phantom, using a hybrid SPECT/CT and a diagnostic CT. ***Materials and Methods:*** The Kyoto Lungman phantom was used with six different spherical lung lesions of different diameters (5-12 mm) and densities (-800, -630 and +100 HU), placed at diverse locations relative to the bronchial structures of the phantom. Nine datasets were produced from hybrid CT scans for selected combinations of exposure (130 kVp, 18 mAs, 110 kVp 27 mAs; or 80 kVp, 65 mAs), slice thicknesses (1, 3 or 5 mm), and kernels (AC, soft tissue, or lung).

Diagnostic CT scans used the clinical standard (100 kVp, 2.2 mAs, deep learning reconstruction) or low dose protocols (80 kVp, 1.2 mAs, iterative reconstruction), reconstructed with 2.5 mm slices, and using 0.625 mm slices with and without edge enhancement; 6 datasets in total. The proposed volume method uses intensity measurements from an oversized volume of interest (VOI), which contains the whole lesion and a margin of background voxels. The VOI, lesion (L) and background (BG) intensities (I) and volumes (V) are then related by VVOI×IVOI=VL×IL+VBG×IBG, and VVOI=VL+VI, giving: VL=((IVOI-IBG)/(IL-IBG))×VVOI. The lesion intensity (IL) was measured using an internal VOI. The background (IBG) was derived from the difference of two spherical VOIs both containing the full lesion. In addition, three alternative measurements were performed for comparison: Volume estimated by three diameter measurements and the ellipsoid equation; a spherical VOI; and using segmentation tools for solid and sub-solid lesions (-800 HU sphere not supported), respectively. All measurements were performed on the hospital's clinical reading system. Relative errors vs nominal sphere volume is reported (arithmetic mean ± standard deviation). ***Results:*** On the hybrid system the observed deviation a was −5±13%. The reference measurements were 8±28%, −3±19% and 18±16% (one outlier removed). On the diagnostic CT the proposed method achieved 4±9%, while the reference results were −3 ± 15 %, 13 ± 15 % and 18 ± 9 %. ***Conclusion:*** The partial volume estimate using an oversized VOI outperformed the diameter-, sphere- and segmentation based approaches. Future work should include, larger lesions, non-spherical lesions, and hand drawn reference volumes.

EP-0947

Comparison of dosimetry techniques for post-therapy 90Y Radioembolization image-based in LYSO and BGO scintillator PET scanners.

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Aim/Introduction: Personalized dosimetry has shown its potential in improving treatment response rates and overall survival. Radioembolization post-treatment dosimetry can be computed by the direct conversion of the PET scanner activity concentration or by introducing the known injected activity in a calibration volume. No recommendations exist of which method it's more reliable, however, there is some evidence that a BGO PET calibration factor could be misleading for 90Y. This study aims to compare both dosimetric methods and evaluate the impact of detector technology. ***Materials and Methods:*** A 90Y-resin microspheres NEMA phantom underwent PET scanning to calculate activity concentration relative error. Image acquisition utilized a BGO PET-CT and a Time of Flight (TOF) LYSO PET-CT reconstructed using Q.Clear with a 2500 penalty factor. Results were validated in 21 90Y-resin microsphere patients (19 in the BGO PET and 6 in the LYSO PET). Post-TARE 90Y-resin microspheres dosimetry was performed using the Local Deposition Method with and without known activity. In the latter approach, administered activity was measured and corrected by the ratio of post and pre-treatment dose rate measurements of the vials and catheters utilizing an area detector at fixed position and reconstructed using the phantom experiment parameters. NEMA phantom activity concentration and the patients tumor dose differences by each method were studied via a Bland-Altman analysis. Additionally, the Wilcoxon signed-rank test was conducted comparing both methods. Separate analyses were performed for the LYSO and BGO PET-CT scans. ***Results:*** In the Bland-Altman analysis, all values fell within the confidence interval, with no dependencies observed with the mean tumor dose calculation. For BGO and LYSO PET-CT scans, the mean relative errors were 19% (95% CI: 1%-72%, p=0.03) and 30% (95% CI: 2%-55%, p=0.006), respectively. On the phantom side, the mean relative error difference between LYSO and BGO PET in the 90Y NEMA phantom was 44% (95% CI: 35%-64%). ***Conclusion:*** The method without administered activity consistently resulted in higher mean dose values in the tumor. The disparity between dosimetric methods was more pronounced in LYSO PET acquisitions than in BGO PET acquisitions, contrary to the expected results. More work should be done 90Y-resin microspheres PET calibration and standard measurements of post-treatment administered activity in order to standardize post-treatment dosimetry.

EP-0948

Quantifying the impact of residual activity on therapeutic index: an updated dosimetric comparison between [^{177}Lu]Lu-PSMA-10.1 and [^{177}Lu]Lu-PSMA I&T

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Aim/Introduction: Radiohybrid ligands to the prostate-specific membrane antigen (PSMA) are a new group of theranostic agents with favourable pharmacokinetic properties compared to the conventional vectors used in radioligand therapy (RLT). We previously compared one of these radioligands, [177Lu]Lu-rhPSMA-10.1 (rh10), with [177Lu]Lu-PSMA I&T (I&T) in patients with metastatic castration-resistant prostate cancer (mCRPC) [1]. However, residual activities within the organs and tumours from the initial administration were not factored into the second set of dosimetry measurements. This can have a notable effect when radioligands with long tumour retention times such as rh10 are used. Here we investigate the influence of these residual activities on the therapeutic index TI (ratio of mean tumour absorbed dose to renal absorbed dose). ***Materials and Methods:*** Comparative dosimetry was performed for four patients (P1-P4) with advanced, histologically proven mCRPC. Each patient received ~1 GBq of rh10.1 and ~1GBq of I&T separated by a period of 7 days. For P1, P3, P4 the first radioligand administered was rh10, P2 started with I&T. Renal and tumour absorbed doses were determined using four SPECT/CT scans up to one week post injection. For the second radioligand, the absorbed doses were corrected for residual activities by taking into account the extrapolated portion of the area under the time-activity curve of the first radioligand. The TI of both radioligands were compared with and without the correction for residual activities. ***Results:*** The TI for I&T decreased in P1, P3, P4 by 66%, 34% and 23%, respectively, when considering residual activities from previous administration of rh10. This is mainly due to an almost unchanged corrected renal dose (maximal reduction of −3%), but a median decrease in tumour absorbed doses of 33% (minimal and maximal decrease: 22%, 100%). Thus, the ratio of the TI for rh10 to I&T increased from 1.3 to 3.8 in P1, from 1.8 to 2.7 in P3 and from 1.1 to 1.4 in P4. For P2 (I&T first), corrections of tumour and renal absorbed doses for rh10 were negligible (less than 0.5% and 2% reduction respectively). ***Conclusion:*** When comparing two radioligands using dosimetry, residual activities from first dosimetry should be taken into account for second dosimetry if

radioligands with long retention times are used. This additional analysis demonstrates an even greater improvement in TI for rh10 compared to I&T, than previously published values. ***References:*** [1] Rinscheid et al., J Nucl Med, 2023, 1;64(12):1918-1924.

EP-59

e-Poster Area

D: Technical Studies -> D4 Dosimetry and Radiobiology -> D43 Clinical Radiobiology

EP-0949

Pharmacokinetic time-dependence and dose-rate effect in molecular radiotherapy - comparing therapeutic potential of different radionuclides?

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Aim/Introduction: In molecular radiotherapy (MRT), absorbed doses D(Gy) to tissues are calculated by integrating time-activity curves (TACs). Today, this can be done in a voxel-wise manner and utilizing efficient dose calculation algorithms. As we readily determine TACs in MRT, radiobiological effect of dose-rate could be used in calculation of biologically effective dose (BED). Furthermore, this can be studied to hypothesize, which radionuclide has the best therapeutic potential depending on the radiobiological (RB) parameters of critical organs and tumors. ***Materials and Methods:*** We performed calculations for altogether ten β- decaying radionuclides. We assumed traditional bi-exponential PK functions of a pharmaceutical leading to TACs of the form $A(t)=C(e^{-at}-e^{-bt})e^{-\lambda t}$ in 1) a critical organ K (dose-limiting organ, e.g. kidney) and 2) a tumor lesion T. Biologically effective dose to tumor was then calculated as $BEDmax(\tau)=D(\tau)+G(\tau)D2(\tau)/\alpha/\beta-k\tau$, where $dBEDT(t)/dt=0$ at $t=\tau$. We defined therapeutic ratios RD=DT/DK ("apparent") and RBED=BEDT/BEDK ("effective"). Moreover, we analyzed behavior of a restricted relative ratio defined as RRR(%)=BEDT,2/BEDT,1, when BEDK,2=BEDK,1 ("critical organ dose limit per cycle"; also, see [1]), to sketch the potential difference in therapeutic efficacy of different radionuclides. ***Results:*** RRR was 69% for Y-90 (C=25 MBq, τ=8 d), 108% for I-131 (86 MBq, 15 d), 132% for Pr-143 (48 MBq, 20 d), 61% for Sm-153 (101 MBq, 6 d), 102% for Tb-161 (84 MBq, 14 d), 51% for Ho-166 (55 MBq, 4 d), 115% for Er-169 (155 MBq, 17 d), 199% for W-185 (121 MBq, 32 d), and 229% for H-3 [sic] (2320 MBq, 38 d) when compared to Lu-177 (BEDT=8.8 Gy; 116 MBq, 14 d), with the following parameters: BEDK=5.0 Gy; the biological clearance parameter aK=0.015 h-1, the biological uptake parameter bK=0.2 h-1, the alpha-beta ratio α/βK=3 Gy, the repair half-life tμ,K= 2 h, and the repopulation factor kK=0 for the critical organ; respectively, aT=0.002 h-1, bT=0.1 h-1, α/βT=10 Gy, tμ,T=1 h and kT=0.3 Gy/day for the tumor; we set CK=CT and mass mK=mT=0.1 kg. Local energy deposition of beta radiation was assumed. Subsequently, we studied the behavior of RD, RBED and RRR as a function of varying tissue PK and RB parameters. ***Conclusion:*** We used the Lea-Catcheside factor based radiobiological modeling of dose-rate effect in MRT, and calculated BEDs with exemplary PK and RB parameters. Several β- decaying radionuclides were compared to observe the effect of different beta energies and physical half-lives. ***References:*** 1. Abou-Jaoudé W, Dale R. Cancer Biother Radiopharm. 2004 Jun;19(3):308-21.

EP-0950

A Novel Approach to Biologically Effective Dose Calculation for Various Dose Rate Scenarios

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Aim/Introduction: Organ dose limits and tumour dose-response correlations in radiopharmaceutical therapy (RPT) are often sought by considering the biologically effective dose (BED) and the equieffective dose in 2 Gy fractions (EQD2). These metrics depend on models that include not only the physical dose, but also various radiobiological parameters characterising the radiosensitivity and damage repair capacity of tissues of interest. Such mechanistic radiobiological models necessitate the BED and EQD2 to depend explicitly on the dose rate and the rate of sublethal DNA damage repair. These dependencies are usually assumed to take the form of a monoexponential, whereas two or more phases are often more appropriate to describe especially the dose rate function. ***Materials and Methods:*** Assuming simple exponential decay for DNA damage repair and a biexponential function for dose rate decay, we rederived the solution for the BED in a closed analytical form. We also arrived at a novel solution for the case of piecewise-defined dose-rate functions, which relies on both numerical and analytical ideas. These two approaches are widely used to model [177Lu]Lu-DOTATATE clearance if comprehensive dosimetry is available. Both expressions were validated using simulated measurements by comparison with a fully numerical method. We further investigated the reliability of the fully numerical, fully analytical, and hybrid methods when attempting to simplify a comprehensive dosimetry protocol. Using publicly available clinical data of two patients undergoing [177Lu]Lu-DOTATATE therapy, we defined the ground truth dose rate as the best biexponential fit to four post-injection SPECT measurements on the organ level and explored the differences in BED and EQD2 values when omitting the last measurement. ***Results:*** It was found that our approaches are accurate and the numerical method converges to our analytical solutions with increasing extrapolation time after injection. A 0.1 Gy difference between methods may necessitate running the numerical method for up to 1300 hours, at which point it may fail due to overflow errors. On the clinical dataset we found that the numerical, hybrid, and analytical approaches underestimated the ground truth to tumours by 15.6 +/- 9.4 %, 5.0 +/- 4.2 %, and 1.5 +/- 2.9 %, respectively, in EQD2 and BED. ***Conclusion:*** As it is often desirable to perform comprehensive dosimetric studies in RPT using more accurate measurements, it is equally important for radiobiological models to match their accuracy, at least theoretically. Our results show that the proposed methods are accurate, scalable, and suitable for radiobiologically motivated RPT dosimetry.

EP-0951

Modelling of the DNA Damage Response in Blood Cells of Patients during Treatment with ^{177}Lu-PSMA

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Aim/Introduction: The aim of the study was to apply a previously developed compartment model [1] to describe patient-specifically

the absorbed-dose-dependent DNA damage response in peripheral blood mononuclear cells (PBMCs) during treatment with 177Lu-PSMA. For this purpose, we used an already published data set [2]. ***Materials and Methods:*** Blood samples collected at up to 96h after therapy start were analysed for radiation-induced gamma-H2AX+53BP1 foci (RIF) as markers of DNA double-strand breaks (DSBs) in PBMCs, including blood-based dosimetry [3]. To describe the time course of the number of RIF, a linear compartment model was applied assuming that the change in RIF is proportional to the dose rate. The induction is described by a proportionality constant c and the repair by fast (k1) and slow (k2) repair rates [1]. Fits were performed for all patients separately taking into account patient-specific blood dosimetry data. ***Results:*** 16 patients were eligible for this study. Five patients had to be excluded (four due to missing late time points, one because of an uncertainty of the fit variables larger than the variables themselves). In all other patients, the RIF data were described well by the model (r2>0.78 except P15 with r2=0.64). Fit parameters differed substantially between patients. The median value of c is 0.021mGy-1 (min: 0.008mGy-1; max: 0.065mGy-1). Only a single slow repair component k2 could be deduced for 4 patients (median 0.054h-1, min: 0.047h-1, max: 0.075h-1). For seven patients, in average 83% of the damage is repaired with k1 varying between 0.17h1 and 1.75h-1, while k2 ranged from 0.002h-1 to 0.075h-1. Our analysis revealed that patients can be allocated to three groups based on their k1/k2-values: Patients with faster repair rates (n=3, k1>1.1h-1) and slower repair rates (n=4, 0.2<k1<0.7h-1), and four patients with a very slow repair rate (k2 only, <0.075h-1). ***Conclusion:*** The results of our model describe patient-specific DNA damage response well and are for seven patients in good agreement with our previous data on patients after radioiodine treatment [1]. Repair rates also vary strongly between individual patients. The reason why four patients failed to show the fast repair rate k1 needs to be investigated in further studies with a larger patient cohort. ***References:*** [1] Schumann et al., EJNMMI 2023 suppl., p.S362 [2] Schumann et al., EJNMMI 2019, p.1723 [3] Eberlein et al., EJNMMI 2015, p.1739.

EP-0952

Assessment of DNA Double-Strand Breaks in Lymphocytes after Ex Vivo Internal Irradiation: A Monte Carlo Simulation Approach Using Thirty-one Experimentally Unexplored Radionuclides

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Aim/Introduction: The aim of this study is to apply a Monte Carlo simulation model [1], validated by experiments with the DNA damage assay [4,5] to assess the radiation-induced double-strand breaks (DSBs) in lymphocytes nuclei after internal ex vivo irradiation of whole blood at low absorbed doses (≤100 mGy) using experimentally unexplored radionuclides. ***Materials and Methods:*** The Monte Carlo simulation model integrates GATE [2] at the macroscopic level and Geant4-DNA [3] at the cellular level. The simulations reproduce ex vivo internal irradiation experiments of whole blood [4, 5] using an 8 ml vial filled with water and containing a concentration of 125 spheres/ml (3.75 µm radius) mimicking the lymphocytes. 31 radionuclides were simulated (e.g., 47Sc, 60Co, 137Cs, 211At, 212Pb, and 228Th). For alpha emitting radionuclides, the entire decay chain was simulated except when involving a daughter with a long half-live (>15 days). For these, the decay chain was truncated at the long-lived daughter (e.g., 222Rn decay chain truncated at 210Pb). Several parameters were calculated inside the lymphocyte nucleus (water sphere of 3.1 µm radius) from the simulations, including the S-value, DSBs·cell-1·mGy-1, αtracks·cell1·mGy1, and DSBs·µm-1 (for alpha emitters only). ***Results:*** For beta- and gamma-emitting radionuclides, the S-values vary between 0.2E-4±0.1E-4 mGy·MBq1·s1 (57Co) and 0.020±0.001 mGy·MBq1·s1 (110mAg). For alpha-emitting radionuclides, S-values vary proportionally with the length of the decay chain (0.10±0.01 mGy·MBq1·s1 for 210Po and 0.62±0.04 mGy·MBq1·s1 for 227Th]. The mean number of DSBs induced by beta- and gamma-emitting radionuclides was 0.012±0.002 DSBs·cell-1·mGy-1. The mean number of α-tracks by alpha-emitting radionuclides was 0.0016±0.0001 α-tracks·cell1·mGy1. Furthermore the number of DSBs·µm-1 produced by α-particles showed a dependence on the average deposited energy per α-particle (MeV/α-particle): 15.7±0.1 DSBs·µm-1 for 210Po (0.52 MeV/α-particle) and 9.1±0.1 DSBs·µm-1 for 213Bi (0.39 MeV/α-particle). ***Conclusion:*** This study provides new insights into DNA damage induction in lymphocytes after internal ex vivo irradiation for radionuclides not accessible for experimental validation. For all radionuclides studied, the number of radiation-induced DSBs and α-tracks per mGy show little variability; thus further encouraging the use of the DNA damage assay for biodosimetry. ***References:*** [1] Salas-Ramirez, M. et al. ZMedPhys. 2023 [2] Jan S. et al. Phys Med Biol, 2004.

EP-0953

Biological radiation effect of 662 keV photon radiation and ^{186}Re β-radiation on the human B-cell line BV-173

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Aim/Introduction: To evaluate and compare the radiation effects of 186Re as a β^--emitter and 662 keV photon radiation on prae-B-lymphocytes regarding biological impact of high and low dose rate irradiation. ***Materials and Methods:*** Prae-B-lymphocytes of the human leukemia Cell line BV-173 were exposed with photon radiation (662 keV) or the β^--emitter 186Re. Viability and number of cells were evaluated daily within an incubation oeriod of one week. Survival curves were constructed and analysed. The MIRD 3.1 based equivalent dose for 186Re incubation was calculated on the basis of considering dose decline in border- and ground area of culture bottles filled with liquid solutions. ***Results:*** Survival curves in both of the investigated types of radiation showed a biexponential progress (72 h after start for 186Re and 24 h for photon radiation). For photon radiation, this can be explained by the existence of a radiosensitive lymphocyte subpopulation, for which there is a D0 of 3.3 Gy, for the other portion the D0 is 10 Gy. For the 186Re incubation there is a D0 of 10 Gy at low doses caused by the repair of sublethal damage, which weakens the biological effect. From an accumulated dose of 3.1 Gy within one cell cycle, a significantly steeper curve with a D0 of 5 Gy emerges for 186Re, which reflects a biological effect that is twice as strong as photon radiation in this range (D0 5 Gy for 186Re or 10 Gy for photons). ***Conclusion:*** Radiation at low dose rates weakens the biological effect in areas of low dose rates. There is a limit value for the accumulated dose within a cell cycle, beyond which the biological effect of β--radiation even exceeds that of photon radiation.

EP-60

e-Poster Area

D: Technical Studies -> D5 Radiopharmacy/ Radiochemistry -> D51 New Radiopharmaceuticals - SPECT

EP-0954

Radiolabeling of RGDFK with 113mIn and preliminary biological evaluation in mice bearing U87MG tumors

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Aim/Introduction: Phenomenon of angiogenesis as a very effective factor on the growth and spread of cancer cells is the molecular interactions between the components of the extracellular matrix and vascular cells. Integrin αvβ3 is a critical receptor that affects tumor growth and invasion, metastasis, and angiogenesis. Aims of this study are optimization of the peptides radiolabeling by Indium-113m radionuclide and production of suitable radiopharmaceuticals for imaging studies of the αvβ3 Integrin expressing cancers. ***Materials and Methods:*** For the 113mIn labeling Briefly, 20 nmol of DOTA-RGDFK peptide was dissolved in 20 µL of ultrapure water and incubated with 4 mCi (148 MBq) of 113mIn for 15 min at 95°C, pH=3.5. After 15 min the reaction was stopped with 8 ml of WFI water and for more purification the product passed through C18 cartridge. 113mIn -DOTA-RGDFK product was then evaluated by analytical RTLC, the radioactive peak containing desired product was collected. Stability test was checked in the human serum and in PBS buffer, radiolabeling yield, radiochemical purity, cell studies on U-87 MG cell lines, biodistribution study in tumor bearing mice (n=3) at 15, 30, 60 and 120min (expressed as %ID/g) and imaging study were examined. ***Results:*** The percentage of radiochemical purity was 100%. 78% radiolabeling yield. In the stability studies section, which were performed in PBS buffer and human blood serum in 0, 60, 90 and 120 minutes. In general obtained result showed that, the stability of the labeled peptide in PBS buffer is higher than human serum in all times of the study, but overall, in both compounds, the stability has been decreased over time, the result indicated radiochemical purity of 96% in PBS buffer and 94% in human serum after 120 min. Constant values of Kd = 17.8 ± 2.9 nM was obtained indicating the high affinity of In113m -DOTA-RGDFK towards U-87 MG cell line overexpressed αvβ3 receptors. Biodistribution study was performed in mice bearing U87MG tumors at time intervals (15, 30, 60, and 120) minutes after the injection, expressed as percentage of injected dose per gram of tissue (%ID/g), biodistribution study and imaging study of free 113mIn and 113mIn -DOTA-RGDFK showed similar accumulation pattern to the other radiolabeled RGDFK compounds. ***Conclusion:*** 113mIn -DOTA-RGDFK is a potential compound for SPECT imaging of the cancer cells expressing αvβ3 integrin. ***References:*** 1. T. Lappchen, JP. Holland. Preparation and preclinical evaluation of a 68Ga-labelled c(RGDfK) conjugate. EJNMMI Radiopharm Chem. 2018 Dec; 3: 6.

EP-0955

Radiopharmaceutical properties of hydroxyapatite smaller than 50 nm produced from eggshell and labeled with Tc-99m and its biodistribution in rabbits

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Aim/Introduction: Radiolabeling of nanoparticles has potential benefits for personalized treatments and theranostic applications, which have been on the agenda in recent years. Hydroxyapatite nanoparticles (HANPs), which have a great similarity to bone tissue, stand out as a biocompatible nanoparticle. The different biodistribution properties of hydroxyapatite molecules in different nanosizes may create new opportunities for their use, especially in bone imaging and in the treatment of bone tumors. This study aims to investigate the labeling of hydroxyapatite molecules smaller than 50 nanometers obtained from eggshells with technetium 99m (99mTc) and the in vivo distribution of this molecule in rabbits. ***Materials and Methods:*** Characterization of nanohydroxyapatite particles obtained from eggshells was performed using SEM, EDX, and XRD. Radiolabeling of HANPs smaller than 50 nm with 99mTc radionuclide, stability of the labeled product, and biodistribution profile in rabbits were investigated. ***Results:*** The radiochemical purity of the 99mTc-HANPs was obtained as 96%. The in vitro stability of 99mTc labeled HANPs was examined for up to 12 hours and showed excellent in vitro stability for the first 4 hours in saline. 99mTc-HANPs remained stable in vivo during the 6-hour imaging period. In quantitative analysis, 99mTc-HANPs showed accumulation in bone tissue in the second hour. ***Conclusion:*** 99mTc-HANP nanoradiopharmaceuticals with sizes less than 50 nanometers (20-31 nm) showed high uptake in bone tissue in rabbits. Therefore, HANPs can be developed as imaging radiopharmaceuticals in bone tissue and bone cancers. ***References:*** 1. Kalash RS, Lakshmanan VK, Cho CS, Park IK. Theranostics. In: M. Ebara [Ed.], Biomaterials Nanoarchitectonics, 2016, p.197-215. 1st Edition. Elsevier Inc.: William Andrew. 2. Aulić S, Bolognesi ML, Legname G. Small-molecule theranostic probes: a promising future in neurodegenerative diseases. Int J Cell Biol 2013:150952. 3. National Cancer Institute Web site. [2004]. "Cancer and Nanotechnology". Retrieved Jan 25; 2024. from https:// https://www.cancer.gov/nano/cancer-nanotechnology 4. Borm PJ, Robbins D, Haubold S. et al. The potential risks of nanomaterials: a review carried out for ECETOC. Part Fibre Toxicol, 2006;3, 11. 5. Khlebtsov N, Dykman L. Biodistribution and toxicity of engineered gold nanoparticles: a review of in vitro and in vivo studies. Chem Soc Rev 2011;40[3]:1647-1671. 6. Li SD, Huang L. Pharmacokinetics and biodistribution of nanoparticles. Mol Pharm 2008;5[4]:496-504.7. Albernaz Mde S, Ospina CA, Rossi AM, Santos-Oliveira R. Radiolabelled nanohydroxyapatite with 99mTc: perspectives to nanoradiopharmaceuticals construction. Artif Cells Nanomed Biotechnol 2014;42[2]:88-91.

EP-0956

Preclinical evaluation of a nanobody-based SPECT radiotracer ^{99m}Tc-AFN with clinical potential for noninvasive monitoring of fibroblast activation after myocardial infarction

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Aim/Introduction: Combining nanomolar affinities and fast blood clearance, nanobodies represent potential radiotracers for cardiovascular molecular imaging1. In this study, we developed a 99mTc-labeled nanobody (99mTc-AFN) with high affinity to fibroblast activation protein (FAP) and explored the feasibility of using 99mTc-AFN for noninvasive monitoring of fibroblast

activation after myocardial infarction (MI). ***Materials and Methods:*** 99mTc-AFN was prepared by site-specific labeling. Ischemia/reperfusion (I/R) mice were constructed for SPECT/CT imaging and biodistribution studies. A series of dynamic imaging from 0.5 to 4 h after injection of 99mTc-AFN was performed in the I/R mice on day 7. Furthermore, I/R mice were subjected to 99mTc-AFN SPECT/CT imaging on postoperative days 3, 7, 14, and 28 at 1 h post injection (p.i). Ex vivo imaging, blocking imaging, and biodistribution studies were performed on day 7, and compared with a 99mTc-labeled FAPI-04-derived radiotracer, HYNIC-FAPi-04 (HFAPi) 99mTc-HFAPi. H&E staining, Masson's staining, and immunohistochemistry were performed to verify the cardiac remodeling after I/R. Pre-clinical evaluation of 99mTc-AFN in a swine model of MI was performed to further explore the feasibility of monitoring activated fibroblasts after MI on day 7. ***Results:*** Dynamic imaging showed that accumulation at infarcted region was most clearly visible at 1 h p.i. 99mTc-AFN uptake in the infarcted myocardium was visible from day 3 and peaked on day 7 after I/R. At 1 h p.i. Both the 99mTc-AFN uptake ratios of the infarcted/noninfarcted region and the infarcted region/blood at 1 h p.i. were higher than that of 99mTc-HFAPi (2.23 ± 0.82 vs. 1.34 ± 0.21; 1.08 ± 0.49 vs. 0.89 ± 0.42). H&E staining, Masson's staining, and immunohistochemical examinations confirmed that myocardium fibrosis and FAP expression reached peak on day 7 after I/R. 99mTc-AFN uptake in the infarcted myocardium was also clearly visualized on day 7 after MI in the swine model. ***Conclusion:*** This study demonstrated the potential of 99mTc-AFN for noninvasive monitoring of fibroblast activation after MI. Moreover, 99mTc-AFN holds the advantages of faster blood clearance and better target-to-background ratio than 99mTc-HFAPi, which provides a new option for clinical imaging. ***References:*** 1. Liu, T.; Wu, Y.; Shi, L.; Li, L.; Hu, B.; Wang, Y.; Gao, H.; Yu, X.; Zhang, X.; Zhao, H.; Wan, Y.; Jia, B.; Wang, F., Preclinical evaluation of [(99m)Tc]Tc-labeled anti-EpCAM nanobody for EpCAM receptor expression imaging by immuno-SPECT/CT. Eur J Nucl Med Mol Imaging 2022, 49 (6), 1810-1821.

EP-0957

Synthesis and evaluation of a novel PSMA-targeted EuK-based radiotracer (^{99m}Tc-IDA-EuKfG) from in silico to in vivo study

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Aim/Introduction: Prostate-specific membrane antigen (PSMA) is a well-known biomarker for nuclear diagnostics and radionuclide therapy (theranostiscs) in prostate cancer (PC). In this study, we intended to discovery the promising EuK derivatives with aromatic amino acids including comparison with L-/D-isomers for PSMA-targeting. Among them, EuKf-based derivative was utilized to develop the new PSMA-targeted theranostics by incorporating a 99mTc or 188Re-tricarbonyl complex. ***Materials and Methods:*** EuK-based derivatives including L-/D-aromatic amino acids (n = 8) were evaluated by molecular docking simulations with the crystal structure of PSMA, and followed by in vitro competitive binding assay with 125I-MIP-1095. The authentic compound and radiotracer were prepared by 185/187Re-/99mTc-(CO)3 incorporation to the precursor (IDA-EuKfG), respectively. Specific cellular uptake and efflux assay of 99mTc-IDA-EuKfG were carried out with PC cells. In vivo biokinetics and tumor imaging properties of 99mTc-IDA-EuKfG was evaluated in orthotopic PC and LNCaP-bearing animal models comparing with 68Ga-PSMA-11. ***Results:*** EuKf derivative was shown the highest binding affinity (IC50 = 2.3 nM) and thermodynamically binding free energy (– 68 kcal/mol). Likewise, Re-IDA-EuKfG showed high binding affinity (IC50 = 3.0 nM) to PSMA. 99mTc-IDA-EuKfG was prepared in high radiochemical yield (>80%) and molar activity (>3.7 TBq/mmol). Comparing to 68Ga-PSMA-11, 99mTc-IDA-EuKfG showed higher accumulation (42%) and internalization (12%) prolonged retention within PC cells after 1 h incubation. The tumor uptake of 99mTc-IDA-EuKfG was comparable to that of 68Ga-PSMA-11. Notably, negligible salivary gland uptake of 99mTc-IDA-EuKfG was observed. ***Conclusion:*** We identified the chirality of amino acid in EuK-based radiotracer as a crucial factor in determining PSMA binding properties. Our new PSMA-targeted radiotracer, 99mTc-IDA-EuKfG, exhibited desirable PSMA binding potency, effective cell internalization in PC cells, and significant tumor accumulation in the PC model. These findings highlight the potential of the novel PSMA ligand IDA-EuKfG as a promising theranostic agent for developing PSMA-targeted theranostics.

EP-0958

New radio-labelling approaches in OMV biodistribution

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Aim/Introduction: Radio-labeling techniques have become an important area of molecular imaging in the study of biological vesicles, extracellular vesicles (EV), outer membrane vesicles (OMV) and platelets. This research focuses on the development of new isotope-based labelling methods for quantitative in vivo imaging, which improve the determination of the biodistribution and understanding the function of these vesicles. ***Materials and Methods:*** Three radiolabeling approaches were used in our work. Eukaryotic EVs were labeled with 99mTc-tricarbonyl. OMVs isolated from a novel E. coli strain were labeled with two different approaches: i) 64Cu labeling was carried out using SpyTag-NODAGA conjugates and outer membrane-anchored SpyCatcher; while ii) HYNIC-duramycin was used for 99mTc labeling. High-resolution biodistribution data in mouse models were obtained using several imaging techniques: SPECT and PET/MRI. ***Results:*** 99mTc-labeled EVs predominantly accumulated in liver and spleen, demonstrating the method's in vivo efficacy. OMVs labeled either with 64Cu or 99mTc-duramycin exhibited stable and specific biodistribution patterns, aligning with previous findings. Together, these in vivo imaging studies demonstrate the importance of radio-labelling in understanding the function of biological vesicles. They provide novel insights into vesicle biodistribution and open new way for diagnostic and therapeutic applications. ***Conclusion:*** Our aim is to demonstrate that these methods hold significant potential for molecular imaging and the development of targeted therapeutic strategies.

EP-61

e-Poster Area

D: Technical Studies -> D5 Radiopharmacy/ Radiochemistry -> D52 New Radiopharmaceuticals - PET

EP-0959

^{68}Ga-radiolabeled triphenylphosphonium PET tracers for rhabdomyosarcoma tumor targeting

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Aim/Introduction: The lipophilic organic cation triphenylphosphonium (TPP) is a molecular probe targeting mitochondria. A series of TPP derivatives have been successfully labeled with the 64Cu radioisotope to image glioma tumors rich in mitochondria in mice, yielding promising outcomes. Our goal is to develop 68Ga-radiolabeled TPP tracers for rhabdomyosarcoma tumors and to investigate the impact of the targeting moiety and bifunctional chelator on the tracers' biodistribution. ***Materials and Methods:*** Radiolabeling of 68Ga to four TPP ligands (DO3A-xy-TPEP, DO3A-xy-TPP, NOTA-xy-TPEP, NOTA-xy-TPP) was achieved by reacting a 68Ga solution (2.0-3.0 mCi) in 0.05 N HCl from a 68Ga generator with the ligands in 0.1 M NaOAc buffer (pH 5.0 - 5.5) at 100 °C for 30 min. After cooling the mixture to room temperature and purifying it using a C-18 cartridge, a sample of the resulting solution was analyzed by radio-TLC. The 68Ga radiotracers (~2 MBq) were administered to rhabdomyosarcoma tumor-bearing mice (RHB14-0120) via the tail vein. Three mice were sacrificed at each time point: 15, 30, 60, and 90 min post-injection (p.i). Organ uptake was calculated as a percentage of the injected dose per gram of organ tissue (%ID/g). ***Results:*** Radio-TLCs indicated that the radiolabeling yields for all four TPP ligands with 68Ga are approximately 70 ± 5%. After purification by a C-18 Sep-Pak column, the radiochemical yields exceeded 95%. 68Ga-DO3A-xy-TPEP exhibited the highest tumor-to-muscle ratio of 2.9 at 90 min post-injection and the highest renal uptake (19.5%ID/g at 15 min post-injection). The highest liver uptake was observed with 68Ga-NOTA-xy-TPP (8.4%ID/g at 90 min post-injection). ***Conclusion:*** The radiolabeling of four TPP ligands with 68Ga was accomplished with high efficiency, resulting in isolation of the compounds with a purity higher than 95%. Altering the TPP ligands and chelators lead to change the biodistribution and targeting capabilities of the 68Ga-radiolabeled tracers. The 68Ga-DO3A-xy-TPEP exhibited the most promising with the highest tumor-to-muscle ratio in a rhabdomyosarcoma mouse model. Further modification of TPP ligands is needed to improve targeting ability for further preclinical and possible clinical applications.

EP-0960

Basic evaluation of the heart-derived fatty acid-binding protein ligand $^{[18F]}$HY11-8

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Aim/Introduction: The heart-derived fatty acid-binding protein (FABP3) is involved in the intracellular transport of fatty acids and is known to be abundantly expressed in cardiac and skeletal muscles. We previously discovered the compound HY11-8, which has high affinity for FABP3 [1]. In the present study, we attempted to radiolabel HY11-8 with fluorine-18 and evaluate its pharmacokinetics and potential as a novel myocardial imaging agent. ***Materials and Methods:*** Radiosynthesis of $^{[18F]}$HY11-8 was performed by 18F-fluorination of the corresponding pinacol boronic acid ester precursor and subsequent deprotection of the ethyl ester protecting group. A mouse biodistribution study was conducted to analyse radioactive metabolites in plasma and myocardial tissue. In addition, dynamic changes of radioactivity in the myocardium were measured using small-animal PET/CT. ***Results:*** The decay-corrected radiochemical yield of $^{[18F]}$HY11-8 was 17.9±3.5% (n = 5; range, 14.5-23.6%), and the radiochemical purity was 99.8±0.1% (n = 5; range, 99.7-99.9%). The molar activity was 256.8±162.8 MBq/nmol (n = 5, range, 109.4-488.2 MBq/nmol). A biodistribution study showed rapid clearance of radioactivity from the blood, high accumulation of radioactivity in the heart, and low accumulation of radioactivity in background tissues such as lung and liver. Furthermore, the accumulation of radioactivity in bone, which is an indicator of defluorination in vivo, was low and the stability of the 18F label in vivo was considered high. Metabolic analysis revealed that $^{[18F]}$HY11-8 was stable in the mouse body and was present mostly in the unchanged form in the plasma and myocardium. In PET measurements of small animals, the heart was clearly visualised and showed an accumulation pattern over time. ***Conclusion:*** The present results suggest the potential use of $^{[18F]}$HY11-8, a ligand that binds to FABP3, as a novel myocardial imaging agent. ***References:*** [1] Guo et al., Redox Biol. (2023) 59:102547.

EP-0962

GMP validation (CMC) and Radiation dosimetry for clinical application of a novel α7-nAChR radioligand: [^{11}C]Kln83

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Aim/Introduction: Nicotinic acetylcholine receptor (α7-nAChR), is closely associated with cognitive functions, memory formation, and attention processes. Utilizing PET imaging to map the α7-nAChR has gained significant attention for understanding the mechanisms and progression of central nervous system disorders like Alzheimer's disease (AD), Parkinson's disease (PD)1. In our earlier work, we described the development of a new α7-nAChR radioligand, [^{11}C]Kln83, and assessed its biological properties2. The aims of this current PET study were (i) to offer dosimetry assessments for [^{11}C]Kln83 utilizing NHP whole-body PET data and (ii) to verify the GMP-compliant production of [^{11}C]Kln83 (CMC) for potential clinical use. ***Materials and Methods:*** Two female cynomolgus monkeys were utilized for whole-body PET scans. Regions of interest (ROIs) were drawn for anatomical structures including the brain, heart, liver, lung, kidney, gall bladder, bone, urinary bladder, stomach, small intestine, spleen, and pancreas based on CT images. Using the OLINDA/EXM 1.1 software and the adult reference model (70 kg), absorbed radiation dose estimates for humans were subsequently calculated. The production of [^{11}C]Kln83 underwent validation procedures in accordance with current Good Manufacturing Practices (cGMP). The radiolabeling and delivery of the product [^{11}C]Kln83 were carried out using an automated synthesis module within a tightly controlled GMP setting. Quality control tests and product specifications adhered to the guidelines outlined in the European Pharmacopoeia.

Results: The radioactivity injected was 150 MBq for one NHP and 155 MBq for the other. The estimated radiation dose was 0.0047 mSv/MBq. In humans, up to 400 MBq can be injected, resulting in a total radiation exposure of <2 mSv. This level of exposure is comparable to that of other 11C-labeled radioligands. During the process validation, three consecutive batches of [^{11}C]Kln83 solution for injection were manufactured successfully. Throughout the validation process, thorough quality control measures are implemented. Radiopharmaceutical batch release criteria are established, including testing for physical appearance, filter integrity, pH, radiochemical purity, molar activity, radiochemical identity, chemical impurity, structural identity, stability, residual solvent, sterility, and endotoxin levels. ***Conclusion:*** The [^{11}C]Kln83 synthesis procedure (CMC) has been validated with successful production. Quality control tests on the final product passed all acceptance criteria. The dosimetry study showed an estimated radiation burden of 0.0047 mSv/MBq, indicating the potential for repeated scans in the same human subject due to its distribution characteristics. ***References:*** (1) Fontana, I. et al.; Acs Chem Neurosci 2024, 15, 328. (2) Nag, S.; et al. ; Acs Chem Neurosci 2022, 13, 352.

EP-0963

Synthesis and Application of meta-TDBFB for F^{18} Indirect Labeling via Suzuki Coupling

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Aim/Introduction: Positron emission tomography (PET) uses bioactive compounds labeled with F^{18} radioisotopes as probes. The introduction of F^{18} into electron-rich aromatic rings through nucleophilic substitution reactions with the [^{18}F] fluoride ion remains challenging. We previously reported a new F^{18} labeling method using the Suzuki coupling reaction with an indirect labeling reagent, the boronic acid derivative 4-(4,4,5,5-Tetramethyl-1,3,2-dioxaborolan-2-yl)-[^{18}F]fluorobenzene (para-[^{18}F]TDBFB). In this study, we investigated the synthesis of meta [^{18}F]TDBFB and its application to PET probes. We attempted to synthesize 3-[^{18}F]fluorobiphenyl and [^{18}F]Fluprofen for the COX-2 imaging tracer. ***Materials and Methods:*** First, we investigated the conditions for the synthesis of 4- [^{18}F]TDBFB, including various F18 sources, solvents, reaction temperatures, and additives. The labeling rate of F18 fluorination was evaluated using Radio-Thin Layer Chromatography (Radio-TLC) and Radio-HPLC. Then, meta-[^{18}F]TDBFB was synthesized under optimal conditions and, [^{18}F]fluorobiphenyl and the NSAIDs derivative [^{18}F]fluprofen were synthesized with meta-[^{18}F]TDBFB as applications. ***Results:*** The [^{18}F]fluoride ion was eluted from the cation exchange resin using DMAP/OTf, and then heated at 120ºC for 20 min in dimethylacetamide, in the presence of TDBFB precursor and CuOTfPy4. This led to the confirmation of the target product on Radio-TLC. This reaction condition resulted in a 4-fold increase in yield compared to previously reported condition [1]. The reaction progress was also evaluated using meta-[^{18}F]TDBFB, yielding similar results and giving the product by Radio-HPLC purification. To synthesize 3-[^{18}F]fluorobiphenyl and [^{18}F]Fluprofen, we employed meta-[^{18}F]TDBFB with the iodo precursor for [^{18}F]fluorobiphenyl, and a triflate precursor for fluprofen, and the desired compound was obtained. ***Conclusion:*** This study supports the notion that meta-[^{18}F]TDBFB could serve as a more versatile indirect labeling reagent. ***References:*** [1]Tetrahedron Letters, 107, 154010 (2022).

EP-0964

Development of automatic synthesis system and basic evaluation of [^{18}F]FBPA synthesis from[^{18}F]HF ([^{18}F$^-$]).

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Aim/Introduction: 2-[^{18}F]Fluoro-4-borono-phenylalanine (FBPA) is an important PET tracer for the determination of Boron Neutron Capture Therapy (BNCT) applicability. Now BNCT has possibility to expanding all over the world, because cyclotron based BNCT system was developed. As BNCT expands, we need more [^{18}F] FBPA radioactivity in one synthesis. Since nuclear reaction yield is larger in 18O(p, n)18F nuclear reaction than 20Ne (d, α)18F. We previously reported a novel [^{18}F]FBPA synthesis from [^{18}F]F- which is produced by 18O(p, n)18F nuclear reaction. In this study, we tried to adopt this method for automatic synthesizer. In addition, we investigated that in vivo bio-distribution of both [^{18}F]FBPA which produced by our method and traditional method. ***Materials and Methods:*** We used a modified type of MPS-200 Aβ (Sumitomo Heavy Industry, LTD, Tokyo) as the automatic synthesizer. Our method is consisted of 3 main steps. That is 18F-fluorination in the first reaction vessel (RV) 1 (80-degree and 20 min), borylation step in RV2 (110-degree and 20 min) and deprotection step in RV3 (100 degree and 5 min). A crude mixture was purified by HPLC. Finally, [^{18}F]FBPA fraction was collected after HPLC purification of the crude mixture. Radiochemical purity (RCP) and molar activity (MA) were determined by HPLC. The concentrations of n-BuOH, DMA and DMF were measured with gas chromatography. In animal experiment, about 0.5 MBq of [^{18}F]FBPA which was synthesized our method and traditional method was administrated to each tumor bearing mouse. 60 minutes after injection, mice were sacrificed and issues are removed, weighed and counted. ***Results:*** The radiochemical yield of [^{18}F]FBPA from [^{18}F]HF was more than 10% (non-decay collected). Total synthesis time from the end of bombardment was about 110 min. RCP and MA of [^{18}F]FBPA were more than 90% and 1,000 GBq/μmol, respectively. Each concentration of n-BuOH, DMA and DMF was less than 100 ppm. About 9 GBq of [^{18}F]FBPA was produced by our method with 60 min and 50 μA irradiation using 12 MeV cyclotron. In vivo study, the accumulation of FBPA prepared by both synthesis methods has no differences. It was about 12 %ID/g in tumors. ***Conclusion:*** We succeeded in synthesizing [^{18}F]FBPA from [^{18}F]HF using an automatic synthesizer. We confirmed that the FBPA synthesized by our method has enough quality for clinical use. It has bioequivalent to FBPA produced by traditional methods.

EP-0965

An improved procedure for the GMP production and formulation of the sigma-1 receptor ligand [^{18}F]FTC146 from a precursor with a chlorine leaving group

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Aim/Introduction: The σ-1 receptor is a transmembrane protein implicated in various human pathologies including neurodegenerative diseases, inflammation, and cancer [1]. The previously published ligand [18F]FTC-146 is among the most promising tools for molecular imaging of σ-1 receptors in vivo using positron emission tomography (PET), with potential for clinical diagnostic and research applications [2]. However, the published six-step synthesis of the tosyl ester precursor for its radiosynthesis is complicated and time-consuming. Therefore, we designed and tested a simple procedure that facilitates the preparation of [18F]FTC-146. Instead of a tosylate-based precursor, we developed a novel one-step synthesis of the AM-16 precursor containing chlorine as a leaving group for the SN2 reaction with [18F]fluoride [3]. For further development and in consideration of possible GMP production for human PET studies, we aimed to optimize the preparative chromatographic conditions for the purification of the radiotracer and to replace the previously mobile phase additive triethylamine (TEA) [2,3] with non-toxic dimethylaminoethanol (DMAE). DMAE is a choline precursor, and unlike TEA, does not require analysis after the tracer formulation for human application. Here we present the results of optimizing preparative chromatographic purification of [18F]FTC-146. The next development step shall be to optimize the radiosynthesis to increase the radiochemical yield. ***Materials and Methods:*** To the dried [18F]fluoride was added AM-16 (4.46 µmol) in DMSO (0.6 mL). The mixture was heated to 155 °C for 5 min, quenched with mobile phase, and directly applied onto preparative HPLC (Kinetex EVO C18 Axia column, 21.2 × 100 mm; 5 mM-DMAE in H2O/EtOH, flow = 4 ml/min, step gradient of H2O/EtOH 0-5 min 60/40, 5-30 min 30/70). ***Results:*** The replacement of TEA with DMAE in the preparative chromatography was successful, giving much better separation of the tracer from its precursor compared to previously published results [3]. The radiochemical yield of the [18F]fluorination step has been significantly improved to over 20%, encouraging us to seek further optimisation. ***Conclusion:*** We successfully replaced the chromatographic additive TEA with DMAE, which should enable a simpler quality control routine for human application of the tracer. The substitution gave distinctly improved chromatographic separation of the precursor and the radiotracer, along with a significant improvement in radiochemical yield of the tracer. ***References:*** (1) Walker, J. M. et al. Pharmacol. Rev. 1990, 42, 355-402. (2) James, M. L. et al. J. Med. Chem. 2012, 55, 8272-8282. (3) Marešová, A. et al. J. Labelled Compd. Radiopharm. 2024, 67, 59-66.

EP-0966

Preclinical study of dual-targeted SSTR2 and FAP molecular probe ^{68}Ga-TATE-46

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Aim/Introduction: At present, 68Ga-labeled somatostatin analogue (SSA) is the most commonly used imaging agent for neuroendocrine tumors (NETs). Among them, 68Ga-DOTA-TATE has strong selectivity for somatostatin receptor type 2 (SSTR-2) frequently expressed by NETs, but its uptake value in NETs is not ideal. To enhance the uptake of tracers in NETs, a combination of SSTR2 and Fibroblast Activation Protein was designed. FAP's dual-targeted radiotracer 68Ga-TATE-46 was evaluated and compared with 68Ga-DOTA-TATE and 68Ga-FAPI-46 to screen novel neuroendocrine tumor therapeutics suitable for 177Lu labeling. ***Materials and Methods:*** The precursor DOTA-TATE-46 was designed and synthesized from somatostatin analogue TATE and quinoline compound FAPI-46. After confirmed by mass spectrometry, 68Ga was used to label it as 68Ga-TATE-46. Its radiochemical purity and stability were verified by HPLC, and its binding affinity was evaluated at the cellular level. Preclinical studies, including micro-PET imaging and biodistribution evaluation, were performed on NCI-H727 tumor xenografts and compared with conventional 68Ga-DOTA-TATE and 68Ga-FAPI-46. ***Results:*** 68Ga-TATE-46 was easily labeled and the radiochemical purity was greater than 95%. Let it sit at room temperature for 2 hours. 68Ga-TATE-46 has high affinity for both FAP and SSTR2. The uptake and retention of 68Ga-TATE-46 were significantly higher than those of 68Ga-DOTA-TATE and 68Ga-FAPI-46 in NCI-H727-bearing mice. ***Conclusion:*** The results of this study validate the clinical potential of the dual-targeted molecular probe 68Ga-TATE-46 for PET imaging and further targeted therapy of neuroendocrine tumors, but further structural modification of 68Ga-TATE-46 is needed to accelerate the clearance rate of normal tissues.

EP-0967

Imaging Synaptic Vesicle Protein SV2C with 18F-UCB-F: An In Vitro Autoradiography and In Vivo NHP PET Study

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Aim/Introduction: The synaptic vesicle protein SV2C protein, mainly found in the basal ganglia, is linked to Parkinson's disease through genetic studies. It plays a role in regulating dopamine release and has been disrupted in PD animal models and brain tissue from PD patients. In studying PD-related synaptopathy, SV2C could be a potential imaging target for tracking changes with disease progression and treatment. This study aims to assess [18F]UCB-F, a PET tracer for imaging SV2C in PD, previously tested in small animals. [18F]UCB-F was evaluated in-vitro using autoradiography (ARG) on rat and non-human primate (NHP) brain tissue and in vivo using NHP PET. ***Materials and Methods:*** The mesylate-precursor and UCB-F reference standard were synthesized at Eurofins Advinus, India. Radiolabeling was accomplished through fluorine-18 nucleophilic substitution reaction. The [18F]UCB-F binding distribution across regions was evaluated using autoradiography (ARG) on brain sections from rats and NHP. A blocking experiment was conducted using cold UCB-F (10 µM). The brain distribution of [18F]UCB-F binding was examined with PET in NHPs. Two PET measurements were conducted in two different cynomolgus monkeys (NHP1 and NHP2), using a high-resolution PET/CT system (LFER, Mediso). Radiometabolites were analyzed in plasma samples using gradient radio HPLC. ***Results:*** [18F]UCB-F was synthesized effectively from the corresponding precursor, yielding over 50% incorporation. At the time of administration, the molar activity was 16 and 25 GBq/µmol. The radioligand exhibited stability, maintaining a radiochemical purity of over 99% even after 2 hours of formulation in a sterile phosphate-buffered solution. ARG on brain slices from rats and NHPs showed specific binding of [18F]UCB-F in pallidum, striatum, substantia nigra and brainstem, consistent with the expression of SV2C in the brain. In NHPs, [18F]UCB-F rapidly entered the brain with a whole brain peak uptake SUV of 3.3 for NHP1 and 3.0 for NHP2 at 3 minutes. The wash-out from the brain was rapid with no

clear evidence of regional distribution. Radiometabolite studies showed the formation of only more polar radiometabolites, with approximately 15% of unchanged radioligand remaining in plasma at 15 minutes post-injection. ***Conclusion:*** [18F]UCB-F was successfully radiolabelled. In vitro, it showed specific binding on tissue slices from rodent and NHP brains. However, in-vivo, [18F]UCB-F displayed too rapid washout from the brain, lack of regional brain distribution and rapid metabolism . Overall, these findings indicate that [18F]UCB-F is not a suitable PET radioligand for imaging SV2C and additional work is needed to identify a potential candidate.

EP-0969

ImmunoPET imaging of ^{89}Zr-labeled antiTrop2 monoclonal antibody in lung cancer models

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Aim/Introduction: Lung cancer, a prominent contributor to cancer-related mortality, is frequently identified in its advanced stages as a result of insufficient early detection techniques. Recently, immuno-positron emission tomography (immunoPET) has emerged as a valuable tool for the early diagnosis of tumors. Trophoblast cell-surface antigen 2 (Trop2), a transmembrane glycoprotein, is frequently overexpressed in lung tumors and is a potential diagnostic target for early-stage lung cancer. Our study aimed to develop 89Zr-labeled anti-Trop2 monoclonal antibody (aTMAB) for immunoPET imaging and evaluate the diagnostic abilities in preclinical stage for lung cancer models. ***Materials and Methods:*** Based on the 89Y(p,n)89Zr nuclear reaction principle, 89Zr was produced using a cyclotron solid target system (11 MeV, 15 µA, 1h) and an automated separation device. The expression of Trop2 in lung cancer was determined by immunohistochemistry on tissue microarray. Flow cytometry was used to screen the Trop2 expression of lung cancer cell lines. Anti-Trop2 monoclonal antibodies were conjugated with p-SCN-Bn-DFO (DFO) for zirconium-89 (89Zr, T1/2=78.4 h) radiolabeling to construct immunoPET probe. The diagnostic accuracy of the probe was evaluated in subcutaneous lung cancer models by ImmunoPET imaging. ***Results:*** A total of approximately 14 millicuries (mCi) of 89Zr was successfully obtained, with a measured radioactive isotope purity of up to 99%. Analysis of immunohistochemical staining on tissue microarrays derived from lung cancer samples revealed a notably elevated expression of Trop2 in both lung adenocarcinoma and squamous carcinoma. Flow cytometry analysis indicated that the HCC-827 cell line exhibited the most pronounced Trop2 expression. Furthermore, the radiochemical purity of 89Zr-DFO-aTMAB surpassed 95%. ImmunoPET imaging demonstrated a substantial and specific accumulation of radioactivity from 89Zr-DFO-aTMAB in the tumor region. The uptake of the tumor exhibited a gradual increase from 1.59 ± 0.11 at 3 hours to 4.77 ± 0.48 at 144 hours, with the maximum tumor uptake value recorded at 9.58 ± 1.23 (n=3) at 144 hours post-injection. Additionally, there was a gradual decrease in radioactive uptake in the blood and liver, leading to elevated tumor-to-background ratios. ***Conclusion:*** This study successfully developed a Trop2-targeted immunoPET probe, facilitating precise visualization of Trop2 and aiding in the diagnosis of lung cancer. The findings suggest strong potential for clinical translation and offer a promising diagnostic approach for Trop2-overexpressing tumors, including lung cancer.

EP-0970

Optimization of [18F]F-FAPI-74 in-house production: technical and economical analysis

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Aim/Introduction: Radiolabeled FAP Inhibitors (FAPI) rapidly gained a clinical interest as successful pantumoral PET agents, being characterized by either elevated FAP expression in tumor microenvironment and high tumor-to-background ratios. Several FAPI molecules have been tested for PET/CT imaging; among these, one of the most appealing is FAPI-74. In this study, we evaluated the optimization of in-house synthesis of [18F]F-FAPI-74 in relation with an expected elevated clinical demand. ***Materials and Methods:*** FAPI-74 (SOFIE, USA) radiolabeled with [18F]fluoride was produced using a fully automated radiosynthesizer (TRASIS, Belgium) following the manufacturer's procedures [1]. [18F]fluoride was produced by a 18/9 MeV cyclotron (IBA, Belgium) irradiating a standard volume of 2.6 mL of [18O]H2O, using a fixed target current of 60 µA, but different times of beam (10', 20'and 40'). Three starting activities of [18F]fluoride (A= 20 GBq, B= 55 GBq and C= 100 GBq) were used for labeling FAPI-74 (at fixed mass of 72 µg) were used to define the best option to achieve the highest Radiochemical Yield (RCY)/final amount of [18F]F-FAPI-74 along with the analysis of costs related to the different activities. ***Results:*** The RCY values at the end of synthesis, not corrected for decay, were respectively 51% for starting activity A (10,2 GBq vs initial 20 GBq), 54% for B (30 GBq vs initial 55 GBq), and 40% for C (40 GBq vs initial 100 GBq). The cost for the production of [18F]F-FAPI-74 was estimated in 1.037€ (considering the amount of FAPI-74, disposable/reagents, personnel, technologies and maintenance, radioactive waste dismission disposables) and it was unchanged for the different activities. The Radiochemical Purity (RCP) evaluated after each production by radio-HPLC and Thin-Layer Chromatography (iTLC) were >99% for the three activity ranges. ***Conclusion:*** According to our results, the most convenient condition in the preparation of large amounts of [18F]F-FAPI-74, is represented by the starting activity B (achieved with the shorter beam time) which allows to perform up to 25 PET/CT exams. These evaluations may represent an useful body of knowledge to evaluate the costs effectiveness of new radioligands introduced in clinical practice. ***References:***
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EP-0971

BY-271-[18F]F-TEG a new Amyloid β PET radiotracer with improved pharmacokinetics

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Aim/Introduction: Amyloid β (Aβ) plaques and neurofibrillary tangles (NFT) are a hallmark features of Alzheimer's disease (AD). Aβ positron emission tomography (PET) is an established research tool for non-invasive early diagnosis for AD patients. Our goal is to evaluate an improved 18F-labeled analog of FIBT (DOI: 10.1038/s41380-018-0203-5), BY-271-[18F]F-TEG, utilized as Aβ tracer with high affinity, excellent selectivity and favorable pharmacokinetics with excellent brain uptake kinetics and low nonspecific binding.

Materials and Methods: BY-271-[18F]F-TEG was chosen due to its exceptional selective Aβ plaque binding out of over 500 compounds. It was then radiolabeled, purified using HPLC, and utilized directly in a 60-minute dynamic PET/MR and PET/CT scans using single and double-transgenic mice model of AD (Arctic APP and Arte-10 APP/PS1 transgenic mice, n≥3) versus age-matched control mice (n≥3). The brain regions were segmented using the Ma-Benveniste-Mirrione mouse template to evaluate uptake values, time activity curves, and parametric mapping analysis. The frontal cortex and cerebellum were considered regions of interest and reference, then the left ventricle was performed as an arterial input function through the parametric mapping analysis. Additionally, plasma stability, biodistribution, in vivo metabolite analyses, and postmortem autoradiography have been studied. ***Results:*** BY-271-[18F]F-TEG shows high binding affinity (Ki 0.7nM), excellent selectivity toward Aβ plaques over NFT (>1000 fold), logD= 1.9±0.13, plasma protein binding 0.47± 0.12 and favorable pharmacokinetics (radiolabel chemical yield 11±1% and purity ≥99.5%). Autoradiography results also confirm an excellent binding to tg mice and cortical regions of postmortem AD versus no binding to healthy control brains confirmed by Immunohistochemistry (IHC). Besides, it shows brain uptake >7 %ID/g (5 min p.i.) and exceptional stability in brain (t1/2 > 8h). It shows excellent PET imaging results in tg vs ctrl with initial uptake >10%ID/g and fast washout down to 1%ID/g (60 min). The parametric mapping analysis represented significantly higher DVR (up to 2.8 ml/cm3), on the frontal cortex and cerebellum of tg brain versus no specific signal (down to 1.07 ml/cm3, 45-60 min) in ctrl mice brain. ***Conclusion:*** The combined preclinical results of BY-271-[18F]F-TEG encourage us to further study it in our translational research towards first in human study.

EP-0972

Development of two pyrrolo-pyridine and -pyrimidine LRRK2 selective PET radioligands

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Aim/Introduction: Leucine-rich repeat kinase 2 plays a key role in human biology. Elevated LRRK2 levels in cytoplasm and mitochondrial membranes are associated with increased intracellular tau levels and accumulation of oligomeric tau, often alongside β-amyloid plaques. Recent studies highlight a connection between LRRK2 and Parkinson's disease (PD), suggesting monitoring LRRK2 expression in brain regions could aid in understanding neurodegenerative progression. Using a LRRK2-specific radioligand PET imaging would allow for quantification of LRRK2 levels in brain. The objectives of this study were i) Fluorine-18 label of two pyrrolo-pyridine and -pyrimidine ligands (1 and 2 respectively) from the chemical series previously published (Williamson et al. J. Med. Chem. 2021, 64, 10312-10332) ii) evaluate their binding properties through in vitro autoradiography (ARG) and in vivo PET. ***Materials and Methods:*** Lundbeck provided precursors and standards for radiolabeling [18F]1 and [18F]2 in a single-step fluorine-18 substitution. Radiochemical yields and purity were assessed via HPLC analysis. Binding properties were evaluated using ARG in postmortem brain slices. ARG blocking experiments were performed using cold 1 and a LRRK2-specific ligand PFE-360 (US patent US20140005183). PET measurements in NHP brain were performed using HRRT PET scanner. Radiometabolites were measured in plasma using gradient HPLC. ***Results:*** The radiolabeling of [18F]1 and [18F]2 was successful, yielding over 2 GBq of product. Radiochemical purity exceeded 99% at EOS, with MA >120 GBq/µmol. ARG demonstrated significant binding of [18F]1 and [18F]2 in rodent, NHP, and human brain slices under baseline conditions. [18F]1 binding was blocked by 10 µM cold 1 but not by 0.1 µM PFE-360. [18F]2 binding in human striatum, hippocampus, and cerebellum was blocked by 10 µM of PFE-360, implying potential specific binding to LRRK2 in vitro. PET scans in cynomolgus monkeys revealed high brain uptake of both [18F]1 and [18F]2. [18F]1 showed highest uptake in the thalamus, followed by the putamen, caudate, hippocampus, frontal cortex, and lowest in the cerebellum. In contrast, brain uptake of [18F]2 was consistent across all regions of interest. No significant blocking effect of [18F]1 was observed in PET imaging experiments after pretreatment with PFE-360 (0.5 mg/kg, iv). Radiometabolite analysis indicated rapid metabolism with less than 10% of parent compounds remaining at 120 minutes post-injection. ***Conclusion:*** The radiolabeling of [18F]1 and [18F]2 was successful. However, subsequent PET imaging, including displacement experiments, revealed low specific binding in the cynomolgus brain. Consequently, these radioligands are unlikely to be suitable for LRRK2 imaging in vivo using PET.

EP-0973

PARP10 targeting by a [18F]fluorinated PET imaging agent

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Aim/Introduction: Human poly-ADP-ribose polymerases (PARPs) are a group of enzymes that promote the covalent attachment of poly- or mono- ADP-ribose units post-translationally on a variety of amino acids of target proteins. While the search for new PARP1/2 inhibitors is widely pursued because of their use as anticancer agents, the development of inhibitors for mono-ADP-ribose transferases is still at the early stages. In this context, the role of PARP10 has not been completely elucidated yet, although its overexpression in various cancer cells leads to hypothesise its involvement in cancer proliferation. It has been recently reported that PARP10 suppression by selective inhibitors has a huge impact in tumour progression, thus making it a promising target. On the basis of a previous work about PARP10 inhibitors (PARP10i),[1] we aimed at developing a new positron emission tomography (PET) agent to study the role of this enzyme in different cancer models. ***Materials and Methods:*** A flexible radiolabelling protocol was developed on a state-of-the-art synthesizer platform by Cu-mediated [18F]-fluorodeboronation starting from different boronic pinacol esters, including deprotection and semi-preparative purification before reformulation. The optimized protocol resulted in the reaction of a SEM-protected precursor (SEM = 2-((Trimethylsilyl)ethoxy)methyl) in 1,3-dimethyl-2-imidazolidinone (DMI), followed by cleavage with HCl. In vitro assays with the [18F]PARP10i tracer were carried out and analysed on different cell lines expressing PARP10 (e.g. MCF7, A549) by using a gamma-counter to assess the activity and a real-time monitoring equipment to investigate the uptake kinetics. ***Results:*** The optimised automated radiosynthesis allowed to reliably produce [18F]PARP10i as the first promising PET imaging candidate in good yield and high radiochemical purity, suitable for in vitro and in vivo experiments, in ~90 minutes including HPLC purification

and final reformulation. From 1.75 to 4.42 GBq were produced, with an activity yield of 10-24% (n.d.c.) and a molar activity in the range 75-223 GBq/μmol. [18F]PARP10i was finally tested on different tumour cell lines expressing PARP10 (according to Western Blot assessments), showing a fast and stable uptake. Competition experiments were also carried out using the corresponding [19F]-analogous compound as "cold" competitor. ***Conclusion:*** The preliminary results show the potential of [18F]PARP10i as new PET tracer for PARP10 imaging in cancer. Further experiments are in progress to improve the chemical yield, as well as to confirm the potential of this new PET diagnostic agent on tumour cell lines with and without PARP10 expression. ***References:*** [1] Nizi M.G. et al. Journal of Medicinal Chemistry, 2022, 65(11), 7532-7560.

EP-0974

Synthesis and evaluation of radiofluorinated GSK321 analogues as candidate radiotracers for imaging mutant IDH1 expression in gliomas

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Aim/Introduction: Mutant isocitrate dehydrogenase (mIDH) has become an important biomarker for effective diagnosis, prognosis, treatment planning and patient stratification in patients with mIDH. Currently, mIDH status is determined by an invasive immunohistochemical method. A non-invasive PET imaging method for the detection of isocitrate dehydrogenase mutations represents a potentially better alternative. To date, there is no clinically available PET radiotracer targeting mIDH. In this study, we have developed [18F]SK60 and [18F]SK87 and are currently investigating their ability to visualise mIDH1.1 ***Materials and Methods:*** A SAR study was carried out starting from the structure of the mIDH inhibitor GSK321.2 Our medicinal chemistry program led to the development of dimethylated GSK321 analogues, SK60 and SK87 which were radiofluorinated in view of their high potency and selectivity towards the mIDH1R13H. To develop [18F]SK60 and [18F]SK87, copper-mediated radiofluorination was performed with optimized reaction conditions. For [18F]SK60, the ex vivo metabolic stability was investigated in female CD-1 mice at 30 min post-injection (p.i) and the biodistribution was evaluated ex vivo at 5, 15, 30 and 60 min as well as by dynamic PET scan studies (60 min) in healthy female CD-1 mice. ***Results:*** The structural optimization and medicinal chemistry on GSK321 resulted in SK60 (IC50 mIDH1R132H = 14.5 nM and IC50 wtIDH1 = 374 nM) and SK87 (IC50 mIDH1R132H = 25.9 nM and IC50 wtIDH1 >10,000 nM). Compounds [18F]SK60 and [18F]SK87 were successfully synthesized by copper-mediated radiofluorination from the respective Bpin and BEpin precursors, respectively. In vivo studies conducted in healthy female CD-1 mice, exhibited the excellent metabolic stability of [18F]SK60, with parent fractions of 80% and 100% in plasma and brain at 30 min p.i., respectively. The ex vivo biodistribution studies and dynamic PET scan showed a low brain uptake (0.6 % ID/g 15 min p.i.) and hepatobiliary excretion of [18F]SK60 in healthy mice. ***Conclusion:*** This study resulted in the development of a novel series of fluorinated mIDHR132H inhibitors. Consequently, [18F]SK60 and [18F]SK87 were successfully radiofluorinated. Our preclinical evaluation of [18F]SK60 demonstrated high metabolic stability, limited brain uptake and hepatobiliary excretion in vivo in healthy mice. In general, further structural modifications in [18F]SK60 are required to enhance the brain uptake. Currently, we are conducting the biological evaluation of [18F]SK87, the analogue with reduced lipophilicity. ***References:*** 1. Patent application number: DE 10 2024 110 434.1 (15 April 2024) 2. Okoye-Okafor, U. C.; et al. Nat. Chem. Bio. 2015, 11 (11), 878-886.

EP-0975

PET imaging of CXCR4 expression with [18F]AlF-NOTA-QHY-04 in multiple tumors

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Aim/Introduction: C-X-C motif chemokine receptor 4 (CXCR4) is a promising target for the diagnosis and treatment of cancers. Here, we aimed to develop a new CXCR4-targeted PET tracer, and to investigate the translational potential for noninvasive imaging of CXCR4 expression in various cancer entities through both preclinical and pilot clinical studies. ***Materials and Methods:*** [18F]AlF-NOTA-QHY-04 was synthesized based on a potent CXCR4 peptide antagonist, and evaluated by cellular uptake, blocking and biolayer interferometry studies in vitro. The pharmacokinetics, biodistribution, and tumor imaging specificity of [18F]AlF-NOTA-QHY-04 were researched in tumor-bearing mice. [18F]AlF-NOTA-QHY-04 PET/CT imaging was performed on 55 patients with 8 different types of cancer. Correlations between ex vivo CXCR4 expression and PET parameters, and CXCR4 expression characteristics in different tumors were analyzed by histopathological staining in patients. ***Results:*** [18F]AlF-NOTA-QHY-04 was prepared with a high radiolabeling yield and radiochemical purity. [18F]AlF-NOTA-QHY-04 exhibited good stability, high binding affinity and specificity for CXCR4 both in vitro and in vivo. NCI-H69 (small cell lung cancer, SCLC) tumor-bearing mice showed the highest tumor uptake of [18F]AlF-NOTA-QHY-04 on PET imaging except for Daudi lymphoma xenograft model, which was consistent with the results of cellular and histological analyses. Similar results were observed in PET imaging of cancer patients (SUVmax for diffuse large B-cell lymphoma and SCLC, 11.10 ± 4.79 vs. 7.51 ± 3.01, $P = 0.004$), which were both significantly higher than other solid tumors ($P < 0.05$). Significant higher T/N of [18F]AlF-NOTA-QHY-04 than [18F]FDG (62.55 ± 38.67 vs. 1.69 ± 0.22, $P = 0.027$) was found in primary brain tumors. Positive correlations between ex vivo CXCR4 expression and [18F]AlF-NOTA-QHY-04 uptake (all $P < 0.01$) were recorded. Multicolor immunofluorescence staining indicated the high tracer uptake in certain patients was mainly due to the high expression of CXCR4 in tumor cells, followed by macrophages and neutrophils. ***Conclusion:*** The CXCR4-targeted radiotracer [18F]AlF-NOTA-QHY-04 was successfully prepared with favorable yield, high specificity and binding affinity to CXCR4. Preclinical and pilot clinical studies demonstrated its feasibility and potential application in precise diagnosis and CXCR4-targeted therapies for not only lymphoma but also SCLC and glioma. [18F]AlF-NOTA-QHY-04 PET/CT can also provide a complementary mapping for brain tumors to [18F]FDG PET/CT.

EP-0976

Biodistribution of Zirconium-89 Conjugated Escherichia Coli for Positron Emission Tomography imaging of Tumor Targeting

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Aim/Introduction: The conventional drug delivery systems often exhibit low intravenous delivery efficiency and restricted transport within tumor tissues. To overcome these limitations, this study chemically modified the surface of Escherichia coli (E. coli), known for its inherent motility and accumulation in tumor tissues, to stably introduce the diagnostic radioisotope zirconium-89. The possibility of these modified bacteria as a radiopharmaceutical for positron emission tomography (PET) was assessed through in vivo PET studies. ***Materials and Methods:*** For quantitative analysis, the primary amines on the surface of E. coli were reacted with fluorescein isothiocyanate (FITC) in phosphate-buffered saline (PBS). At pH 8.83, deferoxamine (DFO), which contains a terminal isothiocyanate (-NCS) group, was chemically conjugated to the primary amine groups on the surface of E. coli. Subsequently, a stable isotope of zirconium was chelated to the DFO-modified bacterial surface using 0.1M HEPES buffer at pH 7.4, preparing the bacteria for PET imaging. CT-26 cells were dispersed in saline and subcutaneously injected into the thighs of Balb/c mice. After the tumors grew to a length of 120 mm, each mouse was intravenously injected with the radiolabeled bacteria (3.7 MBq/100 µL per mouse). The mice were anesthetized with isoflurane and whole-animal imaging was conducted using PET for one day. ***Results:*** As a result of of measuring E. coli combined with FITC using a microplate reader, it was found that the amount of FITC was 0.06 µmol per 2 x 108 cells of E. coli. The binding of the stable isotope zirconium was confirmed through inductive coupled plasma mass spectrometry (ICP-MS). PET was utilized to evaluate the drug delivery efficacy of 89Zr-labeled E. coli within the body. After intravenous tail injection of 89Zr-labeled E. coli, PET imaging conducted one day post-injection revealed that the E. coli initially accumulated in the tumor tissue, and this accumulation was maintained for one day. ***Conclusion:*** In this study, the diagnostic radioisotope zirconium-89 was successfully labeled on the surface of E. coli, and the in vivo targeting capabilities of these modified bacteria were confirmed through PET imaging studies. Through the targeted delivery capabilities of modified E. coli, it is expected that future research focusing on various modifications to the surface of E. coli will contribute to tumor targeting studies by enabling evasion of the reticuloendothelial system (RES).

EP-0977

Development of Antimicrobial Peptide-based Radiopharmaceuticals in Radiotheranostics of S. aureus Infection

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Aim/Introduction: Infections are the second leading cause of death worldwide(1). Biopsy or CT/MRI are commonly used for infection diagnosis, but they mostly only reveal tissue changes caused by advanced infections. Besides, Biopsies also have the disadvantage of not being able to be tested multiple times. The diagnostic modalities such as PET/SPECT to detect infections has yielded promising results, such as $^{[18F]}$FDG(2), however it is unable to distinguish between infection and inflammation. Radiopharmaceuticals are the best option to circumvent such problems due to their affinity is so higher that they can diagnose earlier, more frequent and more accurate than other detectors. In this research, antimicrobial peptide-based radiopharmaceuticals accurately targeting to S. aureus, a pathogen causing metastatic or complicated infections, was developed. The diagnosis specificity was investigated to demonstrate the potential for clinical use. ***Materials and Methods:*** The model in imaging experiment are New Zealand White rabbits (male, 2-3 months), which are divided into infected group (in situ injected with S. aureus in right knee joint, 108cfu) and control group. After injecting for 3 days, [68Ga] KJT3 was injected to rabbits (i.v., 1mCi/rabbit) for PET imaging. The SD rats (male, 4-6 weeks) were injected S. aureus into the right knee joint (106cfu). The diagnosis specificity was compared using [68Ga]KJT3 and $^{[18F]}$FDG (i.v., 0.2 mCi/rat). ***Results:*** PET imaging demonstrated that the uptake of [68Ga]KJT3 was higher in the right knee joint of infected rabbit compared to their right counterpart, as well as rabbit without S. aureus infection. HE and Gram staining indicate significant joint cavity injury and S. aureus infiltration in cartilaginous tissue. The study demonstrated that the targeting specificity of [68Ga]KJT3 was 12.17, which is 4.5 times higher than $^{[18F]}$FDG according to the ratio of ROI in lesion to ROI in muscle. ***Conclusion:*** Highly specific antimicrobial peptide-based radiopharmaceuticals were used in the diagnose of S. aureus infection, presaging the potential acquisition of ever more powerful and meaningful results of such studies going forward. ***References:*** 1.Global burden of 369 diseases and injuries in 204 countries and territories, 1990-2019: a systematic analysis for the Global Burden of Disease Study 2019. (1474-547X (Electronic)).2.Jødal L, Afzelius P, Alstrup AKO, Jensen SB. Radiotracers for Bone Marrow Infection Imaging. 2021;26(11):3159.

EP-0978

Production development and evaluation of Ga-68 labelled Affibody molecule based radiopharmaceutical targeting platelet derived growth factor receptor beta for phase 0 clinical trial in patients with heart injury

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Aim/Introduction: Activation of platelet derived growth factor receptor beta (PDGFRβ) drives proliferation, migration, and production of extracellular matrix involved in fibrogenic activity. In vivo quantitative imaging of PDGFRβ may significantly improve management of patients, with heart diseases undergoing invasive procedures, in terms of the risk of the formation of fibrotic tissue. The visualization of PDGFRβ using a 18F-labelled Affibody molecule has been preclinically proven by us earlier [1]. This study is devoted to the development of the production of 68Ga-labelled analogue for phase 0 clinical trial and preclinical characterization of the resulting radiopharmaceutical. ***Materials and Methods:*** Affibody molecule Z09591 was generated by chemical synthesis and conjugated with a DOTA chelator moiety at the C-terminal cysteine. The fully automated production of [68Ga]Ga-Z09591 was developed using pharmaceutical grade 68Ge/68Ga-generator, disposable and sterile cassettes developed earlier [2] for Modular-Lab PharmTrace synthesis platform (Eckert & Ziegler). The heating temperature and duration, radical scavenger, product purification and formulation steps, and pH were optimized. The identity and purity of the product were determined using UV-Radio-HPLC. Affinity and specific binding of [68Ga]Ga-Z09591 was investigated in vitro by LigandTracer technology using U87 cells, and autoradiography using U87 xenograft and MC38 tumor sections, respectively. The presence of PDGFRβ was verified by immunohistochemistry (IHC). ***Results:*** Fully automated, reproducible (100% success rate), and GMP

compliant production of [68Ga]Ga-Z09591 was developed. The slight radiolysis was suppressed by ethanol, and heat sensitivity of the precursor required lower temperature. The radiochemical purity of the product was over 95% with total peptide content of 120 ± 15 µg. Radionuclidic purity, sterility, endotoxin content, residual solvent content, and sterile filter integrity were controlled and met acceptance criteria. The product was stable at ambient temperature for at least 2 h. The interaction of [68Ga]Ga-Z09591 towards PDGFRβ on U87 cells had a dissociation constant of Kd=65±35 pM. The biological activity of the product was confirmed using frozen sections of tumor tissues, wherein binding was seen in both U87 xenografts expressing human PDGFRβ receptor as well as in tumor stroma of murine MC38 tumors, and correlated well to PDGFRβ expression as assessed by IHC. ***Conclusion:*** Automated production of [68Ga]Ga-Z09591 was established and validated for the use in phase 0 clinical trial. In addition, the biological activity was evaluated in vitro, and the radiopharmaceutical demonstrated full viability. ***References:*** [1] Wegrzyniak et al., EJNMMI Radiopharmacy and Chemistry, 2023, 8(1):23; [2] Velikyan et al., AJNMMI, 2019, 12-23.

EP-0979

A bifunctional CyHOPO derivative for labeling antibodies with ^{89}Zr and ^{177}Lu for theranostic use

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Aim/Introduction: With the immunoPET development, 89Zr has become a radioisotope of choice because of its prolonged half-life (t1/2 = 78.4 h) matching monoclonal antibodies (mAb) pharmacokinetic. For 89Zr chelation, most mAb conjugates use natural desferrioxamine B (DFO). Yet, preclinical studies demonstrated [89Zr]Zr-DFO complexes are not perfectly stable in vivo. Accumulation of released 89Zr is observed in bones, which can be perceived as a major drawback for the clinical translation of 89Zr-radiopharmaceuticals1. The main reason of this release is the uncomplete coordination sphere of 89Zr with DFO. To reach more stable radio-immunoconjugates, several groups worked on alternative chelating agents containing hydroxamate/hydroxypyridinone functions, such as 1,2-hydroxypyridinone (1,2-HOPO) group, demonstrating excellent chelation properties1. However, very few chelators based on cyclic scaffolds containing 1,2-HOPO groups have been tested. Recently, a 1,2-HOPO based chelator named Lumi804 exhibited high affinity for 89Zr, but also for 177Lu, a β- emitter used in targeted radionuclide therapy (TRT), enabling a theranostic application2. Herein, we report the development of a new bifunctional tetra-1,2-HOPO chelator, based on the cyclen scaffold, and adapted from an already published model used for lanthanide luminescence studies3. We present its conjugation to trastuzumab and radiolabeling with 89Zr and 177Lu. ***Materials and Methods:*** A bifunctional tetra-1,2-HOPO chelating agent (N3AMCyHOPO) was synthetized based on the aminomethyl-cyclen (AMC) scaffold. N3AMCyHOPO was then bioconjugated site-specifically to trastuzumab via enzymatic and click reactions. The resulting immunoconjugates were radiolabeled with 89Zr. Radioconjugates stability were assessed in presence of competitor (DFO) and compared to a DFO immunoconjugate analog. We also determined the immunoconjugate radiolabeling potential with 177Lu and compared to DOTA analog, to explore a possible theranostic application. ***Results:*** N3AMCyHOPO was synthesized in 5 steps from AMC and site-specifically conjugated to trastuzumab with a degree of labeling (DOL) = 1.8. Regarding 89Zr complexation, N3AMCyHOPO exhibited excellent properties with high radiochemical yield (>95%) and substantially higher radioconjugate stability compared to DFO model. For 177Lu, radiochemical yields were around 94%, outperforming DOTA conjugates, the gold standard for this radioisotope. Unfortunately, substantial release was observed in stability tests for our conjugates, highlighting a poor stability of the 177Lu-complex. ***Conclusion:*** N3AMCyHOPO demonstrated effective conjugation to mAb and its potential for 89Zr coordination should overcome DFO limitations. However, our experiments with 177Lu resulted in more contrasted results. ***References:*** 1) Heskamp, S. et al. Bioconjugate Chem. 2017, 28 (9), 2211-2223. 2) Foster, A. et al. eBioMedicine 2021, 71. 3) Dai, L. et al. Chem. Sci. 2019, 10 (17), 4550-4559.

EP-0980

Estrogen-positive metastatic breast cancer examined with [^{68}Ga]Ga-NOTA-PEG$_2$-RM26 PET/CT - First in Human experience

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Aim/Introduction: This study aims to introduce a new diagnostic radiotracer specific for gastrin-releasing peptide receptors (GRPR)-producing tumours. GRPR is part of the bombesin peptide family and is overexpressed in various tumours. GRPR overexpression in breast cancer has been extensively demonstrated, particularly in estrogen receptor (ER) expressing tumours [1]. This First-in-Human study aimed to visualise GRPR overexpression in ER-positive (ER+) metastatic breast cancer (mBC) using [68Ga]Ga-NOTA-PEG2-RM26 Positron Emission Tomography/Computed Tomography (RM26 PET/CT). ***Materials and Methods:*** Six female patients diagnosed with ER+ mBC were enrolled in this study from October 2022 to February 2024. The intravenous administration of [68Ga]Ga-NOTA-PEG2-RM26 was dosed at 2 MBq per kilogram of body weight. PET scans were conducted at 5-minute intervals post-injection, including time points at 20, 40, 60, 120, and 180 minutes. Bed position durations were adjusted, starting from 30 seconds per bed for the initial four scans and increased to 2.5 minutes per bed for the final two scans. Reconstruction of PET images utilised ordered subset expectation maximisation (3 iterations, 16 subsets) with a 5.5 cm Gaussian postprocessing filter. Corrections for attenuation, scatter, randoms, normalisation, and dead time were applied, incorporating time-of-flight and point spread function in the reconstructions. The imaging procedures were conducted using a GE Discovery MI4 PET/CT system from GE Healthcare (Milwaukee, WI, USA). ***Results:*** Four study participants had biopsy-proven ER+ mBC, which showed RM26 uptake. One patient with a biopsy-proven ER-negative lymph node showed no RM26 uptake. The remaining patient had no increased RM26 uptake in a biopsied ER+ skeletal metastasis. At the writing moment, no results of immunohistochemical correlation of the GRPR expression exist that would serve as proof of concept for the actual performance of RM26 tracer using PET/CT. The RM26 uptake on ER+ metastatic lesions was evident from the early PET scans in skeletal and soft tissue metastases of various sizes. ***Conclusion:*** PET/CT imaging with GRPR targeting radiopharmaceuticals like [68Ga]Ga-NOTA-PEG2-RM26 represents an attractive future development and clinical implementation in the era of precision medicine. It

holds potential as an attractive target for the development of therapeutic radiopharmaceuticals. ***References:*** [1] Baratto L, Duan H, Mäcke H, et al. Imaging the distribution of gastrin-releasing peptide receptors in cancer. J Nucl Med. 2020;61:792-798.

EP-0981

Dosimetry of 68Ga-OncoFAP based on a prospective Phase I clinical trial

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Aim/Introduction: Fibroblast Activation Protein (FAP) is an emerging pan-tumoural target for the delivery of diagnostic and therapeutic radio-conjugates. OncoFAP is a high-affinity FAP ligand1,2 which is currently studied in a prospective Phase I clinical trial as a diagnostic radiotracer (NCT05784597). ***Materials and Methods:*** The dosimetry of 68Ga-OncoFAP will be evaluated among patients enrolled in cohort A of the ongoing clinical trial PH-FAPGA-01/22. Patients with a confirmed diagnosis of breast, oesophageal, pancreatic, or colorectal cancer are eligible for inclusion. All patients will receive a single administration of 250 (225-275) MBq 68Ga-OncoFAP followed by a series of PET scans starting at 0 min, 10 min, 20 min, 60 min and 120 min after administration. Low-dose CT images will be acquired at 0 min, 60 min and 120 min post-injection. Volumes of interest (VOIs) will be semiautomatically drawn around the organs, and verified by an experienced physician for proper organ delineation and corrected, if necessary, using PLANET Dose internal dosimetry software (DOSIsoft SA). Tumour VOIs will be drawn using patient-specific SUV thresholding (2.5-3.5) using DOSIsoft SA. In organs with tumours, lesion activity will be subtracted from normal-organ source volumes and incorporated in the body remainder term. Residence time in the whole body, in each single organ, and in tumours will be calculated based on the time-integrated activity coefficient by applying a three-exponential fit to the five data points and correcting the data for decay. Radiation absorbed doses and effective doses will be calculated based on the RADAR method3 by entering the time-integrated activity coefficient of each source organ into OLINDA/EXM 1.14, using the reference adult male and female models, and using the MIRD algorithm with S-factors corrected for actual mass of the patients. ***Results:*** At the cutoff date of the 15th April, 3 male and 3 female patients have been enrolled. Data analysis is ongoing. Preliminary dosimetry on the first two patients analysed is in line with those reported for other FAP tracers and 68Ga-labelled PET radiotracers such as PSMA-11 and DOTATOC. ***Conclusion:*** 68Ga-OncoFAP is a promising diagnostic radiotracer for the detection of various solid tumours. ***References:*** 1) Millul et al, PNAS, 2021 2) Backhaus et al, EJNMMI, 2022 3) Stabin MG, Siegel JA. Physical models and dose factors for use in internal dose assessment. Health Phys. 2003;85:294-310 4) Stabin MG, Sparks RB, Crowe E. OLINDA/EXM: the second-generation personal computer software for internal dose assessment in nuclear medicine. J Nucl Med. 2005;46:1023-7.

EP-62

e-Poster Area

D: Technical Studies -> D5 Radiopharmacy/ Radiochemistry -> D53 New Radiopharmaceuticals - Therapy

EP-0982

Development of a click radio-iodination labeling method using the[^{125}I]Iodo-azide/ADIBO pair

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Aim/Introduction: N-3-azidopropyl-3-[125I]Iodo-benzamide ([125I]Iodo-azide) is a residualizing linker that can be click radio-iodinated with ADIBO pair. The [125I]Iodo-azide/ADIBO pair allows for the production of radio-conjugates in high yields across a wide range of materials and biological environments, from small molecules to large molecular weight proteins. In this study, we evaluated the click radio-iodination labeling efficiency of ADIBO-conjugated rituximab with [125I]Iodo-azide. ***Materials and Methods:*** Radioiodinated Iodo-azide was prepared by iododestannylation using Na[125I]I and H2O2 as an oxidizing agent. The [125I]Iodo-azide was then purified using radio-HPLC equipped with a C18 RP column. The antibody, rituximab, and ADIBO-NHS ester were dissolved in pH 7.2 phosphate buffer at a molar ratio of Ab:ADIBO-NHS= 1:12. The mixture was then reacted at 37 degrees for 2 hours. After the reaction was complete, the buffer was exchanged with PBS pH 7.4 using a desalting column. To determine the ADIBO to antibody ratio, the antibody was deglycosylated with PNGase F and analyzed by LC/TOF after undergoing PNGase F digestion. The click radio-iodination labeling efficiency of [125I]Iodo-azide and ADIBO-rituximab was observed at 37 degrees for 4 hours. ***Results:*** Radio-HPLC was used to analyse [125I]Iodo-azide, with a labeling efficiency of 97%. The retention time (RT) of [125I]Iodo-azide was 11.7 minutes, while the precursor Bu3Sn-azide had an RT of 18.9 minutes. The deconvoluted results of LC/TOF showed that the number of ADIBO bindings per antibody ranged from 0 to 6, with the most common distribution being 2 and 3 bindings per antibody. The efficiency of click radio-iodination labelling was evaluated and found to be 32.3±0.57%, 54.0±3.60%, 92.3±0.57%, and 96.6±2.51% at 30, 60, 120, and 240 minutes, respectively. ***Conclusion:*** High labeling rates were achieved through successful click radio-iodination of ADIBO-rituximab antibody using the newly developed [125I]Iodo-azide. ***References:*** Improved In Vivo Stability of Radioiodinated Rituximab Using an Iodination Linker for Radioimmunotherapy E. J. Kim, B. S. Kim, D. B. Choi, S. G. Chi and T. H. Choi Cancer Biother Radiopharm 2016 Vol. 31 Issue 8 Pages 287-294.

EP-0983

Liposomes as Promising Radiotheranostics Platforms Capable of Carrying Diverse Radionuclides within the Same Framework

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Aim/Introduction: Radionuclide therapy has emerged as a promising treatment for systemic cancer, and the combination of radionuclide therapy and diagnostic radionuclide imaging, known as radiotheranostics, is expected to facilitate precision medicine. However, there are still few radio-theranostic pharmaceuticals that have actually been introduced into clinical practice. Liposomes have the potential to encapsulate various radionuclides and regulate their in vivo dynamics, making them a promising platform for radiotheranostics. In this study, we investigated efficient encapsulation conditions for diagnostic radionuclides such as 111In, 67/68Ga, and 99mTc, as well as therapeutic radionuclides like 64/67Cu, 90Y, and 186/188Re within liposomes. Subsequently, we attempted to construct a system that allows the encapsulation of various diagnostic and therapeutic radionuclides for a single liposomal framework, and explored the radiotheranostic potential of their diverse combination. ***Materials and Methods:*** Liposomes were preloaded various hydrophilic chelating ligands, and the remote loading methods used complex exchange reactions for the encapsulation of various radionuclides. Radionuclide-ligand complex formation was evaluated by paper chromatography and HPLC. The tissue distribution of these radionuclides-carrying liposomes and their therapeutic effects were studied using colon 26-bearing BALB/c mice. ***Results:*** Having already established optimal conditions for 111In encapsulation within liposomes, we proceeded to investigate the optimal encapsulation conditions for various radionuclides in comparison to 111In. As lipophilic ligands, 8-hydroxyquinoline, acetylacetone, and tropolone were examined, while as hydrophilic ligands inside the liposomes, DOTA, DTPA, NTA, EC were tested. 64Cu readily formed complexes with lipophilic ligands, and loading into liposomes was completed in a shorter time at lower temperatures than 111In. 88/90Y required more severe conditions to form stable complexes and load into liposomes. 67/68Ga reactivity was similar to 111In. Optimizing types of ligands and reaction conditions for each radionuclide enabled efficient encapsulation into liposomes (>85%). We were able to efficiently encapsulate 111In, 67/68Ga, 64Cu, and 88/90Y in liposomes of the same composition preloaded with DOTA, suggesting that the liposomes were promising as radiotheranostics platforms. When administered to tumor-bearing mice, these radionuclide-carrying liposomes showed nearly equivalent and good tumor accumulation (8-10% administered dose/g). The tumor was clearly depicted in SPECT/CT imaging of tumor-bearing mice administered with 111In-carrying-liposomes. Administration of 90Y-carrying-liposomes to tumor-bearing mice led to significant tumor growth inhibition. ***Conclusion:*** We have established efficient methods for encapsulating various radionuclides in liposomes. By utilizing liposomes as platforms for encapsulating imaging radionuclides and therapeutic radionuclides with different energies, expanding the potential of radiotheranostics is expected.

EP-0984

^{211}At-labeled alpha-melanocyte stimulating hormone peptide analogs for the treatment of malignant melanoma

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Aim/Introduction: Malignant melanoma is the most aggressive type of skin cancer, and metastatic melanoma is associated with high mortality. Recent advances in the treatment of melanoma have improved clinical outcomes. However, the survival of patients with late-stage melanoma still needs to be improved, and new treatment for malignant melanoma is desired. Although malignant melanoma is traditionally considered radioresistant cancer, targeted alpha therapy (TAT) could provide an effective treatment of malignant melanoma due to the high LET of alpha-particles. Alpha-melanocyte stimulating hormone (α-MSH) peptide analogs show high affinities to melanocortin-1 receptors that are overexpressed in over 80% of human malignant melanoma. Astatine-211 (211At) is an alpha emitter appropriate for TAT, and its relatively short half-life (7.2 h) is suitable for rapid pharmacokinetics of radiolabeled peptides. In this study, we prepared 211At-labeled α-MSH analogs by using a neopentyl glycol scaffold that we recently developed [1], and the usefulness was evaluated. ***Materials and Methods:*** Prior to the study using 211At, we prepared four 125I-labeled α-MSH analogs ([125I]1b-[125I]4b). Binding affinities of each non-radioactive iodinated analogs (1a-4a) against B16F10 melanoma cells were determined by competitive binding assays. Four 125I-labeled α-MSH analogs were subjected to biodistribution study in B16F10 tumor-bearing mice. Then, we prepared two 211At-labeled α-MSH analogs, [211At]3c and [211At]4c, which consist of an 211At-labeled neopentyl glycol scaffold, a hydrophilic dipeptide linker (D-Glu-D-Glu (ee) for [211At]3c or D-Glu-D-Arg (er) for [211At]4c), and an α-MSH analog. Two 211At-labeled analogs were subjected to biodistribution study in B16F10 tumor-bearing mice. ***Results:*** The Ki values of α-MSH analogs including ee (3a) and er (4a) linkers were 1.37 nM and 14.9 nM, respectively. In the biodistribution study, 125I-labeled α-MSH analogs without a linker ([125I]1b) and a D-Glu linker ([125I]2b) showed high accumulation in the intestine. Meanwhile, insertion of a dipeptide linker (ee for [125I]3b or er for [125I]4b) dramatically reduced radioactivity levels in the intestine. Both two 211At-labeled α-MSH analogs exhibited biodistribution similar to those of their corresponding 125I-labeled analogs. Correlated with the Ki values, [211At]4c showed higher tumor accumulation than [211At]3c. ***Conclusion:*** Because high tumor accumulation was observed, [211At]4c is a promising TAT agent for the treatment of metastatic melanoma. ***References:*** [1] Suzuki H. et al. J. Med. Chem. 64, 15846-15857 (2021).

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Radiolabelling DOTA-HYNIC-panPSMA with actinium-225 for in vivo studies

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Aim/Introduction: Prostate specific membrane antigen (PSMA) has emerged as a valuable theranostic target in nuclear medicine, with >95% of prostate cancer cells expressing PSMA. DOTA-HYNIC-panPSMA (formerly DOTA-HYNIC-iPSMA) is a compound with high affinity for PSMA that has been used in studies radiolabelled with lutecium-177 (177Lu). Actinium-225 (225Ac) is a promising alpha-emitting radioactive isotope that can be complimentary to beta-emitting 177Lu at different stages of disease by delivering high energy at short lengths to cancer cells while decreasing the risk of damage to surrounding healthy tissue. Here, we established a radiolabelling and quality control (QC) protocol of DOTA-HYNIC-panPSMA with 225Ac for future in vivo studies. ***Materials and Methods:*** DOTA-HYNIC-panPSMA was labelled with 1.5 MBq of 225Ac at a specific activity of 100 kBq/nmol for 15 minutes at

95°C by stirring and incorporation was determined by radio-thin layer chromatography (TLC). The compound was purified on a C18 SepPak purification column, washed with sodium citrate, and eluted in absolute ethanol. The compound was then formulated to an activity concentration of 370 kBq/mL in formulation buffer (sodium ascorbate and pentetic acid) and the radiochemical purity (RCP) of the purified and formulated product was determined by radio-TLC and radio high performance liquid chromatography (HPLC). The compound was re-analysed by radio-HPLC 4 hours after the end of synthesis to assess stability. ***Results:*** DOTA-HYNIC-panPSMA was radiolabelled with 225Ac an showed incorporation of 89.5% in the crude reaction mixture by radio-TLC. The RCP was 98.6% by radio-TLC and 99.0% in the final product determined by radio-HPLC. No major signs of instability were observed when the compound was re-analysed 4 hours after synthesis, resulting in an RCP of 97.9%. Based upon the radiolabelling data, the QC release criteria of ≥95.0% purity and ≤5.0% of free 225Ac by radio-TLC was established. ***Conclusion:*** A radiolabelling procedure and the QC release criteria for in vivo study of 225Ac-labelled DOTA-HYNIC-panPSMA was established. Future studies of 225Ac-DOTA-HYNIC-panPSMA will determine whether targeted alpha therapy is a promising option in the treatment of prostate cancer.

EP-0986

$^{18}F/^{131}I$-labeledMS438, a small molecularagonist of thyroid-stimulating hormone receptor for theranostic in radioiodine refractory differentiated thyroid cancer

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Aim/Introduction: Differentiated Thyroid cancer (DTC) with a great prognosis was the most common cancer of thyroid[1]. However, two-thirds metastatic patients would lose the ability of iodine uptake and develop into be radioiodine refractory DTC (RAIR-DTC)[2]. Therefore, new target for radiotherapy needs to be explored. Thyroid-stimulating hormone receptor (TSHR) retained expression in RAIR-DTC. MS438 is a small molecular agonist of TSHR with nanomolar level of affinity[3]. Therefore, we thought MS438 targeting TSHR is a potential drug to be labeled for theranostic in RAIR-DTC. ***Materials and Methods:*** The 18F/131I-MS438 was labeled based on the substitution of trimethyltin. Purified 131I-MS438 mixed with phosphate buffer saline and saline were incubated in room temperature to explore the stability of 131I-MS438. The cell uptake of 131I-MS438 was examined by TPC-1 cell. 18F-MS438 was evaluated by micro-PET/CT in TPC-1 tumor xenograft. ***Results:*** The radiochemical purity of 18F/131I-MS438 > 95.0%. Besides, 131I-MS438 was stable in phosphate buffer saline and saline at 2 h and 4 h with radiochemical purity > 95.0%. In vitro, the rate TPC-1 cell uptake of 131I-MS438 continuously increased at 30 min, 60 min, 1 h, 2 h, 4 h and 24 h. The rate of TPC-1 cell uptake at 24h in 131I-MS438 group was higher than blocked group (18.96 % ± 0.50% vs. 11.13 % ± 0.55 %, $P < 0.001$). CCK-8 assays and plate clone formation assays demonstrated 131I-MS438 can effectively inhibit the growth and proliferation of TPC-1 cell. In vivo, preclinical 18F-MS438 PET/CT in a mouse bearing TPC-1 tumor xenograft showed fast hepatobiliary excretion and elevated tumor uptake. The uptake of tumor at 30 min, 60 min and 120 min were 3.38 %ID/g, 3.10 %ID/g and 2.95 %ID/g, respectively. ***Conclusion:*** In preclinical studies, 18F/131I-MS438 is a promising radiotracer for imaging and therapy for RAIR-DTC, however, it further needs to be explored in animal and human. ***References:*** 1. Miranda-Filho A, Lortet-Tieulent J, Bray F, Cao B, Franceschi S, Vaccarella S, et al. Thyroid cancer incidence trends by histology in 25 countries: a population-based study. Lancet Diabetes Endocrinol. 2021;9:225-34. doi:10.1016/s2213-8587(21)00027-9.2. Jin Y, Van Nostrand D, Cheng L, Liu M, Chen L. Radioiodine refractory differentiated thyroid cancer. Crit Rev Oncol Hematol. 2018;125:111-20. doi:10.1016/j.critrevonc.2018.03.012.3. Latif R, Ali MR, Ma R, David M, Morshed SA, Ohlmeyer M, et al. New small molecule agonists to the thyrotropin receptor. Thyroid. 2015;25:51-62. doi:10.1089/thy.2014.0119.

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Therapeutic application of ^{177}Lu-labeled anti-claudin-18.2 humanized VHH-based recombinant antibody in gastric cancer mouse xenograft model

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Aim/Introduction: Gastric cancer (GC) is a leading cause of cancer death globally, often diagnosed late with few treatment options. CLDN18.2, a protein overexpressed in GC, is a prime target for therapy and a vital biomaker. Zolbetuximab, an antibody targeting CLDN18.2, is a promising treatment, acting as more than a radionuclide carrier-it is a key part of the immune system. Full-size Zolbetuximab radioimmunoconjugates can accumulate in the non-target tissues, affecting the T/B ratio. Using smaller antibody fragments can improve tumor targeting and radiotracer clearance. This study explores the therapeutic efficacy of 177Lu-labeled Zolbetuximab and its scFv-Fc fragment (hTCE009) in GC mouse models. ***Materials and Methods:*** Flow cytometry was conducted using the CLDN18.2 humanized VHH-based recombinant antibody hTCE009 or Zolbetuximab. Zolbetuximab, or hTCE009, was conjugated with ρ-SCN-Bn-DOTA (DOTA) for 177Lu radiolabeling separately, followed by 177Lu labeling, purification, and evaluation. Cell uptake experiments were carried out with radiolabeled products, and activity measurement was performed using a gamma counter after incubation for different periods of time. SPECT imaging was conducted on the NUGCCLDN18.2 tumor model at multiple time points after administration of 177Lu-labeled antibodies. Biodistribution analysis was performed at the end of the imaging timepoint (168 h). ***Results:*** The NUGC4CLDN18.2 cell line showed the strongest expression of CLDN18.2 and the specific binding ability of hTCE009 or Zolbetuximab according to the results of flow cytometry and cell immunofluorescence. The radiochemical purity of 177Lu-DOTA-hTCE009 or 177Lu-DOTA-Zolbetuximab exceeded 95%. Cell uptake experiments showed a gradual increase in radioactive uptake values over time for both 177Lu-Zolbetuximab and 177Lu-hTCE009 in NUGCCLDN18.2 cell, about 3.03± 0.18 % and 5.45 ± 0.14 % at 4 h, respectively. While the 177Lu -Zolbetuximab blocking group exhibited lower radioactive uptake at all time points, about 0.86 ± 0.06 % at 24 h. And the 177Lu-hTCE009 blocking group exhibited lower radioactive uptake at all time points, about 0.33 ± 0.16 % at 4 h. In vivo SPECT imaging of 177Lu-Zolbetuximab and 177Lu-hTCE009 revealed an increasing tumor-specific uptake over time, and obvious tumor uptake could be observed at 16 h and 18h post-injection, respectively. Radioactive uptake values in the heart, liver, and kidneys rapidly increased initially and gradually decreased. ***Conclusion:*** In preclinical studies, 177Lu-hTCE009 demonstrated significant detecting efficiency of CLDN18.2-overexpressing tumor. It exhibits strong potential for clinical translation, providing a new promising treatment option for CLDN18.2-overexpressing tumors, including GC.

EP-0988

Cost Utility Analysis of ^{177}Lu-PSMA-617 Radioligand Therapy for Metastatic Castration-Resistant Prostate Cancer (mCRPC) in Germany

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Aim/Introduction: The approval of 177Lu-PSMA-617 radioligand therapy (PRLT) offers targeted treatment for metastatic castration-resistant prostate cancer (mCRPC). Our aim is to determine the cost-effectiveness in Germany of (a) PRLT in addition to standard of care (SoC) compared to SoC alone as third-line treatment for mCRPC and of (b) PRLT compared to second-line Cabazitaxel chemotherapy, thus reflecting earlier use of PRLT in the treatment sequence. ***Materials and Methods:*** Two cohort state transition models were developed with (a) three health states (treatment/stable after treatment, progression, death) and (b) four health states (treatment/stable after treatment, 2nd treatment after first progression/stable after 2nd treatment, 2nd progression, death). Tunnel states were implemented to reflect different cost and quality of life values over time. Dynamic transition probabilities were obtained by fitting hazard models to published data from the VISION trial and the TheraP trial. Quality of life data was derived from the VISION trial and the CARD trial. We used claims data on cost of mCRPC patients between 2019 and 2022 from German SHI funds provided by GWQ ServicePlus AG. The models simulated a time span of 5 years with a cycle length of one month each. Half-cycle correction using the life table method and a 3% discount rate was applied. Deterministic and probabilistic sensitivity analyses were conducted to consider uncertainty. ***Results:*** For model (a), the incremental costs incurred by PRLT and SoC compared to SoC as third-line treatment for mCRPC patients amounted to €27,199.62 per patient, while 0.39 quality-adjusted life years (QALYs) were gained per patient. The Incremental Cost-Effectiveness Ratio (ICER) was €69,417.68 per QALY gained. For model (b), PRLT plus SoC compared to Cabazitaxel as second-line treatment for mCRPC followed by SoC or PRLT plus SoC after progression resulted in incremental savings of €1,460.43 per patient and a gain in QALYs of 0.11 per patient and was thus the dominant option. ***Conclusion:*** While there is no explicit willingness to pay threshold for Germany to interpret the ICER of model (a), our ICER is in the range of the ICER of other reimbursed cancer therapies. This indicates that PRLT may be cost-effective as second-line or third-line treatment for mCRPC. However, it should be noted that our cost data originate between 2019 and 2022, when hospitals mainly used self-produced 177Lu-PSMA-617, which is less costly than the one now commercially available, which limits the generalizability of our findings.

EP-0989

Biodistribution of ^{177}Lu- and ^{90}Y-labeled nanoparticles in tumor-bearing mice

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Aim/Introduction: Radioisotopes that emit beta particles are widely recognized for their effectiveness in tumor therapy. Additionally, using nanoparticles to deliver various therapeutics has emerged as a significant area of research recently. This study investigates the biodistribution of two nanoparticle formulations designed to carry the therapeutic radioisotopes 177Lu and 90Y. The first formulation studied is superparamagnetic iron-oxide nanoparticles coated with citrate and labeled with 90Y (90Y-CA-SPION), while the second formulation involves superparamagnetic iron-oxide nanoparticles coated with DMSA and labeled with 177Lu (177Lu-DMSA-SPION). The goal was to examine the biodistribution of radioactive nanoparticles which could potentially be used for tumor therapy. ***Materials and Methods:*** The bare superparamagnetic iron-oxide nanoparticles (SPIONs) were synthesized using Massart's method1, which involves the alkaline co-precipitation of iron salts in aqueous solutions. These SPIONs were then functionalized with either citric acid (CA) or dimercaptosuccinic acid (DMSA) and radiolabeled with either Yttrium (90Y) or Lutetium (177Lu). For the experiments, female BALB/c mice aged 8-10 weeks were used. These mice were implanted with murine CT-26 colon cancer cells to establish tumor xenograft models for the study. Biodistribution was investigated after i.v. applications of nanoparticles as well as after direct i.t. injections. After the application of nanoparticles, the experimental animals were sacrificed after 24 hours and after 4 days, and their organs were measured for radioactivity. In addition, In vivo imaging of the mice was performed using a direct radioisotopic imaging (DRI) instrument. ***Results:*** Radiolabelling yield was higher than 98% and remained high and practically unchanged at 72h post-labelling showing the great stability of both 90Y-CA-SPIONs and 177Lu-DMSA-SPIONs. Biodistribution results revealed that after the i.v. injection, both formulations of nanoparticles were taken up mainly by the liver and spleen (>90% ID). None of the formulations had a tumor uptake of more than 1% ID. In contrast, after the direct intratumoral injection, both formulations were shown to be stable, and radioactivity remained only in tumors during the four days of follow-up with high tumor retention (>95% ID). ***Conclusion:*** This study confirms the delivery of nanoparticles to solid tumors after i.v. injection is a challenge due to the low uptake by tumor tissue. Nevertheless, we believe that intratumorally injected radiolabeled SPIONs can be considered as a potential therapeutic agent for localized cancer therapy using direct intratumoral application. ***References:*** 1. Massart, R. Preparation of Aqueous Magnetic Liquids in Alkaline and Acidic Media. IEEE Trans. Magn. 17, 1247-1248 (1981).

EP-0990

Development and characterization of small molecules targeting tachykinin receptor 1 (TACR1) as potential theranostic agents

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Aim/Introduction: The tachykinin receptor 1 (TACR1) has emerged as a promising target for theranostic applications due to its heightened expression in various cancers, including glioblastoma, neuroblastoma, childhood leukemia, and osteosarcoma. This upregulation of TACR1 influences critical processes like apoptosis, angiogenesis, and migration, making

it pivotal in carcinogenesis. Targeted radionuclide imaging and therapy offer potential for personalized diagnosis and treatment of patients with TACR1-positive tumors. ***Materials and Methods:*** Over fifty de novo stable iodine-containing TACR1-specific small molecules were designed, and synthesized. In vitro assessments were conducted to evaluate essential drug candidate properties, including solubility, metabolic stability, and plasma protein binding. Real-time binding studies using LigandTracer Green on TACR1-positive cells assessed the interaction of FAM-SP (FAM labelled Substance P) with TACR1, followed by competition assays of investigated compounds to FAM-SP to determine the binding affinity of the molecules. A manual inhibition assay using [125I]-substance P validated the replacement capacity of the molecules. Selected compounds were radiolabeled with 125I, followed by HPLC purification and assessment of stability, binding specificity and affinity on cells. ***Results:*** Following purification, the molecules demonstrated a purity of ≥ 98% and the radiolabeled compounds were stable for at least 20 days. Evaluation of FAM-SP binding kinetics on live cells revealed an affinity of 27±10 nM to TACR1. Compounds were ranked based on their efficacy in replacing FAM-SP, with top binders selected for subsequent iodination. The inhibition percentage of [125I]-substance P correlated with FAM-SP replacement efficacy. Radio-iodinated molecules displayed varying binding affinity and kinetics towards TACR1, with some compounds exhibiting affinities in the picomolar range. Specificity assays revealed significant blocking of the compounds by both validated TACR1-binders SP and aprepitant as well as with the cold investigated compound. ***Conclusion:*** Several TACR1-binding compounds have been successfully synthesized and characterized, displaying promising potential for theranostic applications. LigandTracer and specificity assays demonstrated specific binding and high affinity of selected compounds. Further in vitro and in vivo investigations are warranted to validate and expand upon these findings.

EP-0991

Biodistribution and in vivo efficacy of ^{161}Tb-labeled AKIR001, a novel anti-CD44v6 antibody

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Aim/Introduction: Terbium-161 ([161Tb]Tb3+) has been suggested as a possible substitute for Lutetium-177 ([177Lu]Lu3+) in molecular radiotherapy. Both 177Lu- and 161Tb have favorable emissions and half-lives that align well with the pharmacokinetic properties of monoclonal antibodies. We have developed a full-size human IgG1 antibody toward the cell-surface antigen, CD44v6, AKIR001. In previous studies, AKIR001 was conjugated with DOTA and subsequently labeled with [177Lu]Lu3+ for biodistribution, dosimetry and efficacy studies in tumor-bearing mice. In the current study, we present a substantial exploration of [161Tb]Tb-DOTA-AKIR001 from in vitro to in vivo, in terms of stability, affinity, biodistribution and efficacy using the high CD44v6- expressing squamous cell carcinoma (SCC) xenograft model. ***Materials and Methods:*** AKIR001 was labeled with [161Tb]Tb3+ and evaluated for serum stability and EDTA-challenge, using a 500-fold molar excess of EDTA. Affinity of the radioconjugate was evaluated on cancer cell lines with varying degree of CD44v6 expression using LigandTracer technology and in vitro assays determined the specificity of the radioconjugate. Further, biodistribution studies in the SCC xenograft model evaluated the peak uptake and tumor-to-organ ratios of [161Tb]Tb-DOTA-AKIR001. Finally, efficacy of 161Tb-labeled AKIR001 was evaluated using the SCC xenograft model, and small-animal SPECT evaluated and verified tumor-specific uptake. Hematopoietic toxicity was measured by blood sampling throughout the efficacy study. ***Results:*** The radioconjugate was stable in both serum and in the presence of EDTA (> 98% at 48 h) with double-digit picomolar affinities to the target as expressed on cancer cell lines. Biodistribution revealed high peak uptake at 96 h p.i. and favorable tumor-to-organ ratios, while uptake was successfully and significantly impaired in the presence of a 30-fold molar excess of non-radiolabeled AKIR001 in vivo. Further, the radioconjugate demonstrated excellent efficacy in an activity-dose-dependent manner and SPECT-imaging verified tumor-specific at all dose levels. ***Conclusion:*** The 161Tb-labeled AKIR001 demonstrated excellent properties and could potentially be a highly relevant substitution for [177Lu]Lu3+ for future studies both at the preclinical and clinical level.

EP-0992

Fractionation of [^{177}Lu]Lu-DOTA-AKIR001 results in increased curative rates and favorable hematopoietic toxicities compared to single high dose

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Aim/Introduction: One of the main dose-limiting organs in molecular radiotherapy is the radiosensitive bone-marrow. It has been demonstrated that a fractionated dose in a "two-punch" setting can circumvent the toxicity compared to a single, high dose of the same compound. The current study evaluated the efficacy and hematopoietic toxicity a fractionated dose of [177Lu]Lu-DOTA-AKIR001, a full-size anti-CD44v6 antibody in tumor-bearing mice. ***Materials and Methods:*** AKIR001 was labeled with [177Lu]Lu3+ according to standard methods and stability was evaluated in the presence of both mouse- and human serum. The radioconjugate was evaluated for biodistribution and subsequent dosimetric calculations were extrapolated to human equivalent doses. The efficacy of three different dose levels (5 MBq, 7.5 MBq and 15 MBq) was evaluated in SCC xenografts with high CD44v6-expression levels and hematopoietic toxicity was evaluated through hematopoietic analyses. The 7.5 MBq dose was repeated at 14 days post injection (p.i.). Small animal SPECT was used to evaluate and verify tumor-specific uptake of [177Lu]Lu-DOTA-AKIR001. ***Results:*** Labeling yields were > 99% and remained stable in the presence of both mouse- and human serum (> 98% at 48 h). Biodistribution in SCC xenografts revealed peak tumor uptake of [177Lu]Lu-DOTA-AKIR001 at 96 h p.i. (65%ID/g), while tumor uptake was significantly decreased in vivo at 96 h p.i. in the presence of a 30-fold molar excess of non-radiolabeled AKIR001. Efficacy studies in the SCC xenograft model demonstrated an activity-dose-dependent correlation in tumor response, resulting in high curative rates in the fractionated group (100%) and the high dose group (75%) at day 60 p.i. Median survival for the PBS control group was 7 days, while median survival for the 5 MBq [177Lu]Lu-DOTA-AKIR001 group was 31 days, a >four-fold

increase in survival. SPECT imaging at 6 days p.i. verified specific tumor uptake in all treatment groups. Hematopoietic parameters revealed that white blood cells and platelets were greatly affected by the treatment, albeit in a dose-dependent manner. A rapid and considerable decrease in white blood cells, red blood cells and platelets was observed for the single dose, while a moderate decrease was observed for the fractionated dose. ***Conclusion:*** 177Lu-labeled AKIR001 has an activity dose-dependent effect on tumor growth and subsequent survival of tumor-bearing mice. The study verified that a fractionated dose yields better tolerability compared to a single, high dose, while retaining the desired efficacy, indicating that the upcoming clinical assessment of AKIR001 would benefit from a fractionated dose-setting.

EP-0993

Evaluation and Design of New Chelators using Density Functional Theory Modeling : Implications for Improved Performance of ^{203}Pb/^{212}Pb-based Theranostic for Cancers

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Aim/Introduction: 203Pb/212Pb-based alpha-particle theranostics holds significant potential for targeted imaging and therapy for cancers. One of the key factors leading to the success of the targeted theranostics is the sophisticated matching of the chelator to the specific radionuclide, ensuring stability and targeted delivery. In this study, we evaluated multiple chelators for imaging and therapeutic radionuclides, and newly designed chelator compositions to potentially optimize for the Pb isotopes. ***Materials and Methods:*** Density Functional Theory (DFT) modeling techniques were utilized to analyze the interaction energies between radionuclides and chelators and to determine the chelation configuration of the complexes. Multiple chelators extensively used in targeted theranostics (i.e., DOTA, NOTA, and TETA), were investigated with imaging (e.g., 68Ga, 64Cu, 111In) and therapeutic radionuclides (e.g., 177Lu, 90Y). Based on the findings of the initial studies, new chelator compositions were designed and being evaluated for 203Pb/212Pb to identify an optimized form the theranostic pair. ***Results:*** The computational analyses elucidated that the physicochemical properties, particularly size and charge compatibility between chelators and radionuclides, influence the stability of the complexes. NOTA-Ga, DOTA-Y, and TETA-Cu complexes showed the highest levels of stability as suggested previously. The configuration analysis suggested that the coordination number varied depending on the ionic radius. Small ions (e.g., Ga3+, Cu2+) tend to prefer 6-coordinated complex (octahedron), whereas large ions (lanthanide ions) are mostly found in 8-coordinated complexes (square antiprism). Bader charge analysis indicated that the stability of the chelator-radionuclide complex increased when minimal alterations occurred in the total charge before and after chelation. In addition, we observed that a new chelator composition form, Pb specific chelator (PSC), exhibited lower chelation energy, indicating better chelation performance, and preferred configuration compared to the DOTA counterpart. Further analyses with new designs are being performed to identify better chelator candidates. ***Conclusion:*** This study elucidates how each chelator react with imaging and therapeutic radionuclides, optimizing chelating form for the respect radionuclide. The results confirmed the superior performance of the modified chelators when compared to conventional forms and thus validated our computational strategy to be an effective tool for customizing chelators for targeted theranostics. Ongoing studies are expected to suggest novel chelator compositions designed for improved stability and specificity for 203Pb/212Pb theranostic radionuclides.

EP-0994

Radiolabelling, In Vitro Receptor Binding, and In Vivo Distribution of Anti-VEGFR2 Monoclonal Antibody Ramucirumab Radiolabelled with Terbium-161

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Aim/Introduction: Anti-VEGFR2 agents such as monoclonal antibody ramucirumab (RAM) can inhibit the VEGFR2 receptor and suppress undesired angiogenesis in tumours. The fully humanized RAM targets the extracellular receptor binding site and hence prevents interactions with natural VEGF ligands. Besides FDA and EMA approved therapeutic application non-labelled RAM, the antibody can be potentially applied for radio imaging or radiotherapeutic treatment of VEGFR2-positive tumours using appropriate radiolabel. The aim of the study was to prepare an applicable preparation of 161Tb-radiolabelled RAM and evaluate 161TbRAM biological characteristics in vitro and in vivo, including binding to the target and accumulation in a model tumour. ***Materials and Methods:*** Ramucirumab was conjugated with pSCNBnDOTA using a standard method. The purified immunoconjugate DOTA-RAM was further radiolabelled with terbium-161, a β- and γ emitter. The binding ability of the prepared radioimmunoconjugate to the target receptor was tested in vitro using real-time analysis to determine equilibrium dissociation constant (KD) in VEGFR2-bearing human prostate adenocarcinoma (PC-3) and ovary adenocarcinoma (SKOV3) cell lines. [161Tb]Tb-DOTA-RAM organ distribution ex vivo was analysed in BALB/c mice. SCID PC-3 mouse xenografts were used to obtain SPECT/CT imaging in selected timepoints. ***Results:*** The prepared [161Tb]Tb-DOTA-RAM radioimmunoconjugate exhibited a high radiochemical purity (>95 %) and metabolic stability. In vitro experiments found a high binding affinity of [161Tb]Tb-DOTA-RAM to the target receptors in PC3 and SKOV3 cells, respectively. The obtained biodistribution data of [161Tb]TbDOTARAM in noncancerous mice demonstrated dominant accumulation of [161Tb]Tb-DOTA-RAM in lung, liver and spleen (7.0, 5.3 and 3.6 % /g) at 72 h p.i. Similar biodistribution patterns were found in xenografted mice but relatively high radioactivity was found to be continuously accumulated in the model tumour in dependence on time following administration. ***Conclusion:*** The prepared 161Tb-labelled RAM showed adequate radiopharmaceutical parameters to be applicable for biological experiments. The used method for radiolabelling with terbium-161 enabled to preserve high binding ability to the target receptors. In addition, the observed gradual accumulation in the tumour tissue could be a base for potential therapeutic application of the tested

radioimmunoconjugate. ***References:*** Acknowledgements:The authors would like to thank for the financial support to Ministry of Health of the Czech Republic (grant NU23-08-00214), and to Charles University, program Cooperatio Pharmaceutical Sciences.

EP-0995

Comparative study: Exploring the Advantages of Tb-161 over Lu-177 in Targeted Radionuclide Therapy and the impact of Antagonist vs Agonist

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Aim/Introduction: In the field of targeted radionuclide therapy (TRT), [177Lu]Lu-DOTA-TATE is one of the pioneers in the treatment of neuroendocrine tumors (NETs) by targeting the SSTR2 receptor. Over the years, new approaches such as the labeling of antagonists (e.g., DOTA-JR11) have been introduced. Regardless, these studies have shown that SSTR2 antagonists have a lower binding affinity to the receptor in comparison to SSTR2 agonists (e.g., DOTA-TATE), but still results in higher cell-uptake. With the rationale that antagonist are not internalized but remain at the membrane, TRT could potentially be improved by combining an antagonist with an Auger/conversion emitting nuclide, since the cell membrane has been identified as an optimal target for these types of electrons [1]. Similar to Lu-177, Tb-161 is a β--emitter, but additionally emits Auger/conversion electrons. Therefore, Tb-161 could be an interesting isotope for the treatment of NETs. In this study, antagonist/agonist were compared using both Lu-177 and Tb-161 ***Materials and Methods:*** DOTA-TATE and DOTA-JR11 were labeled with either Lu-177 or Tb-161 under identical labeling conditions. The radiochemical yield (RCY) and radiochemical purity (RCP) were determined by iTLC and radio-HPLC, respectively. The stability of the four radiopharmaceuticals were determined in labeling formulation, PBS and mouse serum (MS) at 2, 4 and 24h. Cell-binding assays on U2OS-SSTR2+ cells were performed to evaluate the differences between Lu-177 and Tb-161 labeled compounds at 1h, 2h and 3h. Mouse bio-distributions were performed at 4, 24, 48 and 72h (5MBq/0.5nmol) post injection for all 4 labelled compounds. ***Results:*** Radiolabeling results of Tb-161 were similar to Lu-177. All 4 compounds showed stability >90% RCP in formulation solution, PBS and MS after 24 hours. Cell binding experiments showed a similar pattern in total binding at all-time points for [177Lu]Lu-DOTA-TATE (61.14% at 3h n=3) and [161Tb]Tb-DOTA-TATE (53.07% at 3h n=3) as for [161Tb]Tb-DOTA-JR11 (69.31% at 3h n=3) and [177Lu]Lu-DOTA-JR11 (72.68% at 3h n=3). Preliminary bio-distribution studies showed a tumor-kidney ratio for [177Lu]Lu-DOTA-TATE (0.61% at 4h n=4) , [161Tb]Tb-DOTA-TATE (0.58% at 4h n=4) and [161Tb]Tb-DOTA-JR11 (0.43% at 4h n=4), [177Lu]Lu-DOTA-JR11 (0.7% at 4h n=4). ***Conclusion:*** The labeling conditions and stability were similar for all the 4 radiopharmaceuticals. Cell-binding experiments showed no significant difference between either [177Lu]Lu-DOTA-TATE and [161Tb]Tb-DOTA-TATE or [161Tb]Tb-DOTA-JR11 and [177Lu]Lu-DOTA-JR11. Bio-distribution showed no significant difference in uptake ex vivo. These outcomes underlines the similarity of Lu-177/Tb-161 labelled compound, and will be used to for future therapeutic comparison. ***References:*** 1. Muller, et al, EJNMMI (2023).

EP-0996

Preclinical efficacy of CAIX-targeting [^{177}Lu]Lu-WT-735-0626 for aggressive renal cell carcinomas

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Aim/Introduction: Clear cell renal carcinoma (ccRCC), which accounts for 80-90% of all kidney cancers, is one of the most aggressive subtypes with a high incidence of metastases and low survival. Carbonic anhydrase IX (CAIX), a cell membrane protein overexpressed in >90% of cell ccRCC patients, is an attractive tumor-specific target for radiopharmaceutical therapy (RPT). We aim to develop a novel series of high affinity, selective radioligands targeting CAIX as next-generation RPT agents for ccRCC. ***Materials and Methods:*** Radioligands were synthesized featuring our potent CAIX binders and DO3A as chelating moiety. Lead candidates, WT-735-0626 (626; Ki=2.8 nM) and WT-735-0729 (729; Ki=0.17 nM) were radiolabeled with 111In or 177Lu, for Single-Photon Emission Computerized Tomography (SPECT) and therapeutic studies, at an apparent molar activity of 7.4 or 1.8 GBq/μmol. [111In]In-626/729 (8.4 MBq) was intravenously injected in female nude mice bearing subcutaneous SK-RC-52 ccRCC xenografts and SPECT/CT acquired in an MI Labs U-SPECT scanner at 1, 4, 24, 48, 120 and 168 h post-injection (p.i.). Ex vivo biodistribution followed the last imaging time point. Region of interest analyses of the SPECT/CT images using Imalytics 3.0 software determined tumor and normal tissue uptake, reported as injected activity per gram of tissue (%IA/g; mean ± SD) and absorbed dose per activity (Gy/MBq) for each agent. In therapeutic studies, groups of mice (N=5-10) received IV [177Lu]Lu-626 or [177Lu]Lu-729 (18.5, 37 or 111 MBq), [177Lu]Lu-girentuximab, or vehicle control. Tumor growth, overall survival, and animal health were recorded three times weekly. ***Results:*** Radiolabeling of 626 and 729 with 111In/177Lu proceeded quantitatively with high radiochemical purity and stability (>95%). SPECT/CT images revealed high uptake and prolonged retention in SK-RC-52 tumors, peaking at 45.3 ± 1.8 %IA/g and 51.7 ± 12.1 %IA/g for [111In]In-626 and [111In]In-729, at 24 h p.i. Dosimetry estimates for 177Lu-labeled analogs showed unprecedented tumor adsorbed dose rates north of 3.0 Gy/MBq. Consequently, [177Lu]Lu-626/729 treatment led to significant tumor regression and extended animal survival for over 60 days in all treatment arms compared to the control. Repeat efficacy studies escalating [177Lu]Lu-626 IA confirmed the efficacy and tolerability of the treatment. ***Conclusion:*** We have developed novel CAIX radioligands with exquisite potency, selectivity, in vivo tumor targeting, and normal tissue distribution. Our therapeutic efficacy data evidenced best-in-class potential of [177Lu]Lu-626/729, supporting our current efforts toward the clinical translation of these promising RPT agents in ccRCC and other CAIX-expressing cancers.

EP-63

e-Poster Area

D: Technical Studies -> D5 Radiopharmacy/ Radiochemistry -> D54 New Biological Targets and Ligands

EP-0998

Targeting Esophageal Cancerfor Imaging and Therapy Using Claudin 6 Radioligands

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Aim/Introduction: Advanced or metastatic esophageal cancer(EC) is associated with poor prognosis; new and effective treatment methods are needed. The purpose of this study was to assess whether Claudin 6 (CLDN6) is a useful target for imaging and radioligand therapy of EC, using a novel pair of radioactive nuclides, 89Zr and 177Lu. ***Materials and Methods:*** CLDN6 expression was evaluated in two BC datasets (n = 436 biopsies). We performed a retrospective analysis of 109 patients with EC to evaluate CLDN6 expression. we use the anti-CLDN6 mAb labelled with 89Zr and 177Lu for PET imaging and therapy, respectively. We performed imaging and biodistribution analyses on a xenograft model characterized by high levels of CLDN6 expression. Furthermore,we have evaluated the therapeutic potential of 177Lu-IMAB027 within this model. ***Results:*** CLDN6 is not expressed in normal esophagus, but its expression rate in esophageal cancer tissue is 79.8%. 89Zr-IMAB027 has shown good stability in vitro and can effectively image EC xenografts with high expression of CLDN6. 177Lu-IMAB027 has demonstrated favorable tumor targeting in vivo, with higher tumor uptake compared to other tissues. Therapy studies with a single dose of 177Lu-IMAB027 in the TE-1-CLDN6 model exhibited better tumor regression and survival outcomes compared with the monoclonal antibody and control groups ($p < 0.05$). ***Conclusion:*** CLDN6 has a high expression rate in esophageal cancer and is a promising target for imaging and radioligand therapy. 89Zr-IMAB027 showed high contrast to visualize CLDN6 expressing xenografts for PET imaging, and 177Lu-IMAB027 induced rapid tumor regression in a preclinical model of EC.

EP-0999

Development of Follicle Stimulating Hormone Receptor Ligands for Ovarian Cancer Theranostics

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Aim/Introduction: The Follicle Stimulating Hormone Receptor (FSHR) is physiologically expressed only in the reproductive system, while being overexpressed in many primary and metastatic tumors[1], and notably within the majority of gynecological cancers, like ovarian cancer[2]. We aim to develop first-in-class radioligands targeting FSHR as theranostics for ovarian cancer, based on binding domains of the α- and β-subunit of Follicle Stimulating Hormone (FSH). In parallel, we aim to develop and validate a panel of FSHR-expressing cell lines and tumor models for the preclinical assessment. ***Materials and Methods:*** A series of six rationally designed linear and cyclic peptidomimetics were synthesized by solid phase peptide synthesis; FNM-101, FNM-102 and FNM-103 were based on domains of the FSHβ, and FNM-1, FNM-2 and FNM-4 combined binding domains of FSHα- and FSHβ subunit. All ligands were conjugated to DOTA, characterized by RP-HPLC and ESI-MS and labeled with [177Lu]LuCl3. Their distribution coefficients (log D) were determined in octanol/PBS7.4. A panel of 6 cell lines (HT1080, OVCAR-8, SKOV-3, HEK-293, SKRC-52 and A431) were subjected to lentiviral transduction with pUltra plasmid encoding human FSHR, enabling bicistronic expression of FSHR and EGFP fluorescent reporter (FSHR+), or empty pUltra plasmid to produce FSHR-negative control cell lines (FSHR-). Transduced cells were sorted by FACS and further validated by flow cytometry. ***Results:*** Six new FSH-based ligands were designed and synthesized with >95% purity. They were labeled with Lu-177 with radiochemical purity of >95%, at an apparent molar activity of 50 MBq/nmol. All radioligands demonstrated high hydrophilicity, with log D values ranging from -4.42 ± 0.37 to -3.08 ± 0.33, suggesting favorable biodistribution. Flow cytometry on live FSHR+ cells with Alexafluor647-conjugated FSHR and isotype control antibody demonstrated high and specific expression of FSHR on the cell surface. Mean fluorescence intensity values of FSHR+ cells ranged from 34 to 66-fold increased fluorescence over background. ***Conclusion:*** A first series of 177Lu-labeled peptidomimetics of FSH was synthesized. The successful generation of FSHR-expressing cell lines enables their in vitro evaluation and ensures the generation of a FSHR-expressing tumor model(s) for in vivo assessment. The in vitro and in vivo characterization of the radioligands is currently ongoing and will be presented. ***References:*** [1] A. Radu et al., NEJM 363, 1621-1630 (2010). [2] A. Perales-Puchalt et al., Clin Cancer Res 23, 441-453 (2017).

EP-1000

Fibroblast-activating protein (FAP) expression in high-grade meningioma: a potential target for theranostic treatments

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Aim/Introduction: Fibroblast activating protein (FAP) is a promising target of diagnostic and therapeutic nuclear medicine approaches in a variety of solid tumors. Higher-grade meningiomas represent an unmet clinical need in neuro-oncology, as they are associated with high recurrence rates, limited treatment options and shorter survival times. ***Materials and Methods:*** Overall, 58 samples of high-grade meningioma were retrieved from the institutional Neuro-Biobank. Immunohistochemical stainings of FAP and somatostatin receptor subtype 2a (SSTR2a) have been performed using monoclonal rabbit anti-FAP (clone JA56-11, Thermo Fisher Scientific) and anti-SSTR2a (clone EP149, Cell Marque) antibodies. DNA methylation analysis was performed using Illumina EPIC 850k chips, and panel sequencing for NF2, TRAF7, KLF4, SMO, AKT1, TERT promotor, ARID, SUFU and PIK3CA was done using Illumina NextSeq. ***Results:*** Median age of included patients was 60 years (range: 19-83), and 35/58 (60.3%) of patients were female. Most meningiomas were atypical according to initial diagnosis (30/58, 51.7%), followed by anaplastic (18/58, 31.0%), chordoid (9/58, 15.5%), and rhabdoid histologies (1/58,

1.7%). WHO grades as to the current 2021 classification were CNS WHO grade 1 in 1/58 (1.7%), CNS WHO grade 2 in 39/58 (67.2%), and CNS WHO grade 3 in 18/58 (31.0%) of samples. Most tumors were located at the falx and the cerebral convexity (36/58, 62.1%). FAP expression was seen in 15/58 (25.9%) included samples with marked spatial heterogeneity as positive areas were most frequently located in the stroma or at tumor edges. Overall, 12/18 (66.7%) tumors of CNS WHO grade 3 tumors were positive for FAP as opposed to 3/39 (7.7%) of CNS WHO grade 2 meningiomas ($p < 0.001$). In line, DNA methylation subtyping showed numerically more frequent FAP+ staining in tumors of malignant methylation class (4/8, 50.0%) compared to benign (4/23, 17.4%) or intermediate (7/27, 25.9%, $p = 0.069$). In addition, 4/5 (80.0%) samples with homozygous deletion in CDKN2A/B showed FAP staining. FAP expression was more frequently observed in patients with NF2 mutations (10/25, 40.0%) than in those without (5/33, 15.2%, $p = 0.032$). Of FAP+ samples, 12/15 (80.0%) were also positive for SSTR2a on tumor cell membranes. ***Conclusion:*** FAP is expressed in a subset of high-grade meningioma samples. Further investigation of FAPi-based radioligands is warranted, and given the complimentary expression pattern with SSTR2a, combination treatments with DOTATATE-based treatments could represent a promising strategy.

EP-64

e-Poster Area

D: Technical Studies -> D5 Radiopharmacy/ Radiochemistry -> D55 Radiopharmacokinetics and Drug Development

EP-1001

Development of a Preclinical Physiologically-Based Pharmacokinetic Model for ^{161}Tb-DOTATATE

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Aim/Introduction: 161Tb-DOTA-TATE is an emerging β- and Auger electron emitter with a high potential for radioligand therapy (RLT) against neuroendocrine tumours overexpressing the somatostatin receptor type 2 (SSTR2). RLT is often associated with both an interindividual variability and a heterogenous distribution of the radiopharmaceutical between and within tissues, due to patient- and tissue-specific SSTR2 expressions and tumour burden. Therefore, there is a need to consider the influence of tumour SSTR2 expression levels on radiopharmaceutical uptake by both the tumour and the organs-at-risk. In this respect, this study aimed to investigate and describe the pharmacokinetic behaviour of 161Tb-DOTA-TATE firstly in healthy mice using physiologically-based pharmacokinetic (PBPK) modelling. ***Materials and Methods:*** A murine whole-body PBPK model was implemented for 161Tb-DOTA-TATE using MATLAB Simbiology®. The model structure and model parameters were based on a published 212Pb-DOTAM-TATE tumour mice PBPK model [1]. The model was adapted to 161Tb-DOTA-TATE physicochemical properties and novel in vitro binding data for the CA20948 cell line and healthy mice characteristics. The kinetic parameters and SSTR2 densities of the different compartments were investigated by fitting the model to preclinical biokinetic data of 161Tb-DOTA-TATE in blood, kidneys, pancreas, liver, spleen and lungs obtained from healthy C57BL/6 mice at 6 time points. Model performance was evaluated by comparing the simulated time-integrated activity (TIA) with the observed data. Additionally, parameter sensitivity analyses were conducted. ***Results:*** A good fit of the model to the biodistribution data was observed with relative errors for the TIA ranging from -24% for pancreas, to 38% for spleen. Compared to the values used in [1], substantial organ-specific increases of SSTR2 densities were needed to match the observed data. This increase was up to +120% for lungs, spleen, and pancreas, while much higher adjustments were required for liver (+1700%) and kidneys (+4400%). Thus, the contribution of renal specific binding was substantially increased, while the nonspecific endocytosis rate associated to tubular reabsorption was lowered, compared to [1]. ***Conclusion:*** The developed PBPK model successfully described the pharmacokinetic behaviour of 161Tb-DOTA-TATE in mice. The high influence of SSTR2 expression on the radiopharmaceutical kinetics emphasized the need for an accurate description and quantification of SSTR2 expression in tissues at the organ and sub-organ levels, which will be our next research goal. These results in a preclinical setting constitute a first step towards the application of PBPK modelling to support dosimetry-based RLT personalization with radiolabelled somatostatin analogues. ***References:*** [1] Zaid et al., Pharmaceutics. 2021;10;13(12):2132. https://doi.org/10.1089/cbr.2020.4112.

EP-1002

^{11}C-labeling in two different positions of the prodrug of a potential novel antidepressant.

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Aim/Introduction: An amino acid-based methyl ester prodrug of a potent and selective glycine binding site partial agonist of the N-methyl-D-aspartate (NMDA) receptor was investigated for blood-brain barrier (BBB) penetration. The aim of the study was to label the prodrug with carbon-11 in two different positions to investigate the BBB penetration of the prodrug in a NHP model. ***Materials and Methods:*** The two versions of the prodrug labeled in different positions, but structurally identical, were synthesized from the corresponding precursors using TracerMaker (Scansys, Denmark) module. First, [^{11}C]methyl ester labeled prodrug (1) was synthesized using amino Boc-protected acid precursor, with the carbon-11 introduced using [^{11}C]MeOTf in acetone (with NaHCO3 as base), followed by deprotection with 6M HCl and purification on Shodex Asahipak ODP-50 6E column with MeCN/aq. K-phosphate buffer pH 5.8 (0.05M) as mobile phase. After SPE isolation, the product was formulated in saline/EtOH mixture (<10% EtOH w/v). Secondly, a [^{11}C]methyl group was introduced in the substituted aromatic ring of the prodrug (2) from amino Boc-protected stannyl precursor using a previously published approach (Pretze et al. Molecules 2011, 16, 1129), followed by deprotection. Purification and formulation were conducted similarly to [^{11}C]methyl ester labeled analog. NHP PET imaging was conducted in cynomolgus monkeys on Siemens HRRT system (imaging time of 120 minutes, average injection of 110±40 MBq). ***Results:*** Labeling of 1 and 2 was successfully accomplished, with possibility of producing up to 1 GBq of the [^{11}C]methyl ester labeled prodrug 1 per synthesis. Yield of prodrug 2 were much lower due to labelling complexity.

Labeling of the prodrug, independent of label position, was complicated due to sensitivity of the compound to radiolysis on silica-based stationary phases. This necessitated use of polymer-based SPE cartridges (Oasis HLB) and Asahipak ODP-50 6E semi-prep column. Both compounds were produced in RCP >95% and were stable in formulation for at least 40 min, MA was 173±90 GBq/μmol at TOI, average carrier mass injected was <0.25 μg. Brain uptake of 1 ranged from 0.9 to 1.8 in SUV and between 1.2 to 2.4% injected dose %ID. Peak brain uptake of 2 ranged from 0.7 to 0.9 in SUV and between 0.7 to 0.9 %ID. ***Conclusion:*** A methyl ester prodrug was labelled in two different positions and BBB penetration was clearly seen for both versions in a NHP model. Findings support further evaluation of brain uptake in human subjects using these carbon-11 labelled prodrugs to verify brain penetrance.

EP-1003

Model-Informed Drug Development Framework for the Development and Dose Optimization of Targeted Radiation Therapies

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Aim/Introduction: While targeted radiation therapies (TRTs) are raising more and more interest in the oncology space, the regulatory landscape continues to evolve leaving development teams without clear guidance. Model-Informed Drug Development (MIDD) can provide key insights into optimizing doses to achieve maximum efficacy within safety bounds, as well as the design of novel therapeutics with enhanced therapeutic index. The theranostic nature of TRTs allows for precise modelling and prediction of drug kinetics and absorbed doses which will allow for better decision-making in the development process. In this abstract, we present an end-to-end framework for using MIDD with TRTs, specifically with PSMA targeting radio-ligands. ***Materials and Methods:*** Taking both plasma activity and combining with nuclear imaging, the drug kinetics was modelled in both the blood and organs of interest. The semi-mechanistic compartmental models incorporated any saturable uptake of the radio-ligand into peripheral organs of interest as a function of tissue volume and target expression. Parameterizing the models in terms of drug radioactivity allowed for the calculation and prediction of absorbed doses into specific organs of interest. These models were used to optimize drug properties such as binding affinity, and plasma half-life to improve therapeutic index and support candidate selection. Subsequently, at later stages, with the ability to predict organ absorbed dose, the dosing regimen can be optimized by minimizing the simulated adverse event profile linked to specific organs while maximizing tumour exposure. ***Results:*** The MIDD framework was validated using published clinical data with published Pluvicto (lutetium Lu 177 vipivotide tetraxetan). The framework made accurate predictions of across a range of doses, PSMA densities, and tumor volumes accounting for distribution and competitive binding of labeled and un-labeled drug in tumor and non-tumor tissues. In addition, the framework allowed to characterize the specific radioactive dose absorbed into blood and various organs such as liver, kidney, spleen, salivary gland and tumor. The absorbed dose predictions were in good alignment with the patient specific dosimetry results. Subsequently, the model predicted exposures were linked to safety and efficacy endpoints which allowed extrapolation from the dosimetry to clinical endpoints. ***Conclusion:*** The MIDD framework can be utilized to translate drug design features such as receptor binding affinity on the disposition in various organs of the radio-labeled drug to inform clinical candidate selection to help maximize the therapeutic index. Subsequently, the framework can be utilized to establish first-in-human dosing regimens and to optimize recommended Phase 2 doses.

EP-1004

PET/CT monitoring of lung-targeted extracellular vesicles delivery of siRNA for the treatment of lung metastatic tumors

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Aim/Introduction: Extracellular vesicles (EVs) possess natural material transport properties and excellent biocompatibility, making them uniquely advantageous as gene delivery carriers[1]. However, the tendency of nanomaterials to accumulate in the liver and spleen poses a significant barrier to their clinical translation[2]. Currently, there is a lack of rational design strategies for efficient EVs delivery to target cells in tissues other than the liver. Here, auxiliary molecules are added to the EVs membrane surface to enable targeted delivery of siPD-L1 to the lungs for tumor treatment via endogenous targeting. PET/CT and fluorescence imaging monitor its metabolic distribution in the body. ***Materials and Methods:*** B16-F10 tumor cell-derived microvesicles (TMVs) were extracted using differential centrifugation. The cationic lipid DOTAP was engineered for lung targeting, and the surface of TMVs was modified with the NOTA group for 68Ga labeling. Mice received injections of either 68Ga-TMVs-DOTAP or 68Ga-TMVs via the tail vein. PET/CT imaging was conducted for each group. DiR was used to label TMVs-DOTAP and TMVs, and fluorescence images were collected after intravenous injection into mice. B16-F10 cells were incubated with TMVs-DOTAP/siPD-L1, confirming its ability to silence the PD-L1 gene in vitro. A mouse model of melanoma lung metastasis was established. Subsequently, TMVs-DOTAP/siPD-L1, TMVs-DOTAP/siNC, TMVs-DOTAP, TMVs, and PBS were injected via the tail vein to assess their in vivo anti-tumor effects. ***Results:*** TMVs are extracted from the cell supernatant through multi-step centrifugation. The protein content is 0.4-0.6 mg/mL. The particle sizes of TMVS, NOTA-TMVS, and NOTA-TMVs-DOTAP measured by nanoflow cytometry are 150.2±18.7, 153.2±18.3, and 195.8±14.7 nm. PET/CT imaging revealed that TMVs-DOTAP selectively accumulated in the lungs. In contrast, unmodified TMVs predominantly accumulated in the liver. Fluorescence imaging showed that TMVs-DOTAP persisted in the lungs 72 h post-injection. Western blotting and flow cytometry confirmed that TMVs-DOTAP/siPD-L1 effectively reduced PD-L1 protein expression levels to exert anti-tumor effects. ***Conclusion:*** This study focuses on developing new technologies for functionalized EVs strategies. We introduced the cationic lipid DOTAP to the EVs membrane surface for targeted delivery of siPD-L1 to the lungs through endogenous targeting. This advancement enhances the applicability of EVs in both preclinical and clinical settings. ***References:*** [1] WITWER K W, WOLFRAM J. Extracellular vesicles versus synthetic nanoparticles for drug delivery [J]. Nat Rev Mater, 2021, 6(2): 103-6.[2] KIM J, EYGERIS Y, RYALS R C, et al. Strategies for non-viral vectors targeting organs beyond the liver [J]. Nat Nanotechnol, 2024, 19(4): 428-47.

EP-1005

Preclinical PET kinetic modeling studies with IP injection in mice

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Aim/Introduction: Preclinical positron emission tomography (PET) kinetic modeling is typically performed by injection of the radiotracer via intravenous (IV) tail vein bolus injection. In mice, this route of administration can be challenging due to the small vein size, and in awake animals, it can be painful and stressful. To circumvent these issues, in this study we investigate the feasibility of an alternative method which consists in the intraperitoneal (IP) injection of the radiotracer to perform brain kinetic modeling studies in mice. The dopamine D2/3 receptor antagonist [18F] Fallypride was used for the investigation. ***Materials and Methods:*** Animals (C57BL/6J mice; N = 8 per group) were anesthetized with isoflurane (3% for induction, 1.5% for maintenance) followed by [18F]Fallypride administration via the tail vein (IV), or by inserting a catheter in the animal peritoneum (IP). Two-hour-dynamic PET/CT scans were performed immediately after tracer injection. PET images were reconstructed and processed for analysis. Additionally, to reduce spill-over of skull uptake to the brain, non-negative matrix factorization (NMF) was performed to extract and subtract the skull uptake signal from the rest of the brain. The striatum and cerebellum time activity curves were extracted, and the mean striatum non-displaceable binding potential (BPND) was calculated using the simplified reference tissue model (SRTM), and the BPND standard error (SE) was evaluated in both routes of administration. The coefficient of variation of BPND is reported as well. ***Results:*** Skull uptake signal subtraction with NMF reduced the bone spill-over activity to the brain by 44% and 17% in IP and IV mice respectively. Overall radiotracer brain uptake was half in IP injected mice compared with IV (0.27 vs 0.56 standard uptake value). SRTM kinetic modeling fit was visually adequate in IP injected mice, with similar BPND SE in IP (3.4 ± 1.3%) vs IV (2.7 ± 0.55%). BPND was 4 times lower in IP (5.63 ± 2.1) vs IV (20.1 ± 6.4), and BPND coefficient of variation was similar between IP (37.1%) and IV (31.8 %) injected mice. ***Conclusion:*** We have successfully demonstrated the feasibility of using the IP route of administration to perform PET kinetic modeling studies. Despite lower brain tracer uptake in IP administered mice compared with IV, SRTM kinetic modeling produced accurate model curve fits, and BPND standard error and variability similar to values obtained in IV administered mice.

EP-1006

[11C]Metoclopramide-PET shows that P-glycoprotein function cannot be induced at the human blood-brain barrier via pregnane X receptor activation

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Aim/Introduction: Amyloid-β (Aβ) plays a critical role in Alzheimer's disease (AD). The FDA-approved disease-modifying monoclonal anti-Aβ antibody lecanemab leads in AD patients to a significant reduction in Aβ burden with a moderate delay in disease progression. However, there are safety concerns related to the use of anti-Aβ antibodies due to the occurrence of serious adverse effects. There is thus a need for alternative, safer therapies that target distinct pathways. Preclinical studies showed that the efflux transporter P-glycoprotein (P-gp) mediates at the blood-brain barrier (BBB) the clearance of Aβ peptides from brain into blood and that pharmacological induction of P-gp function via activation of the pregnane X receptor (PXR) decreases brain Aβ load. PET with the radiolabelled P-gp substrate [11C]metoclopramide can measure pharmacological or disease-associated P-gp induction at the mouse or human BBB, respectively. The aim of this study was to assess with [11C]metoclopramide-PET whether treatment with St. John's wort extract (SJW) with a high content of hyperforin, a potent activator of human PXR, leads to induction of cerebral P-gp function in healthy volunteers. ***Materials and Methods:*** Healthy volunteers (n=10) underwent brain PET imaging with [11C] metoclopramide on a fully-integrated PET/MRI system and arterial blood sampling before and after oral treatment with SJW (3-6% hyperforin content) for 12-19 days (1800 mg/day). Concomitant with PET imaging, a low dose of the P-gp probe substrate fexofenadine was orally administered to assess peripheral P-gp function. Using a metabolite-corrected arterial plasma input function, the brain kinetics of [11C]metoclopramide were analysed with a 1-tissue-2-rate constant compartmental model to estimate the rate constants for radiotracer transfer from plasma into brain (K1), from brain into plasma (k2), and the total volume of distribution (VT = K1/k2). ***Results:*** Treatment with SJW increased P-gp function in the intestine as reflected by a significant decrease (-45%) in the area under the blood concentration-time curve of fexofenadine. Despite peripheral P-gp induction, no significant differences in K1, k2 and VT of [11C]metoclopramide were detected in whole brain grey matter between scans before and after treatment with SJW. ***Conclusion:*** Our data show that P-gp function cannot be induced at the human BBB via PXR activation with SJW. This may be related to low expression levels of PXR in human brain capillary endothelial cells and/or insufficient intracellular concentration levels of hyperforin. The targeting of alternative regulatory pathways may be required to achieve P-gp induction at the human BBB.

EP-1007

Recombinant human TSH administration versus thyroid hormone withdrawal prior radioiodine therapy: results evaluation from treated patients

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Aim/Introduction: Patients with differentiated thyroid cancer (DTC) who undergo partial or total thyroidectomy require an elevation in thyrotropin (thyroid-stimulation hormone, TSH) levels prior to thyroid remnant ablation to enhace radioiodine (RAI) uptake. Stimulation of TSH levels can be achieved exogenously by administering recombinant human TSH (rhTSH) or endogenously, through thyroid hormone withdrawal (THW). Although, our centre's guidelines contemplate both methods, using rhTSH, despite its higher cost, may be justified by the temporary hypothyroidism associated with THW, which can affect patients´ quality of life. Recent literature reviews, highlight the lack of consensus over these stimulations methods. This review aims to demonstrate the impact of the chosen stimulation method on TSH levels as well as on the dose rate at hospital discharge. ***Materials and Methods:*** A retrospective study was conducted on 129 patients with DTC diagnosis and treated with RAI at our hospital. The patients were categorized into two groups, depending on the type of TSH stimulation method used: endogenous or exogenous. Medical reports were reviewed to collect data on TSH levels on the day of hospital admission, the administered dose of iodine-131(MBq) and the dose rate(μSv/h) at the time of hospital discharge. ***Results:*** In the rhTSH-group (n:64), 73% of the cases showed TSH levels exceeding 80 μUI/mL, significantly higher than the 31% observed in the THW group (n:65). Regarding

dose rate, all values were less than 40µSv/h at 1 meter distance (according to the 2010 guidelines of the Heads of the European Radiological Protection Competent Authorities (HERCA)). Median and interquartile range (RIC) of those values are exposed below, classified by iodine-131 dose: - 1110MBq: THW-group(29 patients), median 16.8µSv/h (RIC:9.7) vs rhTSH-group(27 patients), median 9.0µSv/h (RIC:11.7)- 3700MBq: THW-group(21 patients), median 15.4µSv/h (RIC:10.0) vs rhTSH-group(16 patients), median 7.0µSv/h (RIC:8.0) - 5550MBq: THW-group(15 patients), median 10.6µSv/h (RIC:9.9) vs rhTSH-group(21 patients), median 13.8µSv/h (RIC:10.8). ***Conclusion:*** Exogenous stimulation presents higher values of TSH, which increase radioiodine uptake. However, despite the same administered doses, the dose rate at hospital discharge, was lower with exogenous stimulation, except in treatments with 5550MBq, likely due to the advanced metastatic nature of the disease, promoting increased extra-thyroidal uptake. Using rhTSH not only improves ablation success rates but also optimizes radioiodine organification and enhances patient quality of life, making rhTSH an effective and practical choice for TSH stimulation. ***References:*** -Clinical Nuclear Medicine, 2024, 49: e96-e104.-EJNMMI, 2023, 50: 3324-3348. -EJE, 2023, 188: R23-R35.-JNM, 2022, 63(6): 15N-35N.-EJNMMI, 2019, 46: 2514-2525.

EP-1008

Kinetic modelling and test-retest reproducibility of the selective PET radiotracer [18F]2FNQ1P for serotonin 5-HT$_e$receptor imaging in pigs

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Aim/Introduction: [18F]2FNQ1P is a new PET radiotracer with highly specific and selective binding to 5-HT6 receptors (1,2). Preclinical studies in non-human primates suggest that [18F]2FNQ1P is a reliable PET radiotracer for visualization and quantification of 5-HT6 receptors in the brain (3). The objectives of this study were to perform a full PET kinetic modeling of [18F]2FNQ1P using arterial input function (AIF) in pigs, to identify a reference region suitable for a simplified modeling method, and to assess reproducibility with test-retest scans. ***Materials and Methods:*** Twelve healthy male or female pigs (33.6±2.0 kg) underwent MRI scans and two 90-min [18F]2FNQ1P PET/CT scans in a test-retest protocol, with arterial input function (AIF) in the second session. Regional time-activity curves (TAC) were obtained by co-registering the MRI and PET images to Saikali's pig atlas (3). Kinetic models were compared (one-tissue compartment, two-tissue compartment, and Logan) and two reference region models were evaluated (simplified reference tissue model, SRTM, and the Logan reference model, LREF). ***Results:*** The mean plasma-to-whole blood ratio was 0.98±0.11, suggesting an equal distribution between plasma and blood. The free plasma fraction remained stable over time with a mean value of 17.4±1.6%. The radiotracer was metabolized and progressively decreased from 59.9±23.4% (1-min post-injection) to 25.9±17.4% of the parent fraction (90-min post-injection) (Figure 1). TAC showed facilitated intracerebral crossing (Figure 2). Interestingly, cerebellum, vermis and insula showed rapid and high uptake followed by a notable fast washout phase. At the end of acquisition (90-min), striatum, amygdala and frontal cortex presented the highest steady-state value while cerebellum and vermis showed the lowest. The cerebellum appears as a possible reference region for simplified kinetic modeling. Figure 3 shows a PET overlay on MRI, demonstrating sufficient signal intensity and contrast for voxel-wise parametric imaging. Interestingly, an important signal was detected in a region identified as the pituitary gland (not included in the atlas). Furthermore, the voxels clusters with highest uptake were located in the caudate nucleus, putamen, prefrontal cortex, and frontal cortex. ***Conclusion:*** So far, [18F]2FNQ1P emerges as a reliable radiotracer to explore 5-HT6 receptors in brain. The favorable brain labeling and pharmacokinetic profile open new perspectives for the study of 5-HT6 receptors. Further analyses are in progress to perform brain quantification of kinetic parameters using AIF models or reference region models and to assess test-retest reproducibility. ***References:*** 1. Emery S et al, 2020. 2. Becker G et al, 2015. 3. Sgambato-Faure V et al, 2017.

EP-1009

Comparative evaluation of albumin binding domain-fused DARPin-drug conjugates targeting EpCAM for ovarian cancer treatment using radiolabeling

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Aim/Introduction: Epithelial Cell Adhesion Molecule (EpCAM) shows overexpression in ca. 70% of epithelial ovarian cancers and is a promising target for drug delivery. Designed Ankyrin Repeat Protein (DARPin) Ec1 has picomolar affinity to EpCAM. Loading Ec1 with a cytotoxic drug DM1 might enable specific eradication of cancer cells. To extend half-life in blood and minimize damage to healthy tissues, Ec1 was fused with an albumin binding domain (ABD) at C- or N-terminus and site-specifically conjugated to DM1, providing Ec1-ABD-DM1 and ABD-Ec1-DM1. The aim of the study was to investigate the impact of molecular design on the functional properties of two Ec1-ABD conjugates in vitro and their biodistribution and tumor targeting in vivo. ***Materials and Methods:*** Ec1-ABD-DM1 and ABD-Ec1-DM1 were radiolabelled with [99mTc]Tc(CO)3 via N-terminal (HE)3 tag for quantitative analysis. Their binding and internalization were evaluated using EpCAM-expressing SKOV3 and OVCAR3 ovarian cancer cell lines. Cytotoxicity in SKOV3 and OVCAR3 cells was determined in the presence and absence of human serum albumin (HSA). Biodistribution of [99mTc]Tc(CO)3-labeled drug conjugates was measured in Balb/c nu/nu mice bearing SKOV3 xenografts at 4, 24, and 48 hours post-injection (p.i.) to assess distribution kinetics. Mice bearing EpCAM-negative Ramos xenografts were used as a negative control. Ec1 (not fused to ABD) was used as a control for evaluation of half-life extension. ***Results:*** The conjugates were radiolabeled and purified with radiochemical purities over 95%. The radiolabel was stable under histidine challenge. The specific binding of both compounds to EpCAM was confirmed. [99mTc]Tc(CO)3-Ec1-ABD-DM1 exhibited stronger binding affinity (0.14±0.1 nM) compared to [99mTc]Tc(CO)3-ABD-Ec1-DM1 (1.24±0.11 nM). Internalized fractions of 25-30% in OVCAR3 cells and 35% in SKOV3 cells within 24 hours suggest efficient drug delivery for both constructs. IC50 values were in the nanomolar range for both conjugates in both cell lines, and were lower for ABD-Ec1-DM1. Biodistribution of [99mTc]Tc(CO)3-labeled conjugates was characterized by predominantly renal clearance. Fusion of Ec1 with ABD extended residence in blood and improved tumour uptake. Tumor targeting specificity was confirmed for both conjugates. Biodistribution showed no major

differences in the uptake of drug conjugates in tumours and normal organs, except 20-30% lower uptake in lungs for [99mTc]Tc(CO)3-Ec1-ABD-DM1. ***Conclusion:*** Radiolabeling of DARPin-drug conjugates using residualizing technetium-99m tricarbonyl label enabled their quantitative characterization and comparison. No major influence of molecular design on tumour targeting and biodistribution was observed. The combination of more potent cytotoxicity and favorable biodistribution profile suggests ABD-Ec1-DM1 as a preferable candidate for therapy.

EP-1010

Development of [18F]-labelled lactate for oxidative cancer imaging

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Aim/Introduction: Glucose analogue PET tracer 2-deoxy-2-[18F]-fluoro-D-glucose (18FDG) is routinely used to detect and monitor malignant tumours in the clinics. Contrast is provided by 6-phospho-18FDG accumulation in cancer cells that have high-rate metabolic activities and take up glucose abundantly. However, slowly growing tumours/metastases with low metabolic activities are often missed, and 18FDG does not inform on oxidative versus glycolytic metabolisms, thus limiting personalized medicine applications. Based on the observation that most clinical tumours use lactate as an oxidative fuel, we aimed to solve these issues by producing [18F]-3-fluoro-2-hydroxypropionate ([18F]-FLac) as a new tracer for imaging oxidative tumours. ***Materials and Methods:*** [18F]-fluoride was produced on a medical-isotope cyclotron (IBA Cyclone 18/9). [18F]-FLac was synthesized in minimally basic conditions on a remote-controlled clinical radiosynthesis module, purified using semi-reparative HPLC, and authenticated using H NMR and mass spectrometry. Metabolic stability was assessed in murine and human serum. For in vitro and in vivo evaluation, cervix, head-and-neck, breast, colon and prostate human cancer cells were screened for monocarboxylate transporter 1 (MCT1) and lactate dehydrogenase B (LDHB) expression using RT-qPCR and western blotting, and for exogenous lactate uptake on an ISCUSflex enzymatic analyser. Whole body mouse PET imaging was performed using a Mosaic PET scan on NMRI tumour-bearing nude mice treated or nor with MCT1 inhibitors AR-C155858 and AZD3965. ***Results:*** To produce [18F]-FLac, we synthesized epoxybenzylacrylate as a precursor by reacting benzylacrylate with meta-chloroperoxybenzoic acid (yield = 53%). Epoxybenzylacrylate was then reacted with [18F]-fluoride in tert-amyl alcohol to yield [18F]-3-fluoro-2-hydroxybenzylacrylate as a preferred regio-isomer, followed by semi-preparative HPLC isolation. The fluorination yield was 15-20%. [18F]-3-fluoro-2-hydroxybenzylacrylate hydrolysis in 0.5 N NaOH yielded [18F]-FLac after 5 minutes, which was confirmed by analytical HPLC and mass spectrometry. The compound was stable in serum. Among all tested human cell lines, SiHa cervix, SQD9 head-and-neck and PC3 prostate cancer cells had elevated MCT1 and LDHB expression, with lactate uptake being sensitive to MCT1 inhibition. In vivo, [18F]-FLac successfully imaged SiHa and SQD9 tumours, with little background from non-cancer tissues (including intestines) to the exception of kidneys and the bladder that cleared the tracer. ***Conclusion:*** [18F]-FLac is a promising PET radiotracer to detect oxidative tumours including those silent to 18FDG. This possibility is currently tested with slowly growing PC3 tumours and metastases in mice. [18F]-FLac could further be used alone or sequentially with 18FDG as a companion diagnostic for personalized treatments selectively targeting oxidative or glycolytic cancer cells.

EP-1011

Comparison Of Mathematical Methods For The Calculation Of Renal Glomerular Filtration Rate With [99mTc]Tc-DTPA in Living Renal Donors

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Aim/Introduction: The objective is to test whether or not there is equivalence between the different methods for calculating glomerular filtration rate (GFR) in potential renal donors and to determine which is the most appropriate. ***Materials and Methods:*** GFR was calculated using the Bröchner-Mortensen (BM) method, described in different guidelines, with [99mTc]Tc-DTPA, in 53 healthy renal donor candidates, from three blood samples taken at different times (t=120, 180, 240 min). Alternative methods were used for comparison: modified BM, Constable and Christensen-Groth. The latter two methods use a single blood sample, at 180 and 240 min, respectively. The modified BM method involves first normalising by body surface area before applying the mathematical model, the opposite order to the original method. A comparison of means was performed using the Student's t-test, considering a 95% confidence interval (CI) and the significance value (p) was obtained. ***Results:*** Expressed as mean ± standard deviation, the results were: — BM method: 83.91 ± 15.89 mL/min/1.73m2 — Modified BM method: 82.89 ± 16.52 mL/min/1,73m2 — Constable method: 90.63 ± 23.31 mL/min/1,73m2 — Christensen-Groth method: 90.36 ± 17.94 mL/min/1,73m2 Comparing the BM method with the Constable and Christensen-Groth methods, p=0.000 (p<0.05) was obtained. Between the BM method and the modified BM, p=0.275 was obtained; and between the Constable and Christensen-Groth methods, p=0.765. ***Conclusion:*** The modification of the BM method does not significantly change the GFR calculation (p=0.275), so it could be used as an equivalent. The single sample methods have shown equality between them (p=0.765), but differences with respect to the original BM method (p=0.000). The BM method will continue to be used for the calculation of GFR, as we consider it the most complete method as it includes three blood samples and is the most widely used in the literature.

EP-1012

In Silico Microscopic Dosimetry Modeling using Spatial Transcriptomics for Various targets of Radiopharmaceutical Therapy to Compare Effects and Feasibility of Combination

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Aim/Introduction: With the growing momentum of

radiopharmaceutical therapy (RPT) in prostate cancer, it is essential to investigate the dosimetry and biological effects of RPT in cellular level, given the complexities of the tumor microenvironment (TME). Here, we combined spatial transcriptomics (ST) and conventional pharmacokinetic modelling to compare the effect of RPT targeting prostate-specific membrane antigen (PSMA), fibroblast activation protein (FAP), and gastrin-releasing peptide receptor (GRPR) and to investigate feasibility of combinations of RPT for different targets. ***Materials and Methods:*** We utilized three publicly available Visium ST datasets from primary tissue samples of two prostate cancer patients. From these, we extracted various gene expressions, including FOLH1, GRPR, FAP, and Hypoxia signature, and estimated the proportions of cell types—epithelial, endothelial, and prostate cancer (PC) cells—in the corresponding ST spots. The spatiotemporal distribution of each radiopharmaceutical therapy was computed by solving the partial differential equation (PDE) using a convection-reaction-diffusion model. A well-established physiologically based pharmacokinetic (PBPK) model was used for input function, which was carefully determined to depost 10 Gy in prostate tumor in 20 days. Kinetic parameters sourced from literature were assumed uniform across RPTs. Dosimetry was then estimated following the Medical Internal Radiation Dose (MIRD) formalism, using dose point kernels (DVK) method. The survival probability was estimated using the linear quadratic model. ***Results:*** The study indicated higher FAP expression in regions with fewer tumor cells, while GRPR expression was more aligned with the presence of tumor cells. Cell survival was moderately higher in these regions for both 177Lu- and 225Ac-labeled therapies, but 225Ac generally led to lower survival rates. PSMA-targeted RPTs resulted in lower cell survival compared to FAP and GRPR, with some regions of malignant cells responding better to FAP or GRPR, advocating for potential combination therapies. The findings emphasize tailoring RPT based on the tumor's unique profile. ***Conclusion:*** Our in silico approach offers a detailed microscopic dosimetry-based evaluation of RPT effects according to targets, supporting the design of new radioligands and their combination for optimizing therapeutic strategies for cancer treatment.

EP-65

e-Poster Area

D: Technical Studies -> D5 Radiopharmacy/ Radiochemistry -> D56 Radionuclide Production

EP-1013

Preparation of Ga/Ni Solid Target for Cyclotron-produced ^{68}Ge by Electrodeposition

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Aim/Introduction: The main applications of 68Ge are its use as a long-lived positron source for attenuation corrections and calibration of Positron Emission Computed Tomography, and its role as mother radionuclide for the preparation of 68Ge/68Ga radionuclide generators. The 68Ge/68Ga radionuclide generator systems attracted interest in nuclear medicine because of its significant potential for PET/CT imaging using 68Ga labelled radiopharmaceuticals. The low melting point of the target material in the production reaction 69Ga (p, 2n) 68Ge has limited the availability of 68Ge. In order to use the existing industrial cyclotron hardware to produce 68Ge, a method of electrodepositing gallium-nickel alloy was set up in this study. ***Materials and Methods:*** The Ga/Ni solid target was prepared by electric deposition method for cyclotron producing 68Ge. Acidic requirements were met through the preparation of the gallium-nickel alloy targets and by optimizing the plating bath composition and electrodepositing conditions, the influences of current density, temperature, pH value, Ga/Ni concentration on the target quality were investigated. ***Results:*** The gallium-nickel solid targets with a gallium content of 75% was prepared by electric deposition method. After three irradiation tests, the process was certified to produce targets of Germanium 68. ***Conclusion:*** This process is user-friendly, the preparation of the targets is of stable quality, and it can be applied to the cyclotron production of Germanium 68.

EP-1014

Long-term evaluation of a PARS-GalluGEN 70 (^{68}Ge/^{68}Ga) generator and its performance in the clinical production of ^{68}Ga-PSMA-11

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Aim/Introduction: The 68Ge/68Ga generator has emerged as a convenient source to provide 68Ga in a hospital radiopharmacy for synthesizing 68Ga-labeled radiopharmaceuticals. In the 2021 EANM, we reported a new 4.45 GBq (120 mCi) TiO2-SnO2 -based 68Ge/68Ga generator of PARS Isotope as named PARS-GalluGEN 70 [1]. The focus of this study was to provide performance evaluation and Long-Term behavior of the PARS-GalluGEN 70. The generator was evaluated in terms of 68Ga yield, elution profile, 68Ge breakthrough, chemical and radiochemical purity of the 68Ga solution for 9 month in conjunction with the production of 68Ga labeled PSMA-HBED-CC intended for clinical use. ***Materials and Methods:*** All other reagents and solvents were purchased from commercial vendors and used directly unless otherwise noted. ***Results:*** PARS-GalluGEN 70 generator eluted more than 700 times in 9 month with 3 mL of 0.1 M HCl. Elution profile of the generator show more than 90% of activity in the first 2 mL. The first eluted activity of this generator was about 75 mCi and elution yield was > 65%. The radionuclide purity of 68Ga was ≥99.999% and the radiochemical purity of 68Ga3+ was 99.9. Although 68Ge breakthrough slightly increased over time, but always remained <0.0001%. Iron and zinc were detected as metal impurities in the eluent but both were ≤0.1 µg/GBq. The endotoxin concentration of the generator eluted was ≤25 EU/mL, and the eluent passed the sterility test. These results show that the generator can stably provide 68Ga solution over a 9 month period and used for routine production of 68Ga-PSMA-11 for clinical imaging. The average radiochemical yield for 200 68Ga-PSMA-11 clinical preparations using this generator was 92 ± 3%. ***Conclusion:*** The new, higher-activity 4.45 GBq (120 mCi) generator (PARS-GalluGEN 70) provides users with more flexibility by increasing the number of daily elutions and the activity in each elution, ultimately increasing the number of patients that can be served. The obtained results indicate that this generator has all the specifications of the European Pharmacopoeia for use. The better performance characteristics such as chemical, radiochemical, radionuclide purity, and acceptable elution yield introduce a new effective 68Ge/68Ga generator for clinical use. ***References:*** 1-Gholamhosseini-Nazari, M., and A. Rahiminezhad. "Development of a Ge-68/Ga-68 Generator (4.45 Gbq): Pars-Gallugen 70 as Largest Commercial 68Ge/68Ga Generator." In EUROPEAN

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EP-1015

Construction of an automatic device for Cu-64 purification

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Aim/Introduction: Imaging technique using positron emission tomography (PET) is useful for diagnosing various diseases and assessing treatment outcomes. A positron emitter Cu-64 is highly regarded for PET tracers due to its proper physical properties (12.7 hour half-life, 17.9% beta+ and 37.1% beta- radiations) and mild labeling condition for radiopharmaceutical productions. Cu-64 radioisotope is produced by cyclotron using Ni-64 target through the (p, n) nuclear reaction. In this study, we established an automatic processing system to purify produced Cu-64 from target. ***Materials and Methods:*** The irradiated Ni-64 solid target was transferred to a reaction vial in a heating bath, and 6 M HCl (10 mL) was added into the reaction vial. The solution was heated to 100 °C for 30 min, and then cooled to room temperature. The cooled solution was loaded onto a pre-conditioned ion exchange resin (SAX, AG1X8). After the column was washed with 6 M HCl solution (10 mL), Cu-64 was recovered using water (10 mL). Fluid delivery was achieved by a syringe pump, directing the flow through isolation valves. All process was controlled by a user-friendly interface (UFI) based program. The device was qualified by test productions of Cu-64 produced from a cyclotron. ***Results:*** The automatic device for Cu-64 purification process had consisted of chemical resistant valves and tubing, it was designed to be driven by sequential operation control. The dissolution by heating and purification using two columns processes were executed in succession. Components and tubing were easily changeable to minimize contamination. The User Interface was configured to produce Cu-64 according to desired process conditions, all process was allowed to continue without the manual intervention of operators. The system was designed to utilize its built-in power source to continue the process in event of a power outage. ***Conclusion:*** We developed a new device for Cu-64 purification process. Using the automatic system, Cu-64 was successfully obtained with minimizing radiation exposure to operators. The device was designed to easily modify the reaction processes, thus we expected that it would be feasible to automate the productions of radiolabeled pharmaceuticals using not only Cu-64 but also any other radioactive isotopes.

EP-1016

Feasability of ^{64}Cu production in a low-power Nuclear Reactor.

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Aim/Introduction: In the field of nuclear medicine, among the metal-based radionuclides for positron emission tomography (PET) and therapeutic applications, 64Cu has garnered escalating attention. This radioisotope exhibits advantageous characteristics due to its relatively long half-life (12.7 hours) and decay modes: low-energy positron emission (17.5%), beta emission (38.5%), and electron capture (44.0%). While typically produced in cyclotrons, alternative methods, like reactor systems, emerges as an useful opportunity to support research, despite an inferior radioactivity yield. We here present a comprehensive investigation, delineating the production and refinement processes of 64Cu, within the confines of a TRIGA Mark II reactor. Demostrating how even a low-power reactor not intended for isotopes production can be an useful tools for research. ***Materials and Methods:*** Eight samples of 20 µg, four of Copper Oxide and four of Metallic Copper, underwent irradiation for 6 hours within a TRIGA Mark II nuclear reactor, at 250 kWatt. Then, they were dissolved in aqua regia and stripped in concentrated HCl. Six samples of 20 µg of Zinc Oxide each, were irradiated for 6 hours in the same TRIGA Mark II nuclear reactor at 250 kWatt. They were dissolved in 8M HCl and separated using an anionic resin. One sample was separated using TK200 resin cartridges (Triskem International) in 1M HCl, while the other was separated using Dowex1X8 chloride form resin (Sigma Aldrich), eluted with 4M and 2M HCl solutions. Radiochemical purity and specific radioactivity were subsequently analyzed. ***Results:*** Copper Oxide and Metallic Copper samples exhibited similar production yields of 64Cu, amounting to 12.67 (± 2.35) MBq with a specific activity of 633.5 MBq/g. However, issues arose with Aqua Regia dissolution, leading to insoluble copper precipitates. Irradiated samples of Zinc Oxide yielded 83.2 KBq (± 0.7) of 65Zn and 11.6 (± 1.21) KBq of 64Cu. The separation demonstrated a radiochemical purity >99.8% of 64Cu. The remaining three samples were dissolved in 4 M HCl, diluted to 1M, and separated using TK200. The separation exhibited a radiochemical purity >98% of 64Cu. ***Conclusion:*** This study demonstrates the feasibility and cost-effectiveness of 64Cu production in the TRIGA Mark II reactor for radiopharmaceutical labeling. Direct production from natural copper yields higher radioactivity but lacks carrier-free purity, while zinc-based production offers carrier-free isolation despite lower yields. Low-power reactors even not intended for isotopes production hold promise for scientific research, with future investigations focusing on enhancing yields through larger mass samples and enriched targets.

EP-1017

^{99m}Tc radionuclide generators based on Low Specific Activity ^{99}Mo: Future Technical Developments to Meet the increasing Medical Demands

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Aim/Introduction: Diagnostic interventions in nuclear medicine strongly rely on 99mTc-radiopharmaceuticals. 99mTc is commercially available from low-pressure column chromatographic 99Mo/99mTc generators that use acidic alumina as a sorbent matrix. However, the limited sorption capability of alumina asks for high specific activity 99Mo, which poses serious production challenges and raises proliferation concerns. Therefore, many ideas aimed to use low specific activity (LSA) 99Mo. Nonetheless, the main roadblock is the low sorption capacity of the used alumina. This work demonstrates the feasibility of using different nano-sorbents developed in our laboratory as potential column material for developing 99Mo/99mTc generators by using low specific activity 99Mo. ***Materials and Methods:*** First, several nano-sorbents were synthesized using a simple preparation method. Then, their structural characterization was performed using different techniques. Additionally, we evaluated the distribution ratios (Kd) of 99Mo and 99mTc, the 99Mo breakthrough profile, and the sorption capacity of the synthesized

sorbents for carrier-added 99Mo. Eventually, we prepared a 99mTc generator, and its elution performance was repeatedly evaluated. ***Results:*** Our findings indicate that the materials synthesized are mesoporous and possess a large surface area. Furthermore, The Kd values prove that the parent, 99Mo, is selectively retained on the prepared sorbents, and its daughter, 99mTc, can be readily collected by using 0.9% NaCl solution. Moreover, the eluted daughter exhibits high chemical, radiochemical, and radionuclidic purity suitable for clinical applications. ***Conclusion:*** The use of nanomaterial-based sorbents offers new advantages that could not be achieved with classical materials due to their high sorption capacity, which arises from a higher surface area along with their high radiation resistance and chemical stability. The payoff for the successful investment of the proposed approach will open up a new possibility to supply onsite, clinical-grade 99mTc for millions of cancer patients worldwide independently of the fission-produced 99Mo. ***References:*** Nawar M.F., and Türler A. (2022). New Strategies for a Sustainable 99mTc Supply to Meet Increasing Medical Demands: Promising Solutions for Current Problems. Front Chem; Volume 10. https://doi.org/10.3389/fchem.2022.926258.

EP-1018

Production of ^{67}Cu via neutron induced reaction: A potential radionuclide in Nuclear Medicine

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Aim/Introduction: The 67Cu therapeutic radionuclide (T1/2=61.83 h, β− =100%, < Eβ- > =145 keV) is a β− emitter that has potential for therapy and can be utilized in SPECT/CT (Eγ=91.3 and 93.3 keV (21.1%) and Eγ=185 keV (44.2%)). This study seeks to develop the production yield of 67Cu from natZnO and natZnONPs targets through both experiment and theory in Tehran Research Reactor (TRR). ***Materials and Methods:*** The targets were irradiated in TRR for 0.5 hours within a fast neutron flux of 1.4×1013 n.cm-2.s-1. The neutron distribution function and average cross section of 67Zn(n,p)67Cu reaction were achieved through the use of nuclear codes of MCNPX and TALYS-1.8. The theoretical activity was also calculated for 300 mg of 67Zn (95% enriched target) with irradiation time of 185 hours. The enrichment of the 67Zn target material is crucial to produce the 67Cu in a n.c.a form suitable for medical application. Scanning Electronic Microscopy (SEM) analysis of zinc oxide nanoparticles were done before and after irradiation process. ***Results:*** The activity of 67Cu at the end of bombardment with nanoscale target was achieved 0.0326 MBq and for its bulk form 0.0168 MBq which indicate the increment activity of nanoscale with relative difference of 48.46 %. The average size of 10-30 nm for zinc oxide nanoparticles were achieved with SEM analysis with no definite changes in before and after irradiation process. The average cross section from TALYS code was achieved 0.8 mb. The theoretical activity was achieved 0.0218 MBq from MCNPX with relative difference of 23.63% in comparison to experimental value (bulk target). The theoretical activity for enriched target was also calculated about 25.066 MBq. This method could be used to estimate the production yield of other radionuclides in the reactor. This reaction has low cross section, which high flux of fast neutrons for high production yield were needed. ***Conclusion:*** The activity of 67Cu from nanoscale target was increased in comparison of bulk state target due to their greater reactivity. Using MCNPX, a proper method for estimating the theoretical radionuclide production yield in the TRR. ***References:*** 1. Mou L, Martini P, Pupillo G, Cieszykowska I, Cutler CS, Mikołajczak R. 67Cu production capabilities: A mini review. Molecules. 2022 Feb 23;27(5):1501.

EP-66

e-Poster Area

D: Technical Studies -> D5 Radiopharmacy/ Radiochemistry -> D57 Radiopharmaceutical Preparation and Quality Control

EP-1019

Preclinical validation of a new PET CBF tracer [^{11}C]MMP on the premise of clinical use

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Aim/Introduction: As [^{18F}]FDG is an analogue of glucose, the accumulation of tracer in the brain is affected by blood glucose levels. In contrast, the cerebral blood flow (CBF) tracer is theoretically not affected by blood glucose levels and is therefore expected to be a useful alternative method for dementia diagnosis in patients complicated by diabetes. However, the techniques currently used for CBF imaging using SPECT and 15O-gas PET are limited as they do not have sufficient resolution or sensitivity for regional brain imaging, especially when accompanied by brain atrophy. To overcome these problems, we developed N-isopropyl-4-[^{11}C] methylamphetamine ([^{11}C]MMP) as a possible CBF tracer with high resolution and sensitivity. PET measurements in conscious nonhuman primates have revealed that [^{11}C]MMP exhibited performance comparable to [15O]H2O, the gold standard for measuring cerebral blood flow [1]. Here, we present the results of preclinical studies based on the clinical application of [^{11}C]MMP to first-in-human studies. ***Materials and Methods:*** The previously used synthesis method using tributyltin as a precursor had a low yield of approximately 11% (decay-corrected) [1]. To obtain a higher yield, pinacol boronic acid ester (Bpin) was used as the precursor. A three-process validation (3 PV) test was conducted using this Bpin precursor. In preclinical safety tests, we performed a single intraperitoneal dose toxicity test for MMP, a single intravenous dose toxicity test for decay-outdated [^{11}C]MMP, and an Ames test for MMP. The radiation exposure dose in humans was estimated from mouse biodistribution data. The affinity of the MMP for various neuroreceptors was measured. ***Results:*** Using Bpin as the precursor, the yield improved significantly to 34%-47%. The results of the 3 PV test met the quality control (QC) standards. No signs of toxicity were observed in a single administration toxicity test of MMP and [^{11}C]MMP. The effective dose calculated according to the MIRD method was 5.4 μSv/MBq, and the maximum absorbed dose to the bladder wall was 57.6 μGy/MBq. MMP, a derivative of phenylalkylamine, showed binding to the Sigma receptor, but had approximately 1/100 of the affinity of existing Sigma receptor imaging agents. The affinity for other brain neuroreceptors was low. ***Conclusion:*** The 3 PV tests met the QC standard criteria for clinical use, and the preclinical toxicological and dosimetry studies indicated that [^{11}C]MMP showed acceptable pharmacological safety at the dose required for adequate PET imaging. ***References:*** [1]Toyohara et al., EJNMMI Res (2020) 10:115.

EP-1020

Evaluations for quality management of metal impurities in [^{64}Cu]Cu-diacetyl-bis(N^4-methylthiosemicarbazone) ([^{64}Cu]Cu-ATSM) as a radiopharmaceutical

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Aim/Introduction: [64Cu]Cu-diacetyl-bis (N4-methylthiosemicarbazone) ([64Cu]Cu-ATSM) is a promising radioactive hypoxia-targeting therapeutic agent and the Phase 1 clinical trials of this agent are currently conducted for patients with recurrent malignant brain tumors. For the quality management of [64Cu]Cu-ATSM as a radiopharmaceutical, understanding the effect of trace metal impurities during the preparation of the chelate between the ATSM ligand and 64Cu is important. To address this, we conducted some coordination chemical studies on metal-ATSM complexes. ***Materials and Methods:*** First, the effects of nonradioactive metal ions on the formation of [64Cu]Cu-ATSM were evaluated. Copper(II), nickel(II), zinc(II), and iron(II) ions were chosen for this experiment since these metals were possibly contaminated by the target system of cyclotron or manufacturing lines. Second, these metals were reacted with ATSM, and chelate formation rates were measured using ultraviolet-visible (UV-Vis) absorption spectra. Finally, since ATSM was found to react quickly with only Cu2+ but not in the other three species, we additionally investigated whether the other three species could react with ATSM when the reaction temperature was increased to 40°C from room temperature. ***Results:*** When the amount of Cu2+ or Ni2+ added was 1.2 or 288 equivalent to ATSM, the labeling yield of [64Cu]Cu-ATSM decreased below 90%. The addition of excess amounts of Fe2+ or Zn2+ to ATSM had little effect. UV-Vis spectra showed a rapid formation of Cu-ATSM complex upon mixing. The reaction rate of chelate formation by Ni2+ and ATSM was lower than that by Cu2+ and ATSM. Fe2+ and Zn2+ showed much slower reactions with the ATSM than Ni2+. The complexation rates of Ni2+ and Fe2+ with ATSM became faster with increased reaction temperature, while that of Zn2+ with ATSM was almost the same. ***Conclusion:*** This study showed that trace amounts of Ni2+, Fe2+, and Zn2+ had little effect on the quality of [64Cu]Cu-ATSM. However, it was concluded that the concentration of Cu2+ should be controlled. These results would provide useful information for the quality management of [64Cu]Cu-ATSM.

EP-1021

Towards a GMP comliant automated radiosynthesis of [18F]FLUDA

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Aim/Introduction: [18F]FLUDA is a selective radiotracer for the in vivo imaging of A2A receptors by positron emission tomography (PET). Recent imaging studies in rodents and piglets have demonstrated the potential of [18F]FLUDA as probe for imaging A2A receptors.[1] The automated radiosynthesis of [18F]FLUDA by an one-pot two-step radiolabeling procedure was published recently.[2] This work describes further optimization of the radiosynthesis and its translation to a GMP-compliant procedure providing an injectable solution for clinical studies in humans. ***Materials and Methods:*** For two-step radiofluorination and purification, an automated TRACERlab FX2 N radiosynthesizer was used. In first experiments, the reported procedure was adapted and tested with low starting activities (0.5 - 2 GBq). The amount of used precursors (d4-fluoroethyltosylate and phenol) and solvent volumes (0.5 ml to 1 ml acetonitrile and 0.5 ml TBAOHaq/acetonitrile to 1 ml DMSO), as well as the temperature for the labeling steps were varied and optimized. Moreover, the C18 light purification cartridge was replaced by a tC18 cartridge. The formulation of the purified product solution was adjusted to requirements for injection in humans by replacing the DMSO solution by saline containing ethanol and subsequently final sterile filtration with Millex GV filter. Finally, the optimized method was evaluated with starting [18F]fluoride activities in the range of 10 - 50 GBq, produced by a TR-Flex cyclotron. ***Results:*** By adding the phenol precursor and the TBAOHaq solution (40 wt.% in water) separately instead of premixed,[1] the labeling yield was significantly improved. In summary, the radiochemical yield of [18F]FLUDA could be increased from 9±1% (EOB)[2] to 30±4% (EOB) in a total radiosynthesis time of 65 min. Starting from ca. 50 GBq [18F]fluoride, 10 GBq [18F]FLUDA were obtained in isotonic saline with 6% ethanol with a radiochemical purity of ≥ 95%. The molar activity after sterile filtration was 90 - 188 GBq/µmol (n=3). Stability studies from the final solution (isotonic saline with 6% ethanol) over 6 h confirmed the stability. ***Conclusion:*** In summary an optimized and fully automated GMP-compliant radiosynthesis was established, supplying [18F]FLUDA in high radiochemical yield, purity and adequate pharmaceutical quality to further explore this promising radiotracer in prospective clinical trials. ***References:*** [1] T.H. Lai et al., Eur J Nucl Med Mol Imaging, 2021, 48(9), 2727-2736 [2] T.H. Lai et al., J Label Compd Radiopharm, 2022, 1-5.

EP-1022

177Lu-DOTATOC : Development of a Fully Automatized In-Hospital Production

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Aim/Introduction: 177Lu-DOTA-peptides are beta-particle-emitting radioactive therapeutic agents indicated for the treatment of neuroendocrine tumors. To date, two radiopharmaceuticals sharing similar profiles are mainly used, 177Lu-DOTATATE which is commercially supplied and 177Lu-DOTATOC with no market authorization holder. The aim of our work is to develop an automated synthesis of 177Lu-DOTATOC to reduce the cost of this treatment and extend its accessibility. ***Materials and Methods:*** Using a MiniAiO® (Trasis) synthesizer, the complexation reaction is performed in acetate buffer at pH 4-5 and with thermal heating (100°C for 28,5min) of 115µg (one dose) to 465µg (4 doses) of DOTATOC and 8,0 to 32,0GBq of 177Lu. At the end of the incubation, the drug substance is eluted through a sterile filter into the product vial. Then, saline is added to dilute the solution.Regarding the quality control, the radiochemical purity (RCP) of 177Lu-DOTATOC was determined by radio-HPLC using the formula : RCP (%) = 100 - (177LuCl3 (%) + other impurities (%)). The radiochemical stability was demonstrated by measuring RCP until 24h post-production. UV-HPLC was used to quantify the amount of DOTATOC per dose and confirm the

identity of 177Lu-DOTATOC using a non-radioactive standard. The concentration of ascorbate in the drug product, which should be ≥ 7mg/mL was measured with a semi-quantitative method. Due to the long half-life of 177Lu, sterility tests were achieved with simulated labelling. Sterility and endotoxin tests were performed in accordance to Ph. Eur. An automated filter integrity test was performed on the final sterilizing filter. ***Results:*** Five validation batches of 177Lu-DOTATOC were performed, 3 with an activity of 8,53±0,42GBq, one with 25,42GBq and one with 32,45GBq. The application volume was from 18mL to 20mL. The RCP at end of synthesis was 97,8±0,6%. Based on the stability data, a shelf-life of 24h was defined for syntheses using 8GBq of starting activity with a RCP of 96,2±0,3% at 24h. The concentration of ascorbate met the specification. The retention time comparison between the standard and 177Lu-DOTATOC was inferior to 6s. The total amount of DOTATOC was inferior to 250µg per dose. Bubble point tests were superior to 3bars for each batch. The drug products were sterile and endotoxin free. ***Conclusion:*** 177Lu-DOTATOC is prepared in sterile conditions by using MiniAiO® synthesizer with high final radiochemical purity. The validation with starting activity ranging between 8 to 32GBq will allow us to perform one production for one to four patient standard doses of 7,4GBq.

EP-1023

Process validation of [^{211}At]PSMA-5 solution using an automated synthesizer for investigator-initiated clinical trial

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Aim/Introduction: [211At]PSMA-5, an alpha-therapy drug developed at Osaka University that targets PSMA, has shown excellent tumor growth inhibition in a mouse model of prostate cancer with minimal side effects in normal organs, and is expected to be a new targeted alpha therapy, especially metastatic castration-resistant prostate cancer (1). We have already optimized the synthesis procedure and performed scale-up production with automated synthesizer of [211At]PSMA-5. In this study, process validation was conducted under the conditions optimized in the scale-up production for investigator-initiated clinical trial. ***Materials and Methods:*** 211At was produced with the nuclear reaction of 209Bi(4He, 2n) using AVF Cyclotron at RIKEN or Research Center for Nuclear Physics, Osaka University. 211At in irradiated Bi target was purified by an automated dry distillation apparatus installed at the GMP manufacturing facility of Osaka University Hospital. Six lots of [211At]PSMA-5 were synthesized (three times by each target) using automated synthesizer. [211At]PSMA-5 was produced by reacting 211At recovered with 7% sodium bicarbonate injection (700 µL), 1 mg/mL precursor solution (10 µL) and 0.1 M potassium iodide (290 µL) at 95°C for 45 min, followed by purification with solid phase extraction (HLB) column. The solutions after filter filtration sterilization were checked for compliance with the specification criteria. ***Results:*** In the six-lot tests, [211At]PSMA-5 was obtained in a synthesis time of approximately 130 minutes with a radiochemical yield of 29±3% (after decay collection). Radiochemical purity was 96±1% at the end of synthesis, and it was remained above 90% after 6 hours of synthesis. The concentration of related substances, including precursor (PSMA-5), was less than 1.0 µg/mL, and the concentration of ethanol used as a solvent to recover [211At]PSMA-5 from the HLB column was 2.8 v/v % on average. Furthermore, the amount of iodine in the potassium iodide used in the synthesis reagent and the amount of bismuth in the target substance were measured and confirmed to be less than 1 ppm. All other quality test items were also confirmed to meet the specification criteria of [211At]PSMA-5 solution. ***Conclusion:*** In this study, [211At]PSMA-5 was obtained stably in a six-lot tests, meeting all quality specification criteria and conforming to process validation. ***References:*** Watabe et al. Eur J Nucl Med Mol Imaging. 2023doi: 10.2967/jnumed.120.245084.

EP-1024

Automated production of [^{68}Ga]Ga-FAPI-46 via routinely used synthesis module and optimised HPLC analysis for safe clinical application

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Aim/Introduction: Cancer-associated fibroblasts (CAFs) in the tumor microenvironment play a key role in proliferation and metastatic spreading of cancer cells. The fibroblast activation protein (FAP) is highly expressed on the surface of CAFs thus representing a promising target for pantumoral PET imaging [1]. The 68Ga-labelled inhibitor FAPI-46 has proven to be a successful tracer candidate for this purpose [2]. The aim of this study was the automated production of [68Ga]Ga-FAPI-46 via a routinely applied synthesis module using standard disposable materials as well as optimisation of the quality control for safe clinical application. ***Materials and Methods:*** For the production via a fully automated synthesis module, commercially available disposable cassettes and reagents, which are applied as standard materials for established 68Ga tracers on this system, were used. The sequence included elution of the 68Ge/68Ga generator, purification of the eluate by cation exchange, labelling in ammonium acetate buffer at 95 °C and purification and formulation of the product. Furthermore, the influence of ascorbic acid in the reaction mixture on the purity of the final product was investigated. The process was optimised in terms of yield and duration by varying the amount of precursor and reaction time. As release criteria, γ-energy, half-life, pH value, radiochemical purity and identity as well as solvent and endotoxin content were determined. ***Results:*** Within 52 steps and 24-26 min, [68Ga]Ga-FAPI-46 was reproducibly obtained with a radiochemical yield of 72-85%, an apparent molar activity of 7.7-22.3 GBq/µmol and a radiochemical purity of > 97%. Unexpected problems in the HPLC-analysis, probably caused by a certain interaction of the radiotracer in the HPLC system, could be systematically solved by spiking the HPLC-sample with a defined excess of cold natGa-reference compound. The addition of ascorbic acid to the reaction mixture successfully prevented the formation of radiolysis side-products. All quality parameters complied with the defined acceptance criteria based on pharmacopoeia specifications for comparable radiopharmaceuticals. ***Conclusion:*** The automated production of [68Ga]Ga-FAPI-46 using a routine synthesis module and standard disposable materials was successfully optimised and performed reproducibly. The quality of the multi-dose formulation met all the criteria for a safe clinical PET-application. ***References:*** [1] L. Gilardi, et al. Imaging Cancer-Associated Fibroblasts (CAFs) with FAPi PET. Biomedicines 2022, 10, 523. [2] A. Loktev, et al. Development of Fibroblast Activation Protein-Targeted Radiotracers with Improved Tumor Retention. J Nucl Med. 2019, 60, 1421-1429.

EP-1025

Radiolabelling of different quantities of PSMA-617 with ^{225}Ac: the more the better?

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Aim/Introduction: Recently, Target Alpha Therapy (TAT) has attracted a great interest in nuclear medicine, particularly in tumor patients who develop resistance to β- therapy. Typically, TAT for solid tumors involves attaching an α-particle-emitter to a tumor targeting carrier, usually a small peptide. Peptide chemical mass may play a crucial role in competitive binding when it competitively binds a target with a saturable receptor density. Therefore, the specific activity (MBq/µg) of a radiopharmaceutical can significantly influence the efficacy of TAT. The impact of the specific activity has been investigated for several targets, and it was reported to be highly pronounced for PSMA radioligands. The aim of this work was to determine the optimal quantity of PSMA-617 required in a standardized method for producing [225Ac]Ac-PSMA-617, keeping the minimum peptide mass that ensures a radiochemical purity (RCP) according to the Pharmacopeia acceptance criteria. ***Materials and Methods:*** It was investigated three different starting amounts of PSMA-617: 100 (A), 50 (B) or 25 (C) µg dissolved in water. The peptide was added to 350 µL of gentisic buffer (gentisic acid 0,25M and sodium acetate 0,35M) pH 5.5. This solution was added to 100 µL of 225AcCl3 (~8 MBq) and heated at 97±2°C for 30 minutes. [225Ac]Ac-PSMA-617 was monitored via iTLC analysis, performed using silica gel as stationary phase and, sodium citrate 0,1M pH 5 (1) and acetonitrile/water 1:1 (2) as mobile phases. The iTLC strips were acquired post-synthesis (t0) and reacquired at 3 hours (t0+R3h), when 221Fr and 213Bi were in Secular Equilibrium with 225Ac, to establish with accuracy the RCP of radiopharmaceutical. ***Results:*** Among three amounts of PSMA-617 used, RCP (t0) of [225Ac]Ac-PSMA-617 was more high for A condition (96,50±0,10 in 1, 95,50±1,10 in 2). However, reacquiring the iTLC strips (t0+R3h), the RCP values for B condition, were closer to A results: 97,77±0,25% vs 87,80±0,95 in 1 and 96,07±1,12 vs 94,80±0,30% in 2. Under 50 µg of PSMA-617, the results were not considered because the RCP was <70%. ***Conclusion:*** The radioligand mass plays a crucial role in optimizing tumor targeting while minimizing accumulation and retention in normal organs. Utilizing low quantities of ligand enhances the specific activity, leading to fewer receptors being occupied by in vivo unlabelled PSMA. However, it is important to acknowledge the possibility of radiolysis phenomena. Additionally, given the recoil effect of 225Ac, it would be prudent to employ the highest tested amount.

EP-1026

Optimizing routine production of $^{[18F]}$BCPP-EF by CFN-MPS-200 multipurpose synthesizer

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Aim/Introduction: Multiple System Atrophy (MSA) is a disorder that presents with parkinsonism, cerebellar ataxia, and autonomic ataxia. Recently, it has been reported that mitochondrial dysfunction is involved in the pathogenesis of MSA. Therefore, to elucidate the pathogenesis of MSA, we have planned to perform a clinical trial of PET imaging with $^{[18F]}$BCPP-EF, which binds specifically to Mitochondrial Complex-I and makes it possible to monitor mitochondrial activity. In this study, we optimized an automated synthesis method of $^{[18F]}$BCPP-EF with a multipurpose synthesizer, "CFN-MPS-200", aiming at its stable supply for clinical use. ***Materials and Methods:*** $^{[18F]}$Fluoride was produced by the 18O(p, n)18F nuclear reaction using a cyclotron with 16.5 MeV energy (PETtrace860, GE Healthcare). The synthesis of $^{[18F]}$BCPP-EF was performed using a CFN-MPS-200 multipurpose synthesizer (Sumitomo Heavy Industry, Ltd) with the following method. $^{[18F]}$Fluoride was loaded onto a QMA carbonate column and then eluted by Kryptofix 222 (10 mg/1 mL 94% acetonitrile, 33 mM K2CO3) into a reaction vial. After the evaporation, Tosyl-BCPP-EF dissolved in DMSO was added to the vial and then reacted at 80 °C for 10 min. The reaction solution was then diluted by 1 mL 50% acetonitrile and then was purified by HPLC equipped with Waters XBridge 5C18 Column, 10ID x 250 mm, or Phenomenex Luna PFP(2) column. The purified $^{[18F]}$BCPP-EF was then evaporated, redissolved in 0.01% tween80, and then transferred to a product vial through the sterile 0.22-µm filter. The quality control tests (radiochemical and chemical purity, radionuclidic identity, half-life, pH, endotoxin, residual solvent, and sterility test) were performed. ***Results:*** The synthesis of $^{[18F]}$BCPP-EF by CFN-MPS-200 automated synthesis module was completed up to 51 min. $^{[18F]}$BCPP-EF was obtained with a radioactivity of 2730 ± 674 MBq, and a radiochemical yield of 9.5 ± 2.4% (decay correlated) (n=3). The solution of $^{[18F]}$BCPP-EF purified by Phenomenex Luna PFP(2) column contained Kryptofix 222 over 40 ppm, while that purified by Waters XBridge 5C18 Column contained less than 40 ppm of Kryptofix 222, and passed all other quality control tests (acceptance criteria: radiochemical purity: >95%, specific activity: >3.7 MBq/µg, pH: 4-8, endotoxin: <15 EU/mL, sterility: negative). ***Conclusion:*** Our results suggest that the optimized production method with CFN-MPS-200 can provide enough radioactivity and quality of $^{[18F]}$BCPP-EF for clinical use.

EP-1027

Radiochemical purity determination of ^{99m}Tc-(EDDA)$_2$/HYNIC-TOC. Is the manufacturer method thorough enough?

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Aim/Introduction: 99mTc-(EDDA)2/HYNIC-TOC is a radiopharmaceutical with high affinity to somatostatin receptor. The radiolabelling is carried out in two steps: first 99mTc-(tricine)2/HYNIC-TOC is formed, which after heating is exchanged to 99mTc-(EDDA)2/HYNIC-TOC. Radiochemical Purity (RCP) is performed according to the manufacturer's method by Instant Thin Layer Chromatography (ITLC) with a double Silica Gel (SG) strip using Methylethylketone (MEK) to determine free 99mTcO4- (Rf=1) and acetonitrile:water 1:1 (ACNW) or water/acetonitrile/pure acetic acid 1:1:2 (WAE) for the 99mTc-colloid fraction (Rf=0). However, literature describes the formation of another impurity, 99mTc-coligands (99mTc-tricine and 99mTc-EDDA), during labelling[1]. The aim of our study is to find out whether the manufacturer's method adequately detects all the impurities generated. ***Materials and Methods:*** n=17 cold kits were radiolabelled with 1600MBq of sodium pertechnetate (99mTc) solution following the manufacturer's instructions. RCP was determined by ITLC-SG using MEK and ACNW (reference method), and adding a third strip developed with sodium chloride 0,9% for the non-peptide bound 99mTc-coligand (Rf=1) (alternative method). RCP was performed once the incubation was finished and on n=5 kits it was also done immediately prior to heating at 100°C. RCP was calculated for both

manufacturer's method and alternative method by subtracting the percentage due to impurities from 100%. ***Results:*** With NaCl 0,9% as mobile phase, free 99mTcO4- and 99mTc-coligands are displaced to the solvent front. The mean RCP value following the reference method, was 99,5±0,4 % after incubation and 99,4±0.5 % before heating, versus 95,1±2,2 % and 9,2%±1,2 % with the alternative method. The mean 99mTc-coligand value, obtained by subtracting the free 99mTcO4- value of the strip developed with MEK from the peak at Rf=1 of the strip with NaCl 0,9%, was 4,4±2,1 % after incubation and 90,3±2.3 % before heating. ***Conclusion:*** The manufacturer's method is not able to discriminate the 99mTc-coligand from the 99mTc-(EDDA)2/HYNIC-TOC, so it overestimates the RCP value and gives compliant values even before heating, incubation and complex formation. Coligand exchange at high temperature is a critical step for the labelling [2], but the reference method fails to detect if appropiate heating has been applied. The alternative method with NaCl 0,9% provides further information and allows us to obtain the real RCP value. Since it separates both free 99mTcO4- and 99mTc-coligand, TLC with MEK could be omitted unless quantifying each impurity separately is desired. ***References:*** [1] Guggenberg EV et al. (2004) J Pharm Sci. Oct;93(10):2497-506. [2] Von Guggenberg et al. (2003). J Label Compd Radiopharm, 46: 307-318.

EP-1028

Optimization and validation of [18F]fluorocholine radiosynthesis on an automated cassette-based system

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Aim/Introduction: HUS Diagnostic Center performs approximately 3800 PET/CT imaging studies annually. In 2022-2023, the clinical use of [18F]fluorocholine ([18F]fluoromethyl-dimethyl-2-hydroxyethylammonium, [18F]FCH) was increased significantly and raised interest towards in-house production of this radiotracer at the Cyclotron Unit. In this work, the radiosynthesis of [18F]FCH and its quality control methods were set up, optimized and validated. ***Materials and Methods:*** [18F]Fluoride was obtained from the cyclotron. The radiosynthesis was performed on a fully automated system using two identical synthesis modules. Reagent set and applicable GMP compliant synthesis cassettes were purchased from a commercial supplier, but the overall synthesis script had to be created and optimized. The radiosynthesis of [18F]FCH was based on published methods on labelling of dimethylethanolamine (DMEA) with [18F]fluorobromomethane. The 18F-fluoromethylation reagent was produced in the first module from where it was distilled to the second module containing 0.5 ml of DMEA on a reversed-phase HLB cartridge. [18F]FCH was purified by cation exchange (CM cartridge). The final product was eluted with 3.5 ml of 0.9% NaCl and diluted into final volume in a dispensing unit. Special attention was paid to prevention of radioactive exhausts: modules liquid waste vial was vented to a gas collection bag and gases from the hot cell were collected to the air compression station for 20 h. ***Results:*** [18F]FCH was produced repeatably with excellent radiochemical purity, ≥ 99% (by radioTLC and -HPLC). In first studies, the amount of DMEA in the final product exceeded the limit set in European Pharmacopoeia, but it was able to be minimized (≤0.1 mg/ml) by modification of the cartridge purification. All the other tests for chemical purity (Kryptofix, dibromomethane) and residual solvents (ACN, EtOH), as well as pH, radionuclidic purity, sterility and endotoxin content met the acceptance criteria. Stability of the product was confirmed until 6 h. By the optimized method the decay-corrected radiochemical yield of [18F]FCH was 24.5±1.2% (process validations, n=5) of the estimated [18F]F- activity available from the cyclotron. However, the radiochemical yield was increased markedly, >33% when a fresh reagent set was used. The overall synthesis time was 60 min. The radiosynthesis was validated up to 100±5 GBq starting activity which provides [18F]FCH for 8-10 consecutive imaging studies for a one PET scanner. ***Conclusion:*** A reliable radiosynthesis method of [18F]FCH by combination of two cassette-based modules was validated and production for clinical studies was started in January 2024. This radiotracer is now produced routinely for parathyroid imaging.

EP-1029

Validation of HPLC and TLC analytical methods to determine radiochemical purity of 99mTc-cAbVCAM1-5, a new experimental radiotracer

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Aim/Introduction: Cardiovascular diseases, including fatal myocardial infarctions from atheromatous plaques, are the primary global mortality cause. Detecting stenotic atheromatous plaques is possible through coronary angiography, but vulnerable plaques with eccentric remodeling are undetectable with current diagnostic methods. Addressing this challenge, our group developed a radiopharmaceutical drug targeting vascular cell adhesion molecule 1, radiolabeled with technetium-99m. Given the absence of a monograph in the European Pharmacopoeia, analytical methods had to be validated. The aim of this work is to validate the analytical method for determining the radiochemical purity (RCP) of the radiolabeled 99mTc-cAbVCAM1-5 by high performance liquid chromatography (HPLC) and thin layer chromatography (TLC). ***Materials and Methods:*** The validation of the analytical method for the determination of 99mTc-cAbVCAM1-5 RCP was carried out according to the EANM Guidelines, the ICH Q2 guidelines and the guide for the elaboration of monographs on radiopharmaceutical preparations. The method validation ensuring conformity with specificity, accuracy, repeatability and intermediate precision, linearity, robustness, quantification limit (LoQ), and range criteria. ***Results:*** Regarding the results of specificity, both HPLC and TLC methods demonstrated excellent separation of 99mTc-cAbVCAM1-5 from impurities, with a high resolution factor greater than two. Accuracy results indicated recovery percentages within the range of 99.52 to 101.40 % for the HPLC and 99.51 to 101.97 % for TLC, ensuring reliable measurements for each concentration of 99mTcO4-. Precision of the methods was validated by assessing repeatability and intermediate precision, with coefficients of variation of less than 2 %. Linearity was determined over the usual concentrations range and the correlation coefficient (R2) was greater than 0.99 for both methods. To assess the robustness of HPLC and TLC methods, we changed different parameters as chromatographic column, composition of the mobile phase. For

each conditions, the RCP of 99mTc-cAbVCAM1-5 assessment was not affected. The LoQ was measured by diluting the 99mTcO4- in order to obtain a signal-to-noise ratio around 10:1. Under these conditions, we obtained an LoQ of 2.1 MBq/mL for HPLC and 2 Mbq/mL for TLC. The validated analysis range was between the value found for the LoQ and the high value of the linearity test (202.0 MBq/mL for both methods). This range was selected to meet the validation guidelines by EDQM and our synthesis specification. ***Conclusion:*** In conclusion, the analytical methods developed in this study comply with EANM recommendations. This therefore allows us to correctly assess the RCP of 99mTc-cAbVCAM1-5, a new radiotracer targeting inflammation in vulnerable plaques.

EP-1030

Improved production ^{68}Ga-MAA: the LASER-assisted radiolabelling.

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Aim/Introduction: 68Ga radiolabeling of commercially Macro-Aggregate of Albumin (MAA) kits has recently gained interest, due to the availability of 68Ge/68Ga generators and the enhanced spatial resolution offered by PET imaging. There are numerous clinical investigations focusing on the evaluation of [68Ga]Ga-MAA, but setting up a standardized and effective production procedure remains crucial. Conventionally, a heating procedure up to 90°C is employed. This method is associated with temperature-induced partial disintegration of MAA particles, leading to the need for an additional step of purification. In this study, we present the outcomes of a novel radiolabelling LASER-assisted method for [68Ga]Ga-MAA preparation. ***Materials and Methods:*** Three vials of MAA (Pulmocis ®) were reconstituted with 4 ml of saline and 200 MBq of buffered 68Ga solution (1.25 mL) each. Vial-1 was kept at room temperature for 15 min, Vial-2 was heated at 75 °C for 15 minutes, Vial-3 underwent irradiation with a blue LASER (Techhodd PWM/TTL Blue laser OEM Module, China) (wavelength 450 nm, power 7 W, frequency 30 Hz) for 15 minutes in a custom-built facility designed to shield irradiation. The temperature of Vial-3 was monitored during irradiation using a thermocouple thermometer. The Labelling Yield was assessed after the labelling procedure using thin-layer chromatography, with ITLC-SG and as mobile phase 0.1 M tribasic citrate solution. Stability tests in serum were also conducted. Particle dimensions were measured using a series of two polycarbonate membrane filters (3 µm and 400 nm pores) and observed in Burker chamber. The particle sizes were then compared to those obtained after standard 99mTc labelling. ***Results:*** Labelling Yield (LY) of [68Ga]Ga-MAA obtained in Vial-1 was very low (38%), while reached 88 % in Vial-2 (heat method) and to > 98% in Vial-3 (LASER method). In Vial-3 only a minimum increase of temperature, up to 38°C, was reported. LY was stable after serum incubation. Moreover, the percentage of particles with size <400 nm was negligible in Vial-1 and Vial-3 (about 1%), similar to the results of routine 99mTc labelling procedure, while it was dramatically higher, up to 68%, in Vial-2 (heat method). ***Conclusion:*** LASER-assisted radiolabelling of [68Ga]Ga-MAA assures a labelling yield higher than the usual heating-method. Also, LASER-assisted method does not affect the MAA size, thus avoiding the need of further purification steps necessary for the heating-method proposed so far. LASER Induced chemical reaction is an interesting approach under development, with no previous applications in the field of radiopharmaceuticals production.

EP-1031

Self-radiolysis rate of small-molecule Lu-177-PSMA verified with external irradiation

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Aim/Introduction: Radiochemical purity (RCP) of radiopharmaceuticals is tested with high-performance liquid chromatography (HPLC). Within small-molecule Lutetium-177-labeled prostate-specific membrane antigen (PSMA) targeting ligand, Lu-177 forms a bond with the PSMA peptide via a chelate. Various factors can compromise RCP over time. In this work, we tested the hypothesis that self-radiolysis predominantly drives this decline. ***Materials and Methods:*** We irradiated a vial of in-house synthesized small-molecule Lu-177-PSMA ("Vial 1") with a clinical linear accelerator on three occasions on the day following the production: each irradiation with 6 MV photons delivered a dose of 500 Gy at the rate of 12 Gy/min. HPLC analyses were carried out after the synthetization, in the beginning of the next day, and after each irradiation. Activity was measured with a radionuclide calibrator and weight with a precision scale to determine the self-absorbed radiation dose during each time interval. This self-dose was calculated assuming local-energy deposition of all beta radiation. Later, we repeated the test using a commercial version of the Lu-177-PSMA product ("Vial 2"): in this case, however, the irradiations and analyses were performed on the second day after the production. ***Results:*** Initially, Vial 1 contained 5.65 GBq in 6.94 g. The product was tested with HPLC right after its synthetization: RCP was 96.23%. After 25 hours, RCP was decreased to 94.16%, while the self-dose was 1653 Gy. After the first round of external irradiation (500 Gy+self-dose 51 Gy), RCP was 93.32%; after the second round (500 Gy+97 Gy), 92.27%; and after the third round (500 Gy+63 Gy), 91.82%. Vial 2 contained 3.77 GBq in 7.35 g, with RCP 93.48% (22 h post-production). The next sample was analyzed 21 hours after this, resulting in RCP 92.30%, while the self-dose during the time interval was 872 Gy. Then followed the three rounds of irradiation: RCP 91.58% (500 Gy-11 Gy; negative value due to delay in the previous HPLC analysis); 90.86% (500 Gy+39 Gy); and 90.19% (500 Gy+42 Gy). For both Vial 1 and 2, the reduction in RCP was linearly related to the accumulated dose ($p<0.001$): for Vial 1 RCP reduction was -1.35% per kGy of absorbed dose ($R2=0.994$), and for Vial 2 -1.36% per kGy ($R2=0.999$), respectively. ***Conclusion:*** Our experiments using external irradiation indicate that radiolysis is the main cause of decrease in radiochemical purity of small-molecule Lu-177-PSMA. The rate of RCP reduction appears to be approximately -1.3% to -1.4% per 1000 Gy absorbed dose.

EP-1032

Evaluation of an automated synthesis method for $^{[18F]}$ fluoromisonidazole using an automated synthesis module in a South African hospital radiopharmacy using off-site produced fluoride-18.

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Aim/Introduction: $^{[18F]}$FMISO is the only PET hypoxia-imaging radiopharmaceutical with a dedicated monograph in the European Pharmacopoeia (Ph. Eur.) [1]. The synthesis of $^{[18F]}$FMISO has previously been reported on both manual and automated synthesis platforms [2,3]. This report details the synthesis and quality control of $^{[18F]}$FMISO using a cassette-based automated synthesis module following a validated method but using commercially

supplied [18F]fluoride from a distant cyclotron. The method using this model of synthesis module has not been published yet. ***Materials and Methods:*** Cassettes, reagent sets, precursor vials and other consumables for the automated synthesis of [18F]FMISO were procured from an approved supplier.The [18F]fluoride solution was purchased from a local commercial PET radionuclide supplier and delivered to our hospital radiopharmacy. A validated synthesis method which was specifically developed for a synthesis module similar to our institution's automated module was provided by the manufacturer of the reagent set. Briefly, the [18F]fluoride solution was trapped on a QMA cartridge and then eluted using a solution of tetrabutylammonium hydrogen carbonate. The [18F]fluoride/ TBAHCO3 solution was dried in anhydrous acetonitrile at 95°C. The precursor was allowed to react with the dried [18F]fluoride solution for 10 min at 110°C.The crude product was evaporated at 95°C for 3 minutes whereafter the solution was purified through a series of SPE cartridges and filtered into a sterile vials. The pH of the final product was adjusted with a citrate buffer. Quality control was performed according to the Ph. Eur. Monograph 2459. Shelf-life was determined over a time period of 8 hours. ***Results:*** Five batches were evaluated for the purpose of this study. The average decay-corrected radiochemical yield was 27.4% ± 3.6%. The average [18F]FMISO activity at the end of synthesis was 1.7 ± 0.5 GBq. The radiochemical purity of the product was 99.4 ± 0.5%. The product met all release criteria. Problems included logistical constraints related to the amount of [18F]fluoride activity available from the supplier. This limited yield and number of patients doses that could be reliably provided. ***Conclusion:*** Using the automated module available to us, a validated method, disposable cassettes, and commercially acquired [18F]fluoride, we successfully synthesised [18F]FMISO with high chemical and radiochemical purity, meeting all the Ph. Eur. quality requirements. This study confirms that the module can be used to produce [18F]FMISO for small-scale in-house applications. The major challenges in our study were problems due to the commercial supply of [18F]fluoride.

EP-1033

Stability of different radiopharmaceuticals used in gastric emptying scintigraphy test

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Aim/Introduction: In gastric emptying scintigraphy tests, the radiopharmaceutical is incorporated into egg and an omelette is cooked and eaten by the patient. The aim of this study was to evaluate the stability of diethylenetriamine pentaacetate ([99mTc] Tc-DTPA) and albumin nanocolloids ([99mTc]Tc-nanocolloid) during this procedure. Both radiopharmaceuticals were exposed to acid pH, egg, or heat. ***Materials and Methods:*** For each radiopharmaceutical, three types of samples were prepared: radiopharmaceutical at room temperature, radiopharmaceutical mixed with egg (1:1) and radiopharmaceutical heated at 100°C for 5 minutes ([99mTc] Tc-DTPA n=18 and [99mTc]Tc-Nanocolloid n=18). All samples were incubated 2 hours with 1 ml of hydrochloric acid (HCl) at increasing concentrations (0.001M, 0.01M, 0.08M, 0.2M). From each radiopharmaceutical labelling a control sample was obtained that was not incubated with HCl. The radiochemical purity (RCP) of the samples and control samples (2h post-labelling) was determined by chromatography. For [99mTc] Tc-DTPA we used strips of Whatman 3 paper with 0.9% NaCl and methyl ethyl ketone and ITLC-SG with methanol: H2O (85:15) for [99mTc]Tc-Nanocolloid. The strips were counted in a MiniGITA TLC-scanner. ***Results:*** The average RCP of the [99mTc] Tc-DTPA and [99mTc]Tc-Nanocolloid control samples was 99.5% and 99.8%, respectively. The average RCP results of the [99mTc]Tc-Nanocolloid samples with increasing HCl concentrations (0.001M, 0.01M, 0.08M, 0.2M) in all samples (at room temperature, mixed with egg and heated 100°C for 5 minutes) were always above 95%. RCP of [99mTc]Tc-DTPA samples was always higher than 95%, except radiopharmaceutical with 0.2M HCl and heated with 0.2M HCl, where RCP was 63.80% and 61.68%, respectively. No significant differences were observed between the RCP results of room temperature and heated samples between the two radiopharmaceuticals, except for the 0.2M HCl samples ($p<0.05$). Significant differences were also observed in the egg samples ($p<0.05$) with higher average RCP of [99mTc] Tc-Nanocolloid. ***Conclusion:*** [99mTc]Tc-Nanocolloid has a higher RCP than [99mTc]Tc-DTPA in all samples and is more stable against heat, acid pH and egg. The RCP of [99mTc]Tc-DTPA is affected at lowest pH. The addition of egg seems to neutralise the acidity and stabilise [99mTc]Tc-DTPA. Therefore, both radiopharmaceuticals can be used in this test.

EP-1034

Fully Automatic Quality Control Tests for Radiopharmaceuticals - the FDG Case

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Aim/Introduction: With the increasing number of different PET radiotracers that commercial radiopharmacies are required to deliver nearly simultaneously and on daily basis, quality control (QC) of the radioactive drugs is becoming a limiting factor. Moreover, QC operations are a main source of radiation exposure to the staff. Trasis has developed a compact device, called QC1, enabling at this stage 10 different tests to be carried out automatically from a single sample. Applied to FDG as a first tracer, the analytical performance of the QC1 with its ready-to-use consumables is compared with the results obtained in parallel from separate conventional analytical instruments on more than 30 batches at commercial activity levels. ***Materials and Methods:*** The following QC tests and measurements are addressed : appearance - color and clarity, radioactivity concentration, pH, K222 or TBAOH spot tests, radiochemical purity by TLC, radionuclide identity, half-life, and purity, as well as residual solvents by GC, within 30 minutes from a single 300µL sample. ***Results:*** The results obtained on the first QC1 commercial units are in line with measurements from conventional instruments. Extension of the equipment beyond the FDG example is also addressed, such as residual solvent methods for up to 6 different solvents (acetone, THF, methanol, 2-butanone, ethanol and acetonitrile), and also methods for 11C tracers. All the data collected are compiled into a comprehensive report next to acceptance criteria and complete traceability informations on the analytical process from equipment, consumable, reference standards and software stand point are provided. They meet the criteria of the European and American pharmacopoeias. ***Conclusion:*** In radiopharmacy, the automation of quality control is a crucial axis of development (e.g., ALARA principle, budget constraints, shortages & dependence on specialized skills).This highlights the increasing integration of automation technologies not only in production but also in quality control, further enhancing its qualitative added value (e.g., standardization, traceability).We demonstrate that with an automated process, QC1 analyzes the quality of a drug based on a single sample (300µL) with improved reliability over conventional

quality control, notably by reducing human errors (e.g. handling, visual interpretation).The integration of instruments (e.g., GC, SG, TLC Reader, Spectrometric Readings), and the upcoming arrival of an HPLC module directly integrated into the QC1, makes it versatile and paves the way for a wide variety of future developments.

EP-1035

Synthesis and quality control of [^{68}Ga]Ga-DOTATOC cold kits produced with two simultaneous elutions from different models of GMP generators

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Aim/Introduction: Over the past 20 years, gallium-68 PET imaging has raised increasing interest. Obtained from 68Ge/68Ga radioelement generator, some of which being available in GMP-grade quality, 68Ga allows in-house preparation of single vial cold kits (e.g. [68Ga]Ga-DOTATOC, SOMAKIT®). However, activity levels involved in the preparations of such radiopharmaceuticals decrease over time as the 68Ge/68Ga generator decays, limiting the number of examinations per preparation. Thus, generators can be resupplied before expiry date and used for a few months in combination with a new one. Besides, different suppliers may be selected in case of a new call for tenders, raising the question of production using two different generators. To validate a method for preparing [68Ga]Ga-DOTATOC cold kits using two generators concomitantly, either identical or from different suppliers. ***Materials and Methods:*** A total of five [68Ga]Ga-DOTATOC syntheses were carried out : three with double GALLIAD® (IRE) generators elutions in manual mode and two with elutions from a GALLIAD ® (IRE) generator coupled with a GALLIAPHARM®(Curium) generator, in automated mode using a GAIA® module (Elysia-Raytest). At the end of synthesis (EoS), activites were measured and quality controls were performed: organoleptic characteristics, pH, sterility tests, bacterial endotoxin tests and radiochemical purity, by both TLC and HPLC, immediately after EoS (H0) and every hour for 4 hours (H1 to H4). ***Results:*** Mean activity measured at EoS when using two GALLIAD® generators was 1590 ± 57 MBq. PRC at H0 by TLC and HPLC was > 95% and >90%. The pH was 3.6. For the two syntheses made with a GALLIAD® plus a GALLIAPHARM®, activities at EoS were 1334 ± 206 MBq. PRC at H0 was > 98.24% in TLC and > 98.81% in HPLC. The pH was 3.2. All the preparations were stable between H0 and H4. Endotoxin and sterility tests were negative for all preparations. With such radiolabeling conditions, more than 10 PET examinations can be performed per synthesis, compared with 7 with a single generator at start of use. ***Conclusion:*** Automated production of [68Ga]Ga-DOTATOC with two generators was successful for all the syntheses performed. The combination of identical and dissimilar generators, as well as use of manual and automated method allowed adaptation to different radiolabeling setups. This dual-generator synthesis is an option for optimizing kits and prolonging generators and reducing costs. In addition, it would be interesting to investigate the use of two GALLIAPHARM® generators, in order to suit all possible configurations.

EP-1036

First Fully Automatized In-house Synthesis of[^{177}Lu]Lu-DOTA-TOC in Bosnia and Herzegovina

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Aim/Introduction: [177Lu]Lu-DOTA-TOC is a beta particle-emitting radioactive agent indicated for the peptide receptor radiotherapy (PRRT) of advanced neuroendocrine tumours (NET). The substance is characterized by affinity to somatostatine receptors, which are overexpressed in NET patients. Since 2022, the Department of Nuclear Medicine in Banja Luka has opened a laboratory where the synthesis of radiopharmaceuticals for theranostic is possible. The aim was to develop and automate the in-house synthesis of [177Lu]Lu-DOTA-TOC to improve NET patient management in our clinical centre. ***Materials and Methods:*** Using a fully automated cassette-based theranostics synthesizer, a radiolabelling process was developed. The complexation reaction was performed in ascorbate buffer at pH 4-5 and with thermal heating (90°C for 33 min) of 115 µg DOTA-TOC and 8,0-8,4 GBq of 177Lu. At the end of the complexation, elution of the drug substance through a sterile filter into the product vial was performed. Then, saline was added to dilute the solution and the final volume of the product was 20mL. Regarding quality control, the radiochemical purity (RCP) of [177Lu]Lu-DOTA-TOC was determined by radio-HPLC and TLC. Two mobile phases were used for TLC based on ITLC-SG strips as a solid phase. The first mobile phase was 0,1 M citrate buffer pH 5,5 and the second mobile phase was ammonium acetate 1 M /methanol 1:1. Confirmation of the identity of [177Lu]Lu-DOTA-TOC was done by UV HPLC using a non-radioactive standard. Following European Pharmacopoeia, sterility and endotoxin tests were performed. An automated filter integrity test was performed on the final sterile filter. ***Results:*** The three validation batches of [177Lu]Lu -DOTA-TOC were synthesized with an activity of 7,55 ± 0,15 GBq and production yield of 92,32 ± 0,08. The application volume was from 19 mL to 20 mL. The RCP determined by HPLC was 99,6 ± 0,5% and with TLC was 99,2 ± 0,5%. The [177Lu]Lu-chloride and [177Lu] Lu -colloid determined by TLC were quantified and the results obtained were 0,7, 0,14, and 0,31% for [177Lu]Lu-chloride and 0,4, 0,2, and 0,4% for [177Lu]Lu-colloid respectively. The retention time comparison between the standard and [177Lu]Lu-DOTA-TOC was inferior to 12s. The bubble point test passed for each batch. The drug products were sterile and endotoxin-free. ***Conclusion:*** The automatized synthesis of [177Lu]Lu-DOTA-TOC was successfully implemented in our department. The reproducibility and the cost of this in-house synthesis give an opportunity to increase the access of the patient with NET to this innovative therapeutic radiopharmaceutical for this region.

EP-1037

Development of Kit-Composition for the Preparation of [^{99m}Tc]Tc-PSMA-GCK01 / RHN001-DX

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Aim/Introduction: Albeit known for a long time, the theranostic pair 99mTc / 188Re has found few applications. With our recently published PSMA ligand PSMA-GCK01 [1] we try to apply this promising pair for the disclosure of PSMA-theranostics to low-income countries. An important cornerstone is the availability of reliable kit-technology. Here we report on our results developing a kit for 99mTc-labelling of PSMA-GCK01 (RHN001-DX). ***Materials and Methods:*** Kit composition was adapted from [2]. All chemicals used for the kit development were of pharmaceutical

grade. The precursor was provided by a commercial supplier in >95 % purity. Test reactions were conducted under without extensive precautions such as exclusion of atmospheric oxygen in 2 ml Eppendorf vessels. The test kits were heated at different temperatures for approx. 10 minutes. The product was analyzed by iTLC for free pertechnetate and radiocolloids. Important results were confirmed by radio-HPLC. First goal is a reliable RCY/RCP > 90%, while our "break-even" was defined as RCY/RCP > 95%. ***Results:*** First successful kits were composed using SnCl2 as reducing agent. Sodium citrate, Mannitol and ascorbic acid were used as buffer and/or auxiliary reagents. The necessary purity was met at 80 °C & 100 °C for 10 minutes with values of free pertechnetate and radio colloids of approx. 2-5 %, each. Currently we are fine-tuning the reagent composition aiming at RCP > 97.5 % and planning robustness testing using different generators (Curium, Rotop and Monrol). ***Conclusion:*** We have successfully adapted a reagent composition for the kit based production of [99mTc]Tc-PSMA-GCK01. Temperature and heating conditions were chosen "conservatively", so that the final kit will provide the product in a broad temperature range of 90 ± 10 °C and reaction times of approx. 15 minutes. The choice of broad reaction conditions without protection against oxygen will secure a high level of robustness for the final kit applying GMP grade materials. ***References:*** [1] J. Cardinale et al., J Nucl Med 2023, 64, 1069-1075. [2] L. L. Fuscaldi et al., Front. Chem. 2023, Online Publication, DOI10.3389/fchem.2023.1271176.

EP-67

e-Poster Area

E: Other Studies -> E1 Case Reports

EP-1038

^{18}F-FDG PET/CT in a case of SMARCA4-deficient poorly differentiated non-small cell lung cancer

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Aim/Introduction: SMARCA4-deficient in poorly differentiated non-small cell lung cancer is a newly discovered pathological type in recent years. This is a rare tumor with poor differentiation, high malignancy and poor prognosis. We report a case of poorly differentiated non-small cell lung cancer with SMARCA4-deficient 18F-FDG PET/CT showing focal FDG uptake. This case suggests that 18F-FDG PET/CT may be useful in the diagnosis of SMARCA4-deficient poorly differentiated non-small cell lung cancer. ***Materials and Methods:*** A 70-year-old male patient with sputum and dyspnea was admitted to hospital for six months. The patient underwent CT and enhanced CT imaging. 18F-FDG PET/CT was used to further identify the cause. ***Results:*** Early diagnosis and staging of SMRCA4-deficient lung cancer is helpful to improve the prognosis of patients. Studies have shown that the primary lesions and metastases of SMRCA4-deficient lung cancer show a strong affinity for 18F-FDG, suggesting that 18F-FDG PET/CT has potential clinical value in the diagnosis and staging of SMRCA4-deficient lung cancer, which still needs to be further explored. ***Conclusion:*** In this case, 18F-FDG PET/CT showed a case of SMARCA4-deficient poorly differentiated non-small cell lung cancer with lymph node metastasis, which provided a strong molecular imaging basis for clinical diagnosis and staging.

EP-1039

Case report: ^{18}F-FDG PET/CT revealing unexpected life-threatening massive neoplastic thrombosis and incidental new primary breast cancer in a patient monitored for recurrent metastatic hepatocellular carcinoma

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Aim/Introduction: A 75-year-old woman affected by recurrent metastatic hepatocellular carcinoma underwent a ^{18}F-FDG PET/CT scan for comprehensive restaging; although asymptomatic, her medical history included multiple liver resections and a recent (2 months prior) adrenal gland resection, pathologically confirmed as metastasis. ***Materials and Methods:*** The patient was addressed by the referring Oncologists to the Nuclear Medicine Unit to perform a ^{18}F-FDG PET/CT as part of standard clinical practice for routine follow-up and restaging. Subsequent ^{18}F-FDG scans, approximately 3 and 9 months later, were also performed and reported. The patient signed written informed consent for data treatment and imaging publication. ***Results:*** The initial FDG PET/CT scan revealed intense uptake consistent with neoplastic pulmonary thromboembolism (SUVmax= 8.4) and thrombosis in subdiaphragmatic vessels, including the inferior vena cava (IVC) (SUVmax= 15.9), left renal vein and left gonadal vein. Additionally, diffuse, heterogeneous intense uptake was depicted along the stomach wall (SUVmax= 9.4), suggesting tumour invasion, and focal moderate uptake was noted in the left breast (SUVmax= 5.8).The patient was addressed to the Emergency Department to perform an urgent AngioTC, which confirmed the presence of massive thrombosis, leading to initiation of appropriate medical treatments, including anticoagulation therapy for thrombosis and immunotherapy for progressive metastatic hepatocellular carcinoma. Histological confirmation subsequently identified the breast lesion as a primary invasive mucinous carcinoma, prompting initiation of hormonal therapy. Due to the high risk of bleeding, determination of stomach wall invasion was deferred.Three months later, an interim FDG PET/CT showed pulmonary progression (SUVmax= 12.3) along with persistent venous thrombosis (SUVmax in the IVC = 10.5), confirmed to be of neoplastic origin: no increase in anticoagulant therapy was deemed necessary. The focal FDG uptake, corresponding to the breast carcinoma, was fully normalized, suggesting response to hormonal therapy.The final scan at 9 months showed progressive disease with lumbar canal invasion, prompting initiation of second-line immunotherapy. ***Conclusion:*** Although it is already reported that thrombosis might show significant ^{18}F-FDG uptake when neoplastic, this case highlights the crucial role of FDG PET/CT in uncovering unexpected, rare and life-threatening complications of metastatic hepatocellular carcinoma, represented by neoplastic pulmonary and subdiaphragmatic vessel thrombosis. In addition, the simultaneous, incidental detection of a new primary breast cancer further emphasizes the diagnostic sensitivity and clinical impact of PET/CT. This case can be encountered within "actionable PET imaging findings" requiring prompt report communication for timely receipt of the information and related clinical interventions.

EP-1040

^{18}F-FDG PET/CT and 68Ga-DOTA-NOC PET/CT in large cell neuroendocrine carcinoma of the lung with myocardial metastasis mimicking primary heart tumor

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Aim/Introduction: Large cell neuroendocrine carcinoma (LCNEC) of the lung is a rare high-grade NET with a prevalence of approximately 3% of resected lung carcinomas. At diagnosis, the tumor often presents with local invasion, thoracic lymph node metastases, and distant spread, resulting in poor prognosis. Myocardial metastases of neuroendocrine tumors (NET) are extremely rare, occurring in 0.7% to 2.4% of NET patients. The most common tumors affecting the heart are metastases from primary lung cancer, followed by breast cancer and hematological malignancies such as lymphoma. We herein present a case of a 76-year-old male presenting with myocardial metastasis of LCNEC in cardiac MRI and 18F-FDG PET/CT and identification of primary tumor in 68Ga-DOTA-NOC PET/CT. ***Materials and Methods:*** 18F-FDG PET/CT was performed on a Discovery ST PET/CT system (GE Healthcare) 65 minutes after injection of 346.7 MBq of 18F-FDG. 68Ga-DOTA-NOC PET/CT was performed on a Biograph mCT 40 PET/CT system (Siemens) 60 minutes after injecting 162 MBq 68Ga-DOTA-NOC. ***Results:*** A 76-year-old male presented with a 5.5 cm right ventricular tumor with significant tracer uptake and a faint lesion centrally in the left lower lobe of the lung in 18F-FDG PET/CT. After resection, the right ventricular tumor was diagnosed as an atypical carcinoid G3, which was regarded as a myocardial metastasis from a neuroendocrine tumor (NET) of another organ. A subsequent postoperative 68Ga-DOTA-NOC PET/CT revealed a significant somatostatin receptor (SSR)-positive lesion centrally in the lower lobe of the left lung with a 1.2 cm size, which was afterward resected. Histopathology revealed an LCNEC, which favors the lung as the primary tumor, showing faint tracer uptake in 18F-FDG and significant uptake in 68Ga-DOTA-NOC PET/CT. Due to multiple SSR-positive mediastinal lymph node metastases and one soft tissue metastasis in 68Ga-DOTA-NOC PET/CT, the patient received 4 cycles of 177Lu-DOTA-TATE peptide receptor radionuclide therapy (PRRT), resulting in partial response with disappearance or regression of the metastases. ***Conclusion:*** This case report shows the existence of LCNECs with predominant 68Ga-DOTA-NOC uptake reflecting preserved somatostatin-receptor expression even in high-grade NET. In conclusion, in myocardial metastasis of LCNEC, both 68Ga-DOTA-NOC and 18F-FDG PET/CT are necessary for therapy planning and staging. However, 68Ga-DOTA-NOC PET/CT can help identify the primary tumor and thus be more sensitive than 18F-FDG PET/CT. In addition, 68Ga-DOTA-NOC PET/CT alone offers a tailored therapeutic approach with PRRT.

EP-1041

A Case of Metabolic Response byFDG PET/CT in Evaluation of Therapy Response for Blastic Plasmacytoid Dendritic Cell Neoplasm

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Aim/Introduction: Blastic plasmacytoid dendritic cell neoplasm (BPDCN) is a rare and aggressive hematological malignancy of plasmacytoid dendritic cells. ***Materials and Methods:*** A 48-year-old woman with a biopsy-proven BPDCN underwent FDG PET/CT twice for therapy response evaluation. ***Results:*** After treatment in our hospital with venetoclax, FDG PET/CT revealed relatively high activity in the cutaneous nodule in the right forearm. After adjusting the chemotherapy management decision, metabolic response by FDG PET/CT revealed that the activity of the primary lesion was significantly reduced, accompanied by the shrinkage of the cutaneous nodule. ***Conclusion:*** FDG PET/CT is a suitable strategy to assess therapy response in clinical oncology.10 The activity changes before and after treatment can indicate the therapy response, and can also timely indicate the recurrence and metastasis of the disease. FDG PET/CT is crucial in evaluating of therapy response and adjusting chemotherapy management decision of BPDCN. ***References:*** 1. Pemmaraju N, Wilson NR, Khoury JD, et al. Central nervous system involvement in blastic plasmacytoid dendritic cell neoplasm. Blood. 2021;138:1373-1377. 2. Li ZG, Mu HY. Blastic Plasmacytoid Dendritic Cell Neoplasm Evaluated by FDG PET/CT. Clin Nucl Med. 2017;42:551-552. 3. Martineau P, Pelletier-Galarneau M, Turpin S, et al. Imaging Pediatric Plasmacytoid Dendritic Cell Neoplasm With FDG PET/CT: Atypical Presentation of a Rare Disease. Clin Nucl Med. 2016;41:426-427. 4. Sapienza MR, Pileri A, Derenzini E, et al. Blastic Plasmacytoid Dendritic Cell Neoplasm: State of the Art and Prospects. Cancers (Basel). 2019;11:595. 5. Gonzaga Y, Fontes M. Blastic Plasmacytoid Dendritic-Cell Neoplasm. N Engl J Med. 2020;383:2158. 6. Hirner JP, O'Malley JT, LeBoeuf NR. Blastic Plasmacytoid Dendritic Cell Neoplasm: The Dermatologist's Perspective. Hematol Oncol Clin North Am. 2020;34:501-509. 7. Egger A, Coello D, Kirsner RS, et al. A Case of Cutaneous Blastic Plasmacytoid Dendritic Cell Neoplasm Treated With a Bcl-2 Inhibitor. J Drugs Dermatol. 2021;20:550-551. 8. Sweet K. Blastic plasmacytoid dendritic cell neoplasm: diagnosis, manifestations, and treatment. Curr Opin Hematol. 2020;27:103-107. 9. Cheng W, Yu TT, Tang AP, et al. Blastic Plasmacytoid Dendritic Cell Neoplasm: Progress in Cell Origin, Molecular Biology, Diagnostic Criteria and Therapeutic Approaches. Curr Med Sci. 2021;41:405-419. 10. Duclos V, Iep A, Gomez L, et al. PET Molecular Imaging: A Holistic Review of Current Practice and Emerging Perspectives for Diagnosis, Therapeutic Evaluation and Prognosis in Clinical Oncology. Int J Mol Sci. 2021;22:4159.

EP-1042

^{18}F-FDG PET/CT in the Diagnosis of a Collision Tumor of Endometrial Adenocarcinoma and Mantle Cell Lymphoma: A Case Report

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Aim/Introduction: The appearance of primary neoplasms in the same individual has been described in the literature and is relatively common. These neoplasms can be of the same or different histological types and can appear simultaneously or separated in time. The appearance of two histologically different neoplasms affecting the same tissue or organ is called a "collision tumor". ***Materials and Methods:*** A 73-year-old woman patient who was diagnosed 7 years ago with clear cell adenocarcinoma of the endometrium (CCAE) underwent extensive surgery. After that, a ^{18}F-FDG PET/CT control showed retroperitoneal and pelvic adenopathies up to 1.6 cm (SUVmax 9.0) so her treating doctors decided to give her chemotherapy and radiotherapy at the

same time and follow-up every 6 months, achieving complete response. 5 years after the diagnosis, a computed tomography (CT) showed a new retroperitoneal paraaortic lesion, so it was recommended to perform an ^{18}F-FDG PET/CT to determine the origin. ***Results:*** The ^{18}F-FDG PET/CT was performed, showing supra/infradiaphragmatic adenopathies with malignant metabolic characteristics, the most significant were left laterocervical and supraclavicular adenopathies up to 0.9 cm (SUVmax 8.3). Excision of the left supraclavicular adenopathy was performed, and the biopsy showed a mantle cell lymphoma (classic) in the lymph node with metastasis of high-grade gynecological adenocarcinoma Ki67 <30%. It was decided to start first-line treatment for the lymphoma until completing 6 cycles. Currently, the patient is in minimal morphometabolic progression of the infradiaphragmatic adenopathies. Given these results, since the lesions are not biopsiable and after the normalization of tumor markers (CA 125), it was decided to follow up closely. ***Conclusion:*** The coexistence of a carcinoma and a lymphoma affecting the same lymph node is rare. A review of the literature shows that the primary neoplasm in these cases is usually a low-grade lymphoma, which has generally been diagnosed years before the appearence of the epithelial neoplasm. High-grade lymphomas have been described less frequently. Probably the relatively indolent course of low-grade lymphomas allows enough time for a second epithelial neoplasm to develop. However, in our case, the CCAE was diagnosed first and, years later, the diagnose of the mantle cell lymphoma was done, which is a high-grade lynphoma. To sum up, the possibility of a collision tumor is infrequent but should be considered due to its therapeutic implications. The identification of a second neoplasm may require a therapeutic strategy modification and it also has a negative impact on patient survival.

EP-1043

A Case Report: Primary Renal Lymphoma Presenting with a Pathological Femur Fracture

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Aim/Introduction: The absence of lymphatic tissue in the kidney makes primary renal lymphoma (PRL) a rare occurrence. While PRL is generally unilateral in adults, it can be bilateral in pediatric patients. PRL lacks definitive clinical symptoms and can be confused with renal cell carcinoma, renal abscess, and other metastases. Patients with PRL may present with hematuria, acute/chronic renal failure, flank pain, or weight loss. ***Materials and Methods:*** A 57-year-old female patient presented with a right femur diaphysis pathological fracture. Direct radiography revealed reduced bone density along the femur diaphysis, cortical irregularities, and periosteal reaction, prompting an F^{18} FDG PET/CT scan for primary malignancy investigation. The F^{18} FDG PET/CT scan identified an exophytic, malignant-appearing mass approximately 27x53 mm in size in the right kidney's mid-section anteriorly, along with conglomerate metastatic lymph nodes in the abdomen and pelvis. A soft tissue component causing destruction in the right femur cortex was also observed. A tru-cut biopsy of the mass in the right kidney was performed under ultrasound guidance. The biopsy was reported as compatible with Diffuse Large B-Cell Lymphoma originating from the germinal center, exhibiting CD20(+), BCL-2(+), CD10(+), BCL-6(+) immunophenotype. At diagnosis, the patient had no B symptoms (weight loss, night sweats, fever), and her hemogram parameters, kidney, and liver function tests were within normal limits. ***Results:*** The patient was planned to undergo 4 cycles of R-CHOP chemotherapy (cyclophosphamide, doxorubicin, vincristine, prednisone, rituximab) and 5 cycles of palliative radiotherapy to the femur. An interim F^{18} FDG PET/CT scan post-chemotherapy showed significant regression of the renal mass and lymph nodes, evaluated as score 2 according to Deauville response criteria. ***Conclusion:*** Primary renal lymphoma is a rare and controversial type of lymphoma due to the normal kidney structure's lack of lymphoid tissue. The whole-body scanning capability of F^{18} FDG PET-CT is critically important for detecting the disease's primary focus, identifying extranodal lesions, and monitoring the treatment process. In the presented case, in addition to conventional imaging methods, F^{18} FDG PET-CT detected not only the renal mass but also lymph node involvement in abdominal and pelvic areas. Despite receiving a diagnosis of diffuse large B-cell lymphoma through tru-cut biopsy, the detection of extrarenal involvement opened discussions regarding the diagnosis of primary renal lymphoma. In differential diagnosis of renal masses, primary renal lymphoma should be considered as a rare but possible option.

EP-1044

Unmasking an Incidental Tenosynovial Giant Cell Tumor on FDG PET/CT in a Melanoma Patient

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Aim/Introduction: Tenosynovial giant cell tumor (TSGCT) is a benign, yet metabolically active tumor affecting the synovium, bursa, or tendon sheath. ***Materials and Methods:*** Case report: We present a 48-year-old male with malignant melanoma undergoing FDG PET/CT surveillance. ***Results:*** A highly FDG-avid mass in the right foot raised concern for melanoma metastasis. However, biopsy revealed an unexpected diagnosis of TSGCT. ***Conclusion:*** This case highlights the importance of FDG PET/CT in diagnosis of extraosseous lesions, particularly in cancer patients. In such scenarios, considering alternative diagnosis and pathohistological diagnosis confirmation becomes crucial to avoid misdiagnosis of metastases.

EP-1045

^{18}F-FDG-PET/CT Findings and Surgical Outcome in a Case of Nodular Pulmonary Amyloidosis

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Aim/Introduction: Primary nodular pulmonary amyloidosis(PNPA) deposits as a solitary amyloid mass in the lungs without evidence of systemic amyloidosis(SA). It is extremely rare and can mimic primary bronchogenic carcinoma. It is usually an incidental finding and its diagnosis is difficult because initial symptoms, laboratory tests and imaging are more related to common diseases. While the gold standard for diagnosis is green birefringence of Congo red staining on biopsy, this procedure could be invasive and risky in the respiratory tract. ***Materials and Methods:*** A 72-year-old male patient was being studied for an hematoma in the left lumbar and costal region. A computed tomography was performed, which showed necrotizing fasciitis of the left hemithorax and hemiabdomen wall and, as an incidental finding, a 1.6 cm irregular nodule was observed in the parahilium of the right middle lobe(ML). Therefore, an ^{18}F-FDG-PET/CT

and bronchoscopy were recommended for further evaluation. ***Results:*** The PET/CT showed a 1.8 cm peribronchial nodule in the ML with increased glucose metabolism (SUVmax 2.7), lesion that cannot exclude low grade malignancy. A core needle biopsy(CNB) of the nodule was performed without finding a neoplasia. However, given its morphological characteristics and fast growth, the multidisciplinary committee decided to perform a medial lobar lung lobectomy with an anatomopathological result of tumor cells of lambda light chain amyloidoma, which is usually related to local amyloidosis. The following studies were performed for diagnosis: probability of monoclonal gammopathy: no M component, serum immunofixation: IgG Kappa paraprotein in very low concentration, urine immunofixation: negative, bone marrow aspirate: normohypercellular without plasma cell infiltration, abdominal fat pad CBN: amyloid negative and blood smear and normal hemogram. So SA was excluded. Follow-up was performed with PET/CT that showed post-surgical changes without evidence of new suspicious lesions. Currently, the patient is in complete remission after first-line treatment (ML lobectomy). ***Conclusion:*** The diagnosis PNPA is extremely rare, due to the unusual nature of the condition, but also because patients are often asymptomatic and the mass growth is usually slow. Its early detection with PET/CT might be difficult at first because it could not differentiate PNPA from other more frequent diseases such as infections and/or neoplasms but it is important in order to know its metabolic behavior (high FDG uptake), the extension and to prevent the destruction of adjacent tissues. Therefore, the resection of the amyloidoma is recommended as a treatment to reduce its destructive impact and improve respiratory function.

EP-1046

Distinguishing Ovarian Metastases from Primary Ovarian Tumors: The Value of ^{18}F-FDG PET/CT in a Patient with Pancreatic Adenocarcinoma

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Aim/Introduction: Between 5-22% of ovarian metastases (OM) are originated from non-gynecological cancers, mainly of the digestive tract (80%), of which the pancreas represents only 5-12%. Therefore, OM from the pancreas in women are very rare in clinical practice, difficult to early diagnose and generally miss the surgical treatment,which gives them an unfavorable prognosis ***Materials and Methods:*** A 66-year-old woman under oncological follow-up for treated lung adenocarcinoma and a second neoplasm, pancreatic adenocarcinoma, which was surgically intervened (corporocaudal pancreatectomy). The patient was asymptomatic. CA 19.9 levels were slightly elevated and CA 125 was within normal limits. ***Results:*** A ^{18}F- FDG PET/CT control showed a slight hilar thickening of the right lung, with a slight metabolic increase SUVmax 2.9 (previously 2.4), without signs of recurrence. Additionally, a nodular lesion was observed in the pancreatic bed measuring 0.8 cm with a focal FDG uptake SUVmax 4.1 (previously 4.8), slightly lower than the previous study, which could be related to persistence of viable tumor tissue. New-onset peritoneal implants were also seen, one in the mesogastrium immediately posterior to the right rectus abdominis muscle measuring 1.6x1.7 cm with SUVmax 10.2 (accessible for biopsy) and another measuring 1.2 x 2.0 cm adjacent to the descending colon segment with SUVmax 10.4. Finally, newly appearing solid-cystic lesions in the bilateral ovaries were described, on the right measuring 3.5x2.7 cm with SUVmax 14.5 and on the left measuring 3.8x 3.5 cm with SUVmax 14.0, both suggestive of malignancy. Subsequently, biopsies of the peritoneal nodule and right ovary were performed, revealing cylinders of desmoplastic stroma occupied by pancreatic adenocarcinoma. ***Conclusion:*** Generally, pancreatic metastases affect both ovaries and appear simultaneously. It could be difficult to distinguish OM from pancreas and primary mucinous ovarian tumors by imaging techniques and histopathological examination. Although these last confirm the diagnosis, PET/CT can help to differentiate them, since it detects pathological uptake in the rest of the body and can find the primary tumor and its metastatic behavior. Finally, surgical resection remains the treatment of choice in this cases combining pancreatectomy and salpingo-oophorectomy.

EP-1047

The Role of 99mTc-Labeled Heat-Denatured Red Blood Cell Scintigraphy in Differentiating Intrapancreatic Accessory Spleen from Neuroendocrine Tumor

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Aim/Introduction: Ectopic splenic tissue presence in the abdominal cavity has been reported in the general population at a rate of 10 to 15%. There are two categories to describe this entity: splenosis secondary to trauma or splenectomy, and accessory spleen, considered a congenital duplication. Its intrapancreatic presence is observed in 1 to 2% of cases. Generally, these anomalies remain asymptomatic, so they are mostly discovered as incidental findings. The importance of these cases lies in their potential to be misdiagnosed as pancreatic neoplasms, leading to unnecessary laparotomies. ***Materials and Methods:*** A 41-year-old woman was initially referred from primary care due to a weight loss of about 10 kg over 4 months without any diet restriction. She was evaluated by a gynecologist who did not find any related disease. A computed tomography(CT) revealed a 2 cm solid nodule in the pancreatic tail with homogeneous enhancement, that was suspicious of a neuroendocrine tumor. Days later, a magnetic resonance imaging(MRI) described a nodular lesion adjacent to the pancreatic tail suggestive of anaccessory spleen. Finally, after consulting with nuclear medicine a 99mTechnetium(TC) labeled heat-denatured red blood cell scintigraphy was done. ***Results:*** A sequential scintigraphic study was performed following intravenous administration of 537 Megabecquerels of 99mTC labeled heat-denatured redblood cells, obtaining static abdomen images at 30 and 120 minutes that did not show any pathological uptake of the radiopharmaceutical at theoretical locations of clinical interest. In addition, an abdominopelvic SPECT-CT was performed, that showed a focal uptake coinciding with a 1.6 cm nodular lesion in the pancreatic tail, suggestive of a peripancreatic accessory spleen. ***Conclusion:*** Imaging studies are important diagnostic techniques that are useful in the study of intrapancreatic accessory spleen, as they determine the morpho-metabolic characteristics of the lesions. MRI shows a similar intensity between the accessory spleen and the normal spleen. CT is not useful for differentiating this entity from a neuroendocrine neoplasm, hence the recommendation of a 99mTC labeled heat-denatured red blood cell scintigraphy, that shows an increased uptake in the intrapancreatic accessory spleen but not in the

neuroendocrine neoplasm. Furthermore, when it is combined with SPECT-CT, it offers great sensitivity and specificity, avoiding unnecessary surgeries.

EP-1048

Penile Metastasis of Prostate Cancer Imitating Peyronie's Disease Detected on [^{68}Ga]Ga-PSMA-11 PET/CT

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Aim/Introduction: [68Ga]Ga-PSMA-11 PET/CT (Gallium prostate-specific membrane antigen positron emission tomography/computed tomography) is an established molecular imaging technique for identifying the spread of prostate cancer in patients with biochemical recurrence (BCR) and in initial staging. Penile metastases of prostate cancer are very rare and can be easily misdiagnosed as noncancerous nodules as part of Peyronie's disease. Most cases of penile metastases are in patients where the disease is already disseminated and usually diagnosed in the late stages. ***Materials and Methods:*** In our case, a 74-year-old patient with prostate cancer had a successful prostatectomy, ADT and radiation of prostate bed with PSAnadir of 0.01 ng/ml. Three and half years after surgery, biochemical recurrence occurred, and the patient was referred to our clinic for a [68Ga]Ga-PSMA-11 PET/CT scan. Before this scan, the patient had sought an evaluation from a urologist for a palpable lump under the skin of his penis, clinically consistent with an early stage of Peyronie's disease. ***Results:*** PET/CT showed pathological PSMA expression in a proximal part of the penile root, later confirmed with pathohistological analysis as prostate cancer metastasis. Our patient, with a PSA value of only 0.38 ng/ml has one of the lowest values of serum PSA and penile metastasis described in the available literature.Penile tissue metastases are exceedingly rare, despite the rich and intricate vascularization of the corpus cavernosum. The earliest case of penile metastasis was reported by Eberth in 1870 (1).In a retrospective study done by Tatkovic et al out of 4860 [68Ga]Ga-PSMA-11 PET/CT studies reported, the incidence of PC penile metastases was 0,1%. (2). Most literature describes these cases as occurring in patients with late-stage disseminated PC and being linked to poor prognosis. ***Conclusion:*** Our case affirms the importance of [68Ga]Ga-PSMA-11 PET/CT in the evaluation of patients with prostate cancer as it enables the detection of rare and unusual metastases. In patients with biochemical recurrence irrespective of PSA levels or in patients with a risk of undiagnosed cancer if clinical suspicion arises for Peyronie's disease, it is crucial to consider the differential diagnosis of penile metastasis. ***References:*** 1.Eberth C.J. Krebsmetastasen des corpus cavernosum penis. (Cancer metastases of the corpus cavernosum of penis) Virchows Arch. 1870;51:145.2.Tatkovic, A., McBean, R., Schoeman, J. and Wong, D. (2020), Prostate penile metastasis: Incidence and imaging pattern on 68Ga-PSMA PET/CT. J Med Imaging Radiat Oncol, 64: 499-504. https://doi.org/10.1111/1754-9485.13052.

EP-1049

^{18}F-FDG PET-CT Findings in an Unusual Case Of Paravertebral Giant Cell Tumor

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Aim/Introduction: A giant cell tumor is a benign tumor of bone. However, at times it may behave aggressively locally and can also metastasize. The stromal cell overly expresses RANKL expression, leading to increased osteoclastic activity. The typical age of occurrence is between 20 and 40 years, with a slight female predominance. More than 50% of GCT occurs around the knee joint. The frequency of GCT decreases in the following order, the distal end of the femur, proximal end of the tibia, distal radius, and sacrum. It rarely occurs at other sites. ***Materials and Methods:*** This case involved a 35-year-old woman who was initially worked-up for complaints of lower backache with associated neurological features which involved paraesthesia and motor weakness in the bilateral lower limbs at a local healthcare facility. She had undergone a magnetic resonance imaging (MRI) of her spine to look for evidence of intervertebral disc prolapse and nerve impingement. However, during the MRI she was incidentally found to have a right sided paravertebral mass that was eroding into the adjacent L2 vertebra and extending into the adjoining spinal canal. The mass was also seen to extend into the right upper quadrant up to the level of the right subhepatic region. Based on these clinical and radiological findings, she was diagnosed to have spinal tuberculosis (TB) and was started on anti-tubercular therapy (ATT). However, even after completing the appropriate course of ATT her clinical presentation continued to worsen. She was then transferred to our facility for further evaluation, where she underwent an F^{18}-labelled fluorodeoxyglucose (^{18}F-FDG) PET/CT to evaluate the metabolic activity of the paravertebral mass and to look for a suitable site for a biopsy. The PET/CT revealed a metabolically active mass in the right paravertebral region which was eroding into the adjacent L2 vertebra with intraspinal extension. ***Results:*** She underwent a surgical tumor biopsy, and to our surprise, the histopathology findings were indicative of a giant cell tumor (GCT). ***Conclusion:*** GCTs have a good prognosis when diagnosed and managed promptly. Local excision of tumor is curative in most patients. In case of unresectable tumors, neoadjuvant therapy with denosumab helps in decreasing the tumor size so that it becomes resectable. When GCTs occur at unusual sites, as seen in this case, diagnosis can get delayed. Therefore, this case serves as a teaching point for physicians who may be dealing with a similar conundrum.

EP-1050

Dual Ectopic Thyroid in an Adult Filipino Female as seen on Technetium-99m Pertechnetate Scintigraphy with SPECT/CT

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Aim/Introduction: Dual ectopic thyroid is an extremely rare form of thyroid dysgenesis, with only a very few cases reported globally. This study aims to present the importance of thyroid scintigraphy in the diagnosis and management of an adult Filipino female with hypothyroidism suspectedly caused by ectopic thyroid tissue. ***Materials and Methods:*** This is a case of a 32 year-old Filipino female with hypothyroidism and ultrasound findings of an absent thyroid fossae with a midline focus superoanterior to the trachea. She was referred for thyroid scintigraphy to confirm the absence of normally-located thyroid and to investigate the presence of thyroid ectopia. ***Results:*** Planar imaging using Technetium-99m (Tc-99m) pertechnetate showed two foci of radiotracer uptake in the supra- and infrahyoid neck regions. Additional SPECT/CT images allowed localization of these two foci to the base of the tongue and left thyroid cartilage lamina, confirming the presence of two functioning thyroid tissues in these areas. ***Conclusion:*** This study further establishes that thyroid scintigraphy, using either radioiodine-131 or Tc-99m pertechnetate, remains the gold

standard for the diagnosis of ectopia. Moreover, the addition of SPECT/CT provides accurate localization of these ectopic sites. ***References:*** [1] Noussios G, Anagnostis P, Goulis DG, Lappas D, Natsis K. Ectopic thyroid tissue: anatomical, clinical, and surgical implications of a rare entity, European Journal of Endocrinology. 2011 Sep; 165(3). [2]Santangelo G, Pellino G, De Falcoi N, Colella G, D'Amato S, Maglione MG, De Luca R, Canonico S, De Falco M. Prevalence, diagnosis and management of ectopic thyroid glands. International Journal of Surgery. 2016 Apr; 28 Suppl 1:S1-6. doi: 10.1016/j.ijsu.2015.12.043. [3]Mendez TJC, Navarro-Locsin, CGS. Double ectopic thyroid gland in a 10-year old filipino boy. Philippine Journal of Otolaryngology-Head and Neck Surgery. 2018; 33(1):47-50. [4]Kumar Choudhury B, Kaimal Saikia U, Sarma D, Saikia M, Dutta Choudhury S, Barua S, Dewri S. Dual ectopic thyroid with normally located thyroid: a case report. Journal of Thyroid Research. 2011; 159703. doi: 10.4061/2011/159703. [5]Chawla M, Kumar R, Malhotra A. Dual ectopic thyroid: case series and review of the literature. Clinical Nuclear Medicine. 2007 Jan;32(1):1-5. doi: 10.1097/01.rlu.0000249590.70176.58. [6] Sood A, Seam RK, Gupta M, Raj Sharma D, Bhardwaj P. Dual ectopic thyroid: a case report with review of literature. Iran Journal of Radiology. 2011; 8(1): 29-32.

EP-1051

Axillary schwannoma mimicking lymphadenopathy in a patient with follicular lymphoma on ^{18}F-FDG PET/CT

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Aim/Introduction: This case report presented a patient diagnosed as follicular lymphoma accompanied with axillary schwannoma on 18F-FDG PET/CT, which is rare and difficult to distinguish from primary malignancy. ***Materials and Methods:*** A 44-year-old man complained of pain in shoulder with cervical lymphadenopathy. Left cervical lymph node was excised and confirmed as follicular lymphoma. 18F-FDG PET/CT was performed for staging. ***Results:*** The MIP image (A) revealed intense FDG uptake in multiple organs. The soft-tissue lesion in left axilla presented with elevated FDG uptake (34mm; SUVmax, 2.2) was also considered as lymphadenopathy involved by lymphoma (B-D), compared to retroperitoneal involved lymph node(E-G).The patient started on chemotherapy for 3 cycles and underwent post-therapy PET/CT. Compared to the baseline imaging, metabolic activity and extent of disease were significantly reduced (H, MIP) with remaining hypermetabolic lesions at left axilla (34mm; SUVmax, 3.2; I-K) and retroperitoneum (14mm; SUVmax,3.8; L-N) , indicating a 4-point Deauville score. Biopsy of lesions in left axilla indicated schwannoma(O) compared to left cervical lymphoma(P). ***Conclusion:*** 18F-FDG PET/CT play an important role in staging and therapeutic evaluation in follicular lymphoma[1]. Schwannoma is a neoplasm arises from schwann cells of the peripheral nerve sheath, occuring in any organ, among which axillary schwannomas are rare[2]. Schwannomas may be intense and heterogeneous FDG avidity with average SUVmax 5.4 ± 2.7[3],making a dilemma for differential diagnose from malignancy. Several cases have indicated schwannoma mimicking lymph node metastasis in different malignancy[4,5]. In this case, PET/CT failed to distinguish schwannoma from lymphadenopathy, for the imaging manifestation of schwannoma was quite similar to lymphoma. In conclusion, schwannoma should be considered as a differential diagnosis of axillary masses when concurrent with lymphoma. ***References:*** 1. Ricard F, Cheson B, Barrington S, et al. Application of the lugano classification for initial evaluation,staging,and response assessment of hodgkin and non-hodgkin lymphoma: the prolog consensus initiative(part 1-clinical). J Nucl Med. 2023;64(1):102-108. 2. Wang SY, Liu JH, Yao S, et al. PET/CT and contrast-enhanced CT imaging findings in benign solitary schwannomas. Eur J Radiol. 2021;141:109820. 3. Dewey BJ, Howe BM, Spinner RJ, et al. FDG PET/CT and MRI features of pathologically proven schwannomas. Clin Nucl Med. 2021;46(4):289-296. 4. Fujii T, Yajima R, Morita H, et al. FDG-PET/CT of schwannomas arising in the brachial plexus mimicking lymph node metastasis: report of two cases. World J Surg Oncol. 2014;12:309. 5. Bai X, Wang X. Solitary benign schwannoma mimics residual malignancy on FDG PET/CT. Clin Nucl Med. 2018;43(10):782-784.

EP-1052

^{68}Ga-PSMA-11 and ^{18}F-siPSMA-14 positive synchronous differentiated thyroid carcinoma in routine staging and restaging PET/CT scans of a patient with prostate cancer

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Aim/Introduction: Thyroid cancer is the main endocrine neoplasia worldwide. Given the increased expression of carboxypeptidase type II in the vascular endothelium in the neovasculature of many solid tumors, increased 68Ga- prostate specific membrane antigen (PSMA) PET/CT uptake has been demonstrated in several non-prostate malignancies, including thyroid cancer. The increased expression of PSMA in the detected lesions - incidentalomas of the thyroid gland with 68Ga - PSMA are due to a malignant process up to 23.0% (1). ***Materials and Methods:*** A 67 old male diagnosed with prostate cancer undewent staging 68Ga PSMA PET/CT study and revealed tumor with increased PSMA expression, presented as bilateral malignant involvement of the peripheral zones of both lobes of the prostate, seminal vesicles and malignant infiltration of the urinary bladder (confirmed by MRI); as well as metastatic pelvic lymph nodes, without evidence of distant metastatic lesions. As an additional finding, an incidentaloma- nodular lesion in the left lobe of the thyroid gland with increased PSMA-expression was found. The patient underwent hormone therapy, and 4 months later, a reduction in PSA levels was reported at 5.73 ng/m. ***Results:*** A restaging PET/CT was performed with the newly synthesized radiopharmaceutical 18F-siPSMA-14, which revealed PSMA-active changes associated with PC (defining a partial response from the performed therapy). Increased PSMA expression was also demonstrated in a hypodense nodule involving the left thyroid lobe, persisting without significant dynamics compared to the previous scan (regarding size and activity). Ultrasonographic clarification of the finding and fine-needle aspiration biopsy were recommended. Subsequently, differentiated thyroid carcinoma, papillary type, was histologically verified ***Conclusion:*** The hybrid method using PSMA radiopharmaceuticals (18F-PSMA-14 and/or 68Ga-PSMA) in the presented clinical case, aided the diagnosis of differentiated thyroid carcinoma, which raised the question of their possible future application in thyroid cancer patients. The PSMA uptake mechanism is independent of the I-Na symporter and does not require levothyroxine suppression, moreover, the hybrid method can prematurely identify lesions with more aggressive potential that may undergo radioiodine refractoriness. Future prospective studies are needed to investigate the diagnostic value and possible advantages of the

hybrid method with PSMA radiopharmaceuticals (18F-PSMA-14 and/or 68Ga-PSMA), with a view to the possible expansion or supplementation of therapeutic options and the potential application of the principles of theranostics-PSMA -targeted radionuclide therapy for patients with limited therapeutic options. ***References:*** 1. Bertagna F, Albano D, Giovanella L, Bonacina M, Durmo R, Giubbini R, et al. 68Ga-PSMA PET Thyroid Incidentalomas. Hormones (Athens) (2019) 18(2):145-9.

EP-1053

Increased PSMA expression in synchronous neoplastic processes in patient with prostate cancer on PET/CT staging imaging with the newly synthesized radiopharmaceutical, a highly promising novel radiotracer ^{18}F-siPSMA-14

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Aim/Introduction: Preliminary findings suggest that [18F]siPSMA-14 exhibits favorable kinetics for prostate cancer (PC) staging. Despite the rarity of synchronous 68Ga-labeled prostate-specific membrane antigen (PSMA)-avid malignancies in PC patients (0.7%), data on the utility of 18F-siPSMA-14 radiopharmaceutical remain sparse in the literature. ***Materials and Methods:*** A 69-year-old patient with histologically confirmed PC, Gleason score 5+4=9, and ISUP group 5, presented with an initial PSA level of 126.0 ng/ml. After initiation of endocrine therapy, a decline in PSA levels to 1.45 ng/ml was noted. ^{18}F-siPSMA-14 PET/CT staging imaging revealed, alongside changes related to the primary PC, two synchronous tumors exhibiting increased PSMA expression, subsequently confirmed histologically as rectal cancer and lung carcinoma. ***Results:*** PET/CT images demonstrated diffuse and heterogeneous increased PSMA expression throughout both prostate lobes, accentuated in the peripheral zones at the mid/apex level, indicative of primary PC. Additionally, two focal areas exhibiting heightened PSMA activity were identified: in the body of the right iliac bone and the body of Th8 vertebra, consistent with bone marrow metastatic lesions. Further synchronous tumors with increased PSMA expression were observed. The first, involving the rectum, appeared/manifested as irregular thickening of the intestinal wall, later confirmed as rectal adenocarcinoma via flexible colonoscopy and biopsy. The second synchronous tumor, characterized by parenchymal involvement with spiculated margins, was located peripherally in the upper lobe of the right lung. It displayed heterogeneous PSMA expression increase and pleural involvement, subsequently confirmed histologically as synchronous lung adenocarcinoma. A small subpleural nodular lesion ipsilateral to the lung adenocarcinoma was identified, warranting further characterization through contrast-enhanced CT and staging ^{18}F-FDG PET/CT examination. Additionally, bilateral cervical and mediastinal lymphadenopathy with increased PSMA expression were noted, likely related to synchronous lung cancer in the right lung. ***Conclusion:*** It is crucial to histologically confirm lesions exhibiting heightened ^{18}F-siPSMA-14 expression, even if they appear atypical for prostate cancer involvement. A thorough evaluation, taking into account the clinical background, morphological characteristics of the lesions, and additional imaging results, is vital to ascertain their relevance. The utilization of ^{18}F-siPSMA-14 holds considerable promise in broadening the scope of PSMA-targeted theranostics beyond prostate cancer.

Keywords: ^{18}F-siPSMA-14 PET/CT, synchronous primary lung cancer, synchronous primary rectal cancer. ***References:*** Medhat M. Osman, Amir Iravani, Rodney J. Hicks and Michael S. Hofman. Detection of Synchronous Primary Malignancies with 68Ga-Labeled Prostate-Specific Membrane Antigen PET/CT in Patients with Prostate Cancer: Frequency in 764 Patients. Journal of Nuclear Medicine December 2017, 58 (12) 1938-1942; DOI: https://doi.org/10.2967/jnumed.117.190215.

EP-1054

^{99m}Tc-PSMA and ^{99m}Tc-FAPI-46 uptake in pulmonary lymphangitic carcinomatosis as a rare form of metastasis in a patient with prostate cancer: case report

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Aim/Introduction: We presented a 70-year-old patient with the history of significant weight loss and lower urinary tract symptoms including hematuria, nocturia, hesitancy and incontinency since 4 months and cough since from 1 month before the referrence who refused to have any history of previous lung disease and bone pain. Regarding the high serum prostate-specific antigen level (PSA>100 ng/ml), the patient with the primary diagnosis of prostate cancer was referred for further molecular imagings to clarify the distant metastases and 3 month after initiation of treatment with ADT and taxane-based chemotherapy. ***Materials and Methods:*** We administered 20 mci of 99m Tc-PSMA and the same dose of 99m Tc- FAPI 46 in two separate days, followed by delayed whole body imaging as well as SPECT/CT images performed for precise localization of the detected lesions. ***Results:*** In our study we noted diffuse 99m Tc- PSMA and 99m Tc- FAPI 46 uptake throughout both lungs of a metastatic patient which was considered to be compatible with lymphangitic carcinomatosis pattern. The findings on the hybrid imaging included nodular and irregular interlobular septal thickening, sub pleural nodules and mediastinal nodal enlargement on the dedicated CT slices. In interim 99mTc-PSMA scintigraphy, decreased PSMA uptake in both lungs and skeletal metastases as well as decreased in interlobular thickening and sub pleural nodules along with decreased in clinical respiratory symptoms were noted. ***Conclusion:*** Our study illustrated lymphangitic carcinomatosis as an unusual form of metastasis in prostate cancer as a first presentation that showed diffuse lung uptake on both 99m Tc-PSMA and 99m Tc-FAPI 46 scintigraphies.

EP-1055

The Significance of Total Body ^{18}F-FDG PET/CT in Multiple Myeloma: A Clinical Case

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Aim/Introduction: Multiple myeloma (MM) manifests with long bone involvement in approximately 25% of patients. This report aims to present a clinical case of a MM patient with established metabolically active lesions affecting the long bones of the lower limbs, as revealed by ^{18}F-FDG PET/CT imaging. ***Materials and Methods:*** We describe the case of a female patient diagnosed with MM IgG-kappa. Initial staging imaging with computed tomography of the thorax identified a solitary osteolytic lesion with a soft tissue component in the sternum, categorizing the stage as Ia (Durie-Salmon PLUS). Subsequently, the patient

underwent ^{18}F-FDG PET/CT evaluation after completing 6 courses of chemotherapy due to persistent lower extremity pain, requiring crutches for ambulation. Because of this complaints, it was decided to perform a total body PET/CT- from the vertex to the toes. ***Results:*** The ^{18}F-FDG PET/CT scan revealed multiple metabolically active osteolytic lesions in the thoracic vertebrae, both femurs, and tibias, prompting a re-evaluation of the patient's disease stage and treatment strategy. Following an intensified chemotherapy regimen, a follow-up total body ^{18}F-FDG PET/CT showed a significant expansion of osteolytic involvement and elevated glucose metabolism within the long bones of the lower limbs. Additionally, a new metabolically active lesion was identified in the right tibia, indicative of disease progression. ***Conclusion:*** Long bone lesions and fractures significantly diminish quality of life in MM patients. Limited literature exists regarding long bone involvement in multiple myeloma. Standardizing the extent of the scan field remains unresolved. We recommend extending the scan field from the vertex to the distal third of the tibia in MM patients presenting with lower extremity pain or signs of diffuse bone involvement. This approach facilitates early detection of osteolytic lesions, which are prone to fractures and associated with impaired quality of life, thereby enhancing diagnosis, monitoring, and treatment strategies.

EP-1056

Challenges in Interpretation of ^{18}F-FDG PET/CT in Multiple Myeloma: Potential Diagnostic Pitfalls and Mitigation Strategies - Illustrated by Two Clinical Cases

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Aim/Introduction: ^{18}F-fluorodeoxyglucose positron emission tomography/computed tomography (^{18}F-FDG PET/CT) is a pivotal imaging modality in the assessment of multiple myeloma (MM). However, its nuanced interpretation poses challenges, particularly in distinguishing diffuse bone marrow infiltration characteristic of MM from other conditions such as anemic syndrome. This study presents two clinical cases to elucidate a potential diagnostic pitfall in 18F-FDG PET/CT imaging in MM patients and explores strategies to mitigate misinterpretation. ***Materials and Methods:*** Two cases are described: First patient, who presented with debilitating general fatigue, bone pain, and elevated total protein, underwent 18F-FDG PET/CT for staging the disease. Second patient had MM (light chain Lambda, International Staging System [ISS] III) and concomitant anemia after chemotherapy. Both patients underwent either staging or post-therapeutic 18F-FDG PET/CT scans as part of their diagnostic workup. ***Results:*** In the first patient, the 18F-FDG PET/CT exhibited diffusely increased bone marrow activity without distinct osteolytic lesions, yet a noticeable diffuse reduction in bone density, particularly observed in pelvic bones and sacrum. This imaging pattern may be attributed to the diffuse patchy bone marrow infiltration characteristic of MM. Later, those findings was histologically proven for myelomatous infiltration. In contrast, second patient, despite presenting with stable disease and anemia, demonstrated above-background increased metabolic activity in the bone marrow without evident osteolytic lesions on the post-therapeutic ^{18}F-FDG PET/CT. The patient's hemoglobin level was 76g/L. After biopsy, no myeloma cells were found in the bone marrow. ***Conclusion:*** These clinical cases serve to highlight a potential diagnostic pitfall in ^{18}F-FDG PET/CT interpretation in MM patients, where the overlapping metabolic patterns between diffuse bone marrow involvement from MM and anemic syndrome can lead to challenges in differentiation. This emphasizes the critical need for meticulous correlation between ^{18}F-FDG PET/CT findings and laboratory results in the management of MM. Heightened awareness of this diagnostic challenge is essential to prevent false positive interpretations and guide precise clinical decision-making in MM patients undergoing ^{18}F-FDG PET/CT imaging.

EP-1057

Misleading Focal [99mTc]Tc-MDP Uptake in the Whole-body Scintigraphy of a Patient with History of a Recent high energy Trauma

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Aim/Introduction: This case report discusses the use of bone scintigraphy in diagnosing suspected occult fractures, emphasizing the importance of hybrid imaging for confirming the whole-body plannar findings. ***Materials and Methods:*** A 54-year-old man presented with thoracic pain following car accident. Despite negative radiographs and CT scans, a three-phase bone study with technetium-99m MDP was conducted, followed by pelvic SPECT/CT imaging to investigate focal uptake in the left pubis ramus. ***Results:*** Bone scintigraphy revealed increased uptake in the right 9th rib, indicating an occult fracture, while uptake in the pubis ramus was initially misinterpreted as a traumatic lesion. Pelvic SPECT/CT identified urine contamination on the glans of the penis as the cause of the misleading uptake. ***Conclusion:*** This report underscores the significance of SPECT/CT imaging as an integral component of bone scintigraphy, particularly when dealing with abnormal findings on whole-body planar images.

EP-1058

False-Positive Radioactive Iodine Uptake in A Huge Uterine Fibroid: A Case Report

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Aim/Introduction: Differentiated thyroid carcinoma (DTC) patients often undergo post-treatment whole-body iodine scans (WBIS) to assess treatment efficacy. However, interpreting incidental findings on these scans can be challenging, particularly when distinguishing between physiological and pathological uptake. We present a case highlighting a notable pitfall in WBIS interpretation. ***Materials and Methods:*** A 37-year-old woman with DTC, pT3aN1b, underwent adjuvant radioactive iodine therapy. Post-treatment WBIS revealed unexpected iodine uptake in a large uterine fibroid. Clinical and radiological correlations were assessed to elucidate the nature of this uptake. ***Results:*** The patient's WBIS showed iodine uptake in the mid-abdomen, above the bladder. Physical examination and SPECT/CT correlation confined the uptake to a uterine mass. Review of gynecologic history and imaging studies revealed a known uterine fibroid, stable in size, which had trapped the radioiodine. ***Conclusion:*** This case underscores the importance of recognizing potential pitfalls in WBIS interpretation, particularly in women of reproductive age with thyroid carcinoma. Differentiating between physiological and pathological iodine uptake is crucial to avoid unnecessary interventions. Hybrid imaging modalities, such as SPECT/CT, can aid in localizing and characterizing unexpected iodine avidities, improving clinical decision-making and reducing the risk of overtreatment in thyroid cancer patients.

EP-1059

Focal Radiotracer Uptake in the Falciform Ligament; A Rare lymphoscintigraphic Pattern in Breast Cancer

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Aim/Introduction: Breast cancer lymphatic drainage involves pathways towards axillary and extra-axillary regions. A rare challenging case in this understanding is the identification of lymphatic drainage via the falciform ligament, presenting a unique pattern in breast cancer lymphoscintigraphy. ***Materials and Methods:*** A 67-year-old woman with invasive ductal carcinoma underwent lymphoscintigraphy using technetium-99m Phytate. Planar imaging and subsequent SPECT/CT were conducted to localize tracer uptake. ***Results:*** Planar imaging revealed two distinct focal uptake in the left axilla as well as another focus in the falciform ligament amidst diffuse hepatic activity which is a rare finding. SPECT/CT precisely identified this uptake within the ligament without any underlying distinct lymph node, suggesting a rare lymphatic drainage pathway. Histopathologic evaluation of axillary sentinel nodes showed no metastatic involvement. ***Conclusion:*** The identification of lymphatic drainage via the falciform ligament challenges conventional understanding, indicating potential implications for breast cancer metastasis. Factors such as lymphatic obstruction and impaired contractility may contribute to this phenomenon. Further cases evaluations are warranted to elucidate the complexity of breast cancer lymphatic pathways and their role in metastasis.

EP-1060

Iodine Contamination Mimicking a Common Pattern in Whole Body Iodine Scan Unveiled by SPECT/CT: A Case Study

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Aim/Introduction: The whole-body iodine scan (WBIS) is essential for assessing metastasis in thyroid cancer patients, particularly where SPECT/CT is unavailable. However, interpretation challenges can lead to misdiagnosis, emphasizing the need for hybrid imaging modalities. ***Materials and Methods:*** A 61-year-old man with poorly differentiated thyroid carcinoma underwent total thyroidectomy and adjuvant radioactive iodine (RAI) therapy. Post-treatment WBIS initially showed misleading patterns, later clarified by SPECT/CT. ***Results:*** The WBIS revealed misleading iodine uptake patterns, including a zone of contamination misinterpreted as thyroid bed uptake. SPECT/CT confirmed the misinterpretation, highlighting the importance of hybrid imaging techniques. ***Conclusion:*** This case underscores the critical role of integrating SPECT/CT with WBIS to prevent misdiagnosis and ensure accurate treatment planning in thyroid cancer patients. Complementary imaging modalities enhance diagnostic accuracy and improve patient outcomes.

EP-1061

Sentinel node mapping and biopsy in a rare case of ectopic breast cancer

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Aim/Introduction: Primary breast cancer arising within accessory breast tissue is a rare occurrence. Accurate diagnosis and management of ectopic breast cancer pose significant challenges due to its unusual presentation and localization. We present a case of invasive ductal carcinoma originating in accessory breast tissue located in the left axillary region, emphasizing the importance of precise diagnostic techniques and optimal treatment strategies. ***Materials and Methods:*** A postmenopausal 62-year-old woman presented with a palpable mass in the accessory breast within the left axillary region. Core needle biopsy confirmed invasive ductal carcinoma. Lymphoscintigraphy was performed by injecting 30MBq of technetium-99m Phytate intradermally in the periareolar region of the eutopic breast. Plannar and single-photon emission tomography/computed tomography (SPECT/CT) images were obtained to visualize lymphatic drainage and identify sentinel lymph nodes. ***Results:*** Lymphoscintigraphy revealed a solitary sentinel lymph node in the ipsilateral axilla, corresponding to the accessory breast malignancy. Surgical resection of the accessory breast and sentinel lymph node biopsy were performed. Pathological examination of the sentinel node showed no evidence of metastasis. The patient underwent adjuvant radiotherapy, chemotherapy, and anti-hormonal therapy. ***Conclusion:*** Our case highlights the diagnostic and therapeutic challenges associated with primary breast cancer in accessory breast tissue. Lymphoscintigraphy with periareolar injection of radiotracer proved effective in identifying sentinel lymph nodes, guiding surgical decision-making, and minimizing unnecessary mastectomies. Accurate diagnosis and appropriate management are crucial for improving outcomes in patients with ectopic breast cancer.

EP-1062

Application of Tc-99m FAPI-46 Imaging in a Patient with Medullary Thyroid Carcinoma: Navigating the Landscape of Novel Radiotracers

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Aim/Introduction: Metastatic medullary thyroid carcinoma (MTC) poses significant therapeutic challenges, often refractory to conventional treatments. We present the case of a 58-year-old male with metastatic MTC unresponsive to peptide receptor radionuclide therapy (PRRT) and lutetium-177 Dotatate therapy, highlighting the need for alternative approaches in managing this aggressive malignancy. ***Materials and Methods:*** The patient underwent multiple interventions, including total thyroidectomy and cervical lymph node dissections, followed by PRRT and lutetium-177 Dotatate therapy. Despite these treatments, serum calcitonin levels continued to rise, indicating disease progression. Subsequent evaluation with technetium-99m FAPI-46 scintigraphy was performed to assess the potential of FAPI-labeled radioisotopes in detecting and targeting metastatic lesions. ***Results:*** Technetium-99m FAPI-46 scintigraphy revealed remarkable uptake in metastatic lesions, including parapharyngeal mass, lung metastasis, lymph nodes, and bone metastasis. This finding suggests a potential role for FAPI-targeted radiotracers in the management of metastatic MTC, especially in cases refractory to conventional therapies. ***Conclusion:*** Our case highlights the emerging utility of technetium-99m FAPI-46 scintigraphy in identifying and characterizing metastatic lesions in MTC patients resistant to standard treatments. FAPI-targeted radiotracers hold promise as a novel approach in oncologic nuclear medicine, warranting further investigation to explore their therapeutic potential in metastatic MTC and other malignancies.

EP-1063

Newly Formed Hepatic Inflammatory Myofibroblastic Tumor Mimicking Neuroblatoma Metastasis: ^{18}F-FDG and ^{68}Ga-DOTANOC PET/MRI Imaging

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Aim/Introduction: A 4-year-old boy with history of stage IV neuroblastoma (NB) underwent surgery resection, chemotherapy and radiotherapy. One enhancing hepatic lesion with intense 18F-FDG uptake (SUVmax of 6.8) on the right lobe was newly found on latest PET/MRI which is negative on prior PET. Hepatic metastasis from NB was highly suspected at first but was ruled out due to its absence of 68Ga-DOTA-NOC uptake, a somatostatin receptor targeted radiotracer. An extremely rare inflammatory myofibroblastic tumor (IMT) in liver was confirmed based on post-operation histopathologic examination. ***Results:*** NB is the most common extracranial solid tumor in childhood with unknown etiology, highly variable biologic behavior and clinical presentation. Recurrence and metastasis after therapy are the major obstacle to improve the prognosis of NB patients. Liver is one of the most common sites of metastases from NB. To detected metastatic lesions, routine imaging methods including CT, MRI and ultrasonography may be complemented by functional imaging methods such as PET/CT or PET/MRI. Various PET tracers have been used in NB patients. Somatostatin receptor 2 (SSTR2) is expressed by the majority of NB tumors. Therefore, SSTR enabling PET imaging agents, for example, 68Ga-DOTA-TATE, 68Ga-DOTA-TOC and 68Ga-DOTA-NOC, show high sensitivity in detecting NB lesions. 18F-FDG is usually considered to be a second-line imaging agent because of its less specific for NB. Actually, FDG is useful for those NB lesions do not uptake meta-iodobenzylguanidine (MIBG) However, IMT is an extremely rare tumor with no known unique clinical, laboratory, or radiological features for identification, especially it is usually FDG-avid. On this occasion, the hepatic lesion may be misdiagnosed as a metastasis from NB. According to our knowledge, this is the first reported case of solitary liver IMT in a NB patient. It is suggested that surgical resection should be recommended for solitary lesions if not prohibited by anatomic location or morbidity. Targeted imaging methods and pathologic studies are crucial in these atypical cases. ***Conclusion:*** Somatostatin receptor imaging can be critical in the differential diagnosis of NB metastasis and multimodality PET/MRI imaging may provide more information about the lesion.

EP-1065

Hyper parathyroid scan case report

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Aim/Introduction: Hyperparathyroidism is a state of increased synthesis and release of PTH from single or multiple parathyroid glands. The parathyroid scan is intended to localise the active parathyroid tissue for unilateral minimally invasive surgery intent. Intraoperative 50% reduction of serum PTH level post gland removal indicates a successful procedure. ***Materials and Methods:*** A 60-year-old female with a known case of recurrent urinary stones and thyroid MNG had persistent PTH levels and midline non-painful neck swelling with generalised muscle pain. Thyroid U/S showed multiple bilateral thyroid nodules, confirming the diagnosis of MNG. FNAC was done for the suspected left thyroid nodule, which was benign. MIBI scan was done as well to locate the source of hyperfunctioning parathyroid tissue before surgery. ***Results:*** MIBI scan showed evidence of multiple hyperactive parathyroid tissues that could be hyperplasia, though no renal impairment was present for histopathological follow-up post-surgery. ***Conclusion:*** Multiple adenomas are rare in 5% of cases of hyperparathyroidism. Secondary hyperparathyroidism to renal insufficiency is usually associated with parathyroid hyperplasia(seen in 20% of hyperparathyroidism cases), and an MIBI scan, in this case, has lower sensitivity (around 60%). ***References:*** SNMMI procedure standard for parathyroid scintigraphy 4.0, 20122009, EANM parathyroid guidelines Seminars in Nuclear medicine Volume 45, Issue 5, Sep 2015, Pitfalls and limitations of Radionuclides Imaging in EndocrinologyScintigraphic parathyroid imaging Concepts and new developments, 22 June 2015, 2015:5-9-18.

EP-1066

^{18}F-FDG PET/CT Findings in a Rare Case of Renal Synovial Sarcoma with SYT-SSX1 Translocation

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Aim/Introduction: We present the case of a 65-year-old man with presenting complaints of recurrent hematuria whose initial abdominal CECT demonstrated a hyperenhancing mass arising from the right kidney, following which he underwent a staging ^{18}F-FDG PET/CT to look for locoregional spread and distant metastasis. ***Materials and Methods:*** The ^{18}F-FDG PET/CT revealed a hypermetabolic right renal mass along with the presence of a hypermetabolic metastatic nodule in the left lung. He underwent a radical right sided nephrectomy. ***Results:*** The post-operative histopathology of the specimen revealed the mass to be a synovial sarcoma with rhabdoid and sarcomatoid changes and accompanying perinephric fat & lymphovascular invasion. Real time PCR of the specimen revealed the presence of SYT-SSX1 translocation. ***Conclusion:*** He received multiple lines of therapy including cabozantinib, nivolumab, lenvatinib & brigatinib before finally being initiated on Doxorubicin based chemotherapy. This case demonstrates the PET/CT findings of metastatic renal synovial sarcoma.

EP-1067

A typical case of follicular cell sarcoma of the duodenum on ^{18}F-FDG PET

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Aim/Introduction: Follicular dendritic cell sarcoma (FDCS) is a rare malignant neoplasm. This article presents a case of typical FDCS located in the pancreatic-duodenal region, with findings from enhanced CT and 18F-FDG PET/CT. This case exhibits typical features of FDCS, emphasizing the importance of considering FDCS in the differential diagnosis of characteristic gastrointestinal hypermetabolic lesions. ***Materials and Methods:*** We report the case of a 69-year-old woman who presented with a pancreatic mass found during a routine physical examination. Blood tests revealed CA125 at 26.1 U/ml, and NSE at 20.1 ng/ml. The primary lesion manifested as a large cystic-solid mass, showing significant enhancement on enhanced CT. The patient underwent 18F-FDG PET/CT to further evaluate the potential malignant tumor. The primary lesion showed notable uptake in the solid portion on 18F-FDG PET/CT . ***Results:*** The tumor was surgically resected. Histopathological and immunohistochemical analysis confirmed it to be a follicular dendritic cell sarcoma located on the serosal aspect of the duodenum adjacent to the pancreatic capsule. ***Conclusion:***

Follicular dendritic cell sarcoma is a rare malignant tumor derived from follicular dendritic cells, typically involving lymph nodes, with occasional extranodal occurrences [1]. It often presents as a slow-growing, painless mass with few systemic symptoms [1]. CT often depicts well-defined, round, or oval-shaped masses, which may appear lobulated when the lesion is larger, with the presence of cystic changes, necrosis, and calcifications [2]. Enhanced CT scans reveal progressive, uneven, and intense enhancement of the mass [2].18F-FDG PET/CT has been proven to be an important imaging modality for differentiating extranodal follicular dendritic cell sarcoma [3]. Currently, there are limited reports on the 18F-FDG PET/CT findings of gastrointestinal follicular dendritic cell sarcoma [4]. This case presents a typical follicular dendritic cell sarcoma of the duodenum, emphasizing the need to consider the possibility of follicular dendritic cell sarcoma in the differential diagnosis of gastrointestinal tumors. ***References:*** 1. Chen T, Gopal P. Follicular dendritic cell sarcoma. Arch Pathol Lab Med 2017; 141:596-599. 2. Mao SY, Dong J, Wang YQ, Zhang C, Dong AN, Shen JX. Follicular Dendritic Cell Sarcomas: CT and MRI Findings in 20 Patients. AJR Am J Roentgenol 2021;216:835-843.3. Subesinghe M, Smith JT, Chowdhury FU. F[18] FDG PET/CT imaging of follicular dendritic cell sarcoma of the mediastinum. Clin Nucl Med 2012;37:204-205.4. Ji X, Dong A, Wang Y. FDG PET/CT in Follicular Dendritic Cell Sarcoma of the Jejunum With Hepatic Metastasis. Clin Nucl Med 2023;48:902-904.

EP-1068

Utility of FDG PET/CT in a Case of Primary Retroperitoneal Extraosseous Ewing's Sarcoma of Atypical Age

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Aim/Introduction: We report a case of a 57-year-old female with a rare and rapidly progressive extraosseous Ewing's sarcoma (EES) located in the retroperitoneum. ***Materials and Methods:*** The patient presented with a large retroperitoneal mass discovered during a medical examination for herpes zoster-related pain. Histopathological and immunohistochemical staining showed positive staining for CD99, Fli-1, and Vim. The Ki67 proliferation index was 40%. FISH testing revealed EWSR1 positivity, indicating the diagnosis of extraosseous Ewing's sarcoma. Subsequently, 18F-FDG PET/CT was performed for staging. The maximum intensity projection image displayed a large abdominal mass. It showed an indistinct border with the diaphragm, exerting compression on the thoracic and abdominal organs and wrapping around the aorta and its major branches. The patient did not fit the typical age characteristics of extraosseous Ewing's sarcoma and had a significant tumor burden. She underwent combined chemotherapy and radiation therapy, and on follow-up chest CT, multiple lung metastases were detected. Subsequently, targeted therapy was initiated. One year later, a PET scan showed a reduction in the size of the retroperitoneal mass compared to previous imaging. There was a slight decrease in glucose metabolism, and the mass displayed heterogeneous density with a multi-cystic appearance. The boundary between the mass and the surrounding tissues remains indistinct, as observed during the previous examination. There were new findings of widespread metastases, including lymph node, lung, liver, pancreatic, bone, and pathological fracture of the fourth lumbar vertebra. ***Results:*** EES is a rare malignant tumor that typically affects young individuals, presenting with subtle clinical manifestations but exhibiting high malignant potential and invasiveness [1]. It commonly metastasizes to lungs, lymph nodes, and bones, resulting in a poor prognosis [2]. Imaging studies typically reveal poorly defined borders of soft tissue masses, but a definitive diagnosis requires histopathological confirmation [1]. 18F-FDG PET/CT demonstrates high sensitivity in detecting both primary lesions and distant metastases [2]. ***Conclusion:*** The atypical age of onset in our case suggests that the possibility of EES should be considered when a large retroperitoneal mass is discovered in elderly individuals. Furthermore, our case emphasizes the significant role of 18F-FDG PET/CT in assessing the disease burden of EES, thereby guiding diagnosis and treatment. ***References:*** 1. Wright A, Desai M, Bolan CW, et al. Extraskeletal Ewing Sarcoma from Head to Toe: Multimodality Imaging Review. Radiographics. 2022;42:1145-1160. 2. Jamet B, Carlier T, Campion L, et al. Initial FDG-PET/CT predicts survival in adults Ewing sarcoma family of tumors. Oncotarget. 2017;8:77050-77060.

EP-1069

^{18}F-FDG PET Images in a Patient with Nephritis Mimicking Renal metastasis from Primary Hepatocellular Carcinoma on MR: a case report

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Aim/Introduction: We report the 18F-FDG PET/CT findings of postoperative newly inflamed renal nodules that were mistaken for renal metastases on MR in a 58-year-old patient with hepatocellular carcinoma(HCC). ***Materials and Methods:*** A 58-year-old man underwent a partial hepatectomy for HCC and was followed up for monitoring 1 month after surgery. The tumor marker levels were normal. The patient underwent contrast-enhanced MR of the chest, abdomen, and pelvis. MR showed two new nodules with hypointense on DWI in the upper pole of the left kidney. Nodules were suspected to be metastatic. To further clarify the nature of the nodules, 18F-FDG PET/CT was performed subsequently. Two nodules of increased metabolic activity were shown in the upper pole of the left kidney. Delayed imaging was performed at 3h after the injection of 18F-FDG to exclude the effects of renal urine. For subsequent treatment arrangements, the identification of benign versus malignant renal nodules is crucial. The findings on 18F-FDG PET suggested that nodules were inflammatory. Subsequent pathological examination did not reveal any definite tumor tissue. In combination with the imaging findings and laboratory parameters, the renal nodules were clinically considered to be inflammatory nodules. ***Results:*** HCC can cause intra- and extrahepatic metastases. 1/3 of patients with HCC develop extrahepatic metastases and are associated with a poor prognosis [1]. The most common sites of extrahepatic metastases are lung, adrenal glands, bone, and regional lymph nodes, with renal metastases rarely occurring [2]. Care should be taken to consider nephritis in the differential diagnosis when renal metastases are suspected in patients with HCC [2]. Determining whether HCC has extrahepatic metastases is crucial for accurate staging and treatment planning. [1]. In this case, MRI showed an abnormal signal in the kidney, which was considered to be metastasis. Combining conventional and delayed imaging in PET/CT, these abnormal signal lesions were considered inflammatory, which was consistent with the pathological diagnosis. ***Conclusion:*** Renal metastases rarely occur in hepatocellular carcinoma. When nodules show a malignant sign, it may lead to misdiagnosis in MR. FDG-PET/CT may provide additional information for staging and monitoring the efficacy of hepatocellular carcinoma. ***References:*** 1 Uchino K, Tateishi R, Shiina S, et al. Hepatocellular carcinoma with

extrahepatic metastasis: clinical features and prognostic factors. Cancer 2011;117:4475-4483. 2 D'Antonio A, Caleo A, Caleo O, et al. Hepatocellular carcinoma metastatic to the kidney mimicking renal oncocytoma. Hepatobiliary Pancreat Dis Int 2010;9:550-552.

EP-1070

^{18}F-FDG PET/CT findigs of primary Ewing sarcoma of the Prostate

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Aim/Introduction: Ewing sarcoma/PNET are the second-most common primary malignant bone tumor in children and adolescents, but the extraosseous sarcomas rarely manifest in the prostate. In this article, we present 18F-FDG PET/CT findings of a patient who presented with dysuria and was diagnosed with extraskeletal Ewing sarcoma of the prostate. ***Materials and Methods:*** The patient was administered 0.15 mCi/kg FDG intravenously PET/CT imaging was obtained from whole body at 60th minute after the injection. ***Results:*** A 22-year-old male was admitted to hospital for dysuria that had persisted for more than 2 months. In the pelvic CT imaging of the patient, a heterogeneous cystic mass lesion with axial dimensions of 80x70 mm was detected in the left anterolateral aspect of the prostate gland. Thereafter, he underwent prostate biopsy. Histopathological examination revealed small round tumor cells and immunohistochemistry showed that the tumor cells were positive for vimentin, CD59, and CD99, but negative for myogenin, MyoD1, SMA, S100, desmin, SALL4, PANCK, NSE, WT1, and CD34, suggesting extraskeletal Ewing sarcoma. 18F-FDG PET/CT was then performed for primary tumor diagnosis and staging. On the MIP image (Figure 1), abnormal uptake was observed in the pelvic region. The corresponding axial CT and fusion PET /CT images showed (Figure 2): The gross mass lesion completely occupying the prostate with the widest extent of 103 x 74 x 118 mm that shows heterogeneous, intensely elevated FDG metabolism, also containing focal hypometabolic necrotic areas (SUVmax=17.71); a second gross mass lesion weas detected in the left lateral neighborhood of the mass, having intense FDG metabolism in bilateral iliac lymphatic basin (SUVmax,13.45). ***Conclusion:*** Extraskeletal Ewing sarcoma of prostate is an extremely rare condition1-2. The other rare locations in this respect include the retroperitoneum, omentum, orbit, skin, chest wall, and viscera3-5. ***References:*** 1.Guo, Yue-Hong MD; Yang, Min-Fu MD. ^{18}F-FDG PET/CT of Primary Extraskeletal Ewing Sarcoma of the Prostate. Clinical Nuclear Medicine 47(12):p e754-e755, December 2022. 2.Galyfos, G., Karantzikos, G.A., Kavouras, N. et al. Extraosseous Ewing Sarcoma: Diagnosis, Prognosis and Optimal Management. Indian J Surg 78, 49-53 (2016). 3.Jiang, Chengzhi, et al. "FDG PET/CT of primary Ewing sarcoma of the peritoneum." Clinical Nuclear Medicine 47.1 (2022): e4-e5. 4.Tripathy, Sarthak, et al. "Primary Ewing Sarcoma/Primitive Neuroectodermal Tumor of Kidney With Inferior Vena Cava Thrombus: Findings on: ^{18}F-FDG PET/CT." Clinical Nuclear Medicine 45.2 (2020): e103-e105. 5.Zhang, Jun, et al. "FDG PET/CT in a case of primary pulmonary Ewing sarcoma." Clinical Nuclear Medicine 44.8 (2019): 666-668.

EP-1071

Carcinosarcoma Originating From The Inferior Vena Cava Detected on 18F-FDG PET-CT

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Aim/Introduction: Primary carcinosarcoma originating in the inferior vena cava (IVC) is a very rare, malignant neoplasm which is composed of both carcinomatous and sarcomatous elements. To the best of our knowledge, there are no cases in literature describing a primary IVC carcinosarcoma. We present the case of a biopsy-proven primary carcinosarcoma of the IVC in a 63-year-old man whose ^{18}F-FDG PET/CT demonstrated a large hypermetabolic lesion in the IVC along with hypermetabolic pulmonary tumor emboli. ***Materials and Methods:*** We report the case of a 63-year-old man who initially presented to us with complaints of swelling in his feet, dyspnoea & non-productive cough with the non-specific radiological findings of deep vein thrombosis (DVT) of the bilateral lower limbs along with an IVC thrombus and had been started on enoxaparin for the same. However, despite being given appropriate medical treatment, his condition slowly continued to deteriorate over the course of a few months. A whole body ^{18}F-FDG PET/CT was performed in view of the patients deteriorating medical condition to help identify a potential cause for the same. ***Results:*** The PET/CT revealed a dilated IVC with a large hypermetabolic non-enhancing hypodense intraluminal lesion in the intrahepatic IVC with extension into the right hepatic vein, extending into the suprahepatic IVC up to the right atrium & the infrahepatic IVC up to the right renal vein & associated with ascites. The PET/CT also helped identify few hypermetabolic filling defects in segment branches of the bilateral pulmonary arteries in the lungs which were deemed to be metastatic tumor emboli originating from the lesion in the IVC along with bilateral pleural effusion. A CT-guided biopsy was performed for securing a tissue-based diagnosis, which ultimately revealed the IVC lesion to be a carcinosarcoma. Unfortunately for him, the lesion was not amenable to surgery. He underwent stenting of the right hepatic vein & was put on palliative care. His condition continued to deteriorate over the next few weeks at which point he developed septic shock & coagulopathy & had to be put on vasopressor support. He eventually succumbed to his disease. ***Conclusion:*** The role of ^{18}F-FDG PET/CT was pivotal in this case for two reasons; first, it helped to differentiate a tumor thrombus from a bland thrombus; and second, it also allowed us to upstage the disease from being locally advanced to being metastatic, by identifying pulmonary tumor emboli.

EP-1072

Adrenocortical Carcinoma with Sarcomatoid Differentiation Detected on ^{18}F-FDG PET-CT

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Aim/Introduction: We present the case of a 52-year-old woman who presented to the out patient department of our hospital with chief complaints of left flank pain and vague lower backache. She was suspected to be suffering from renal stone disease and was asked to undergo a non-contrast CT (NCCT) of the abdomen to look for evidence of renal calculi. However, upon undergoing the NCCT, it was revealed that she in fact did not have any renal calculi, but was instead found to have a mass originating from her left adrenal gland. ***Materials and Methods:*** Based on these findings, it was suspected that the adrenal mass may be neoplastic in origin. It was decided to perform a whole body ^{18}F-FDG PET-CT of the patient to look for any evidence of suspicious metabolic activity in the mass and also to look for evidence of any metastatic lesions. Upon performing the PET-CT, it was revealed that she had a large, enhancing and hypermetabolic mass (SUVmax: 10.4) with areas of internal necrosis situated in her left adrenal gland, measuring

approximately 6.9x6.2 cm. The mass was involving the left adrenal so extensively that the gland could not be visualized separately at all. There was no evidence of infiltration of any adjacent blood vessels. Additionally, the PET-CT also revealed to us, the presence of another, smaller, hypermetabolic (SUVmax: 9.7) nodular lesion arising from her right adrenal gland, measuring approximately 1.7x1.4 cm. She also had developed a hypermetabolic (SUVmax: 12.8) lytic lesion in her D8 vertebra which had an accompanying soft tissue component as well. Apart from all these ominous findings, her PET-CT also revealed the presence of diffuse hypermetabolism in the walls of her ascending aorta, aortic arch, descending aorta, upper abdominal aorta all the way till the level of the superior mesenteric artery- this was considered to be due to some form of active vasculitis. ***Results:*** She underwent a left adrenalectomy and retroperitoneal lymph node dissection. The histopathology of the left adrenal mass revealed the presence of cells that were positive for CDK4 and negative for CD45, CK8, CK18, CK HMW, CD31, CD34, HMB45, Melan A, SOX-10, Calretinin, Inhibin, Chromogranin, GATA3 and EMA. However, the retroperitoneal lymph node turned out to be benign. ***Conclusion:*** Based on the radiological findings, the morphology and immunohistochemistry findings of the mass, it was suggested to be a poorly differentiated adrenocortical carcinoma with sarcomatoid differentiation and skeletal metastasis.

EP-1073

Poorly Differentiated Gastric Carcinoma Incidentally Detected on ^{18}F-FDG PET-CT in a Known Case of Bladder Cancer

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Aim/Introduction: We present the case of a 43-year-old woman who had just recently been diagnosed with a high grade of muscle invasive urothelial carcinoma of the urinary bladder and who had just undergone a transurethral resection of the urinary bladder tumor (TURBT). Her past history was significant for having undergone a renal transplant a decade ago. CT urography had revealed only an eccentric thickening of the urinary bladder wall. It was decided to perform a whole body ^{18}F-FDG PET-CT to look for any evidence of locoregional or distant metastasis of the disease. ***Materials and Methods:*** Upon performing the PET-CT, it was revealed that she had no evidence of any metabolically active soft tissue thickening in the urinary bladder-post TURBT, to suggest any form of residual disease. Her renal graft was also visualized as being located in the right iliac fossa. However, an incidental finding of a hypermetabolic (SUVmax: 7.7) eccentric and minimal soft tissue thickening along the pylorus and the 1st part of the duodenum was made, it is important to note that this thickening was not, in any way, causing an obstruction of the gastric outlet. This pyloro-duodenal soft tissue thickening was observed to extend upto the right lobe of the liver. There was no evidence of any metastatic lesions anywhere else in the body. The patient herself, did not complain of any symptoms at all that could corroborate these findings. Therefore, based on these findings and given her recent diagnosis of a high-grade muscle invasive urothelial bladder carcinoma, it was suspected that this hypermetabolic lesion was, in fact, a metastasis from the urinary bladder malignancy. After discussion with the oncologist and surgeons, it was decided to perform a distal gastrectomy with regional lymph node sampling of the pyloro-duodenal lesion. ***Results:*** After she underwent the distal gastrectomy and regional lymph node sampling, the tissue samples were sent to the pathologist for characterization. The lesion showed features of a poorly differentiated adenocarcinoma with involvement of the muscularis mucosa and no infiltration into the adjacent esophagus or duodenum and no lymphovascular or perineural invasion. ***Conclusion:*** The tumor stained positively for CK7 and CDX2 and negatively for Synaptophysin, CK20, P63, HMWCK and GATA3. Since it was negative for GATA3, P63 and HMWCK, the possibility of a urothelial primary was ruled out by us. Thereby making this a second primary malignancy of the gastric pylorus which was incidentally detected on PET-CT.

EP-1074

^{18}F-FDG PET-CT Findings in Pancreatic Adenocarcinoma with Ovarian Metastasis

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Aim/Introduction: Ovarian metastasis in pancreatic adenocarcinoma is very rare and is seen in only 4-6% of patients with this malignancy. It is even less likely to present has a recurrence in patients who have already been treated for pancreatic cancer. Herein, we present the case of such a patient and describe the findings of her whole body ^{18}F-FDG PET-CT scan. ***Materials and Methods:*** This case is of a 62-year-old woman who had been diagnosed with adenocarcinoma of the head of the pancreas 2 years prior to the events of this case report. At that time, she had undergone a Whipple's surgery as her disease was amenable to resection and had received all the appropriate adjuvant treatment. She was completely symptom free when she presented to the oncology clinic with complaints of post-menopausal bleeding. A USG of her abdomen and pelvis revealed a large abdomino-pelvic mass which appeared to arise from the left adnexa. Her serum CA 125 and CA 19.9 were both elevated. This prompted us to perform a whole body ^{18}F-FDG PET-CT for the patient to evaluate the abdomino-pelvic mass for possibility of a primary ovarian malignancy. ***Results:*** The PET-CT revealed no evidence of any residual/ recurrent disease in the post-operative bed of the Whipple's surgery. However, it did reveal a large hypermetabolic (SUVmax: 4.5), abdomino-pelvic mass with areas of internal necrosis arising from the left adnexa, measuring approximately 8.4x9.0x9.7 (cc) in volume and was seen to abut the uterus & compress the anterior wall of the urinary bladder along with multiple hypermetabolic bilateral axillary lymph nodes and multiple subcentimeter sized omental and peritoneal deposits in the abdomen and pelvis. There was also evidence of mildly metabolically active (SUVmax: 2.9) soft tissue thickening in the aortocaval region, which was encasing the aorta, inferior vena cava and extended upto the origin of the superior mesenteric artery. ***Conclusion:*** In the end, she underwent a biopsy of the abdomino-pelvic mass and the axillary lymph nodes. The mass revealed a mucinous adenocarcinoma with few patchy signet ring cells that stained positively for CK7, CK19, CA 19.9, MUC2, CDX2 and CK20 while staining negatively for ER and PAX8. However, the axillary lymph nodes turned out to have reactive lymphoid hyperplasia. Based on the presence of an elevated CA 19.9, previous history of pancreatic adenocarcinoma and a pancreatico-biliary phenotype, the final diagnosis of primary pancreatic carcinoma with ovarian metastasis was finally made.

EP-1075

Hydatic cyst infection of the tibia mimicking chondrosarcoma on FDG PET-CT scan

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Aim/Introduction: Hydatid cyst is a zoonotic infection caused by Echinococcus granulosus, with the liver and lungs being the most commonly affected organs. Although rare, hydatid cyst disease can also involve bone due to the hard structure of the bone trabeculae, which prevents the formation of adventitia. The spine is affected in almost half of patients. While FDG PET findings in hepatic and pulmonary hydatid cysts are well described, FDG PET/CT scans in hydatid bone disease have not been reported in the literature. ***Materials and Methods:*** We report a 54-year-old male patient who presented with pain and swelling in the left knee region for several years. Physical examination revealed mild local tenderness. Anteroposterior knee radiographs showed diffuse lytic destructive changes in the tibia. MRI showed a large bone lesion at the epiphyso-metaphyseal level of the tibia with cystic necrotic features without signal enhancement on T1 and T2 calcified areas. This finding strongly suggested the possibility of chondrosarcoma, a fairly common primary bone malignancy in this age group. ***Results:*** FDG-PET/CT was requested to determine the systemic extent of the disease and to plan therapeutic management. The scan clearly showed cortical irregularities at the distal end of the femur, at the level of the lateral condyle, with intense increased FDG uptake. This was followed by a distinct mass lesion in the posterior tibiofemoral joint extending distally along the tibia with obvious destructive changes and continuity in the soft tissue component containing ossified/chondroid calcific densities. Mild hypermetabolic lymph nodes were also seen in the left groin. No other pathological uptake was detected. After discussion with the institutional musculoskeletal tumour service, a tru-cut biopsy was scheduled. Pathology confirmed a solitary hydatid cyst in the tibia, which is a rare site. Abdominal CT and HRCT were performed for further evaluation of the disease, but no findings compatible with hydatid cysts elsewhere in the body were noted. The patient was started on antihelminthic albendazole and total surgical excision was achieved. ***Conclusion:*** To our knowledge, this case appears to be the first report of a patient with osseous hydatid disease evaluated by F^{18} FDG PET/CT scan. This unusual case shows that nuclear medicine physicians should be aware of the potential pitfalls of hydatid disease mimicking malignancy, especially in patients living in rural areas. It also illustrates the complexity of making a correct diagnosis in patients with rare bone diseases, even with the use multimodality imaging.

EP-1076

Differentiating Brown Tumors from Malignancy: A Combined Approach with ^{18}F-FDG PET/CT and ^{99m}Tc-sestaMIBI Scan

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Aim/Introduction: Brown tumors are non-malignant and lytic bone lesions characterized by rapid osteoclastic activity, typically stemming from hyperparathyroidism. These lesions can present a significant diagnostic challenge due to their deceptively malignant appearance on various imaging modalities. We present a case of multiple brown tumors mimicking malignancy on 18F-FDG PET/CT. ***Materials and Methods:*** The patient was a 35-year-old male, with a chronic history of generalized bone pain, fatigue and weight loss. Physical examination did not reveal any notable abnormalities. A plain radiography of the left shoulder revealed an osteolytic lesion along the humeral shaft. To further investigate the possibility of a primary malignant tumor, a PET/CT scan was performed following the administration of 222 MBq of ^{18}F-FDG. ***Results:*** The 18F-FDG PET/CT scan demonstrated widespread, multiple and relatively symmetrical foci of increased FDG uptake in the skeleton. Additionally, a mass with a lower FDG uptake was discovered in the anterosuperior mediastinum. Laboratory tests later revealed hypercalcemia associated with unexpectedly high PTH levels of 600 pg/ml. A whole-body 99mTc-sestaMIBI scan showed a mediastinal round lesion with increased uptake, with good spatial correlation to the one previously detected on PET/CT, associated with a mild diffuse uptake throughout the skeleton. Further investigation confirmed the diagnosis of brown tumors secondary to parathyroid adenoma. ***Conclusion:*** Given their remarkably malignant-like glucose uptake and aggressive nature, brown tumors represent a rare pitfall in interpreting18F-FDG PET/CT scans when screening for bone malignancy. This case illustrates how molecular imaging with 18F-FDG PET/CT, combined with a 99mTc-sestaMIBI scan proved valuable in differentiating brown tumors from true bone metastases within the context of hyperparathyroidism.

EP-1077

Bone Scintigraphy in Recurrent Assessment of Chondroblastoma - a Case Report

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Aim/Introduction: Chondroblastoma is one of the most frequently encountered benign epiphyseal neoplasms in immature skeleton. According to WHO diagnostic criteria chondroblastomas are characterized by following features: 1) lesions are predominantly osteolytic, 2) lesions contain network of pericellular calcifications and 3) chondroblastomas might be complicated by local recurrence (from 6 month up to 8 years). Bone scintigraphy (BS) usually demonstrates increased 99mTc-labelled bisphosphonates uptake in uninvolved bone tissues adjacent to chondroblastoma (e. g. stroma, inflammatory and vascular cells), as well as in intratumoral calcification network. Due to faint indistinct structure, the small recurrent lesions are difficult to recognize by plain radiograph, CT or MRI. On the contrary, BS is sensitive not to structural, but also to metabolic changes and thus may help to detect the bone neoplasm recurrence at early stage. ***Materials and Methods:*** We report a case of a 19-year-old woman with chondroblastoma lateral condyle of the right tibia (diagnostic criteria according to the WHO classification of soft tissue and bone tumors), diagnosed in 2013. The patient underwent surgical removement of lesion with autograft replacement on 04.12.2013. The disease was considered as cured for almost 7 years. Due to new clinical symptoms, which appeared in 2020 (fever, pain and swelling at the right knee joint) the patient was referred for the clinical investigation. ***Results:*** MRI (25.01.2020) revealed imparity and small surface defects with areas of heterogeneity at articular cartilage in lateral condyle of the right tibia, and slight perifocal swelling of the bone marrow, which were interpreted as postoperative osteochondral changes with stress reaction. Clinical data and MRI evaluation did not find new bone neither soft tissue injury; thus, patient underwent anti-inflammatory therapy. The control MRI (01.12.2020) revealed only enhancement of perifocal edema at postoperative area with clinical symptoms remained. Thus, it was decided to make a 3-phase BS for evaluation

metabolic activity. At 3-phase BS and SPECT (21.12.2020) the large area of intensive 99mTc-methylenediphosphonate fixation (30 x25 mm) in the lateral condyle of the right tibia was visualized, that corresponded osteochondral changes at MRI. Due to these findings, the patient was directed to the next surgical intervention that was performed on 10.03.2021. As the result of intervention, the chondroblastoma's recurrence was confirmed. ***Conclusion:*** The results suggest that 3-phase BS and SPECT was sufficient method to reveal and evaluate metabolic status and localization of small recurrent lesions which are undetectable by other methods.

EP-1078

Patient Case Study - HER2+ Breast Cancer Patient with Brain Metastasis, Treated in a Phase 1/2 Study with the HER2-Directed Radiopharmaceutical, CAM-H2

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Aim/Introduction: This case study reports the journey of patient 001-001, a 45-year old female diagnosed with metastatic HER2+ breast carcinoma with brain metastasis in a phase 1, open-label trial of the HER2-directed radiopharmaceutical, CAM-H2 ***Materials and Methods:*** This patient was diagnosed with HER2+ breast cancer in 2016. She underwent a mastectomy and received systemic anti-cancer treatments including Tucatinib, Emtanzine-Trastuzumab, Trastuzumab, and Capectabine. She had undergone loco-regional radiation in 2016, scapular and pelvic palliative radiotherapy in 2019 and multiples courses of brain irradiation (multiples sites of radiosurgery and 2 courses of fractionated posterior fossa radiation) in 2019, 2020 and 2021. Patient 001-001 entered this phase I trial, and received 2 doses of CAM-H2. 50 mCi doses were administered on Sept 28, 2021, and Oct 26, 2021. ***Results:*** SPECT/CT imaging revealed significant uptake of CAM-H2 in brain lesions, suggesting a potential for intracranial therapeutic effect. Three intracranial tumors showed absorbed dose (Gy) of 3.1, 2.5 and 3.9 after the 1st administration of CAM-H2 and 5.4, 5.6 and 5.8 after the 2nd administration of CAM-H2. After the 1st administration of CAM-H2, absorbed dose (Gy) to the kidney was 1.8, 0.4 to the liver and 0.1 to the bone marrow. Absorbed dose (Gy) of CAM-H2 after the 2nd administration was 1.5 to the kidney, 0.3 to the liver and 0.1 to the bone marrow. Overall safety was acceptable with no grade 3 AEs reported. Despite promising imaging findings, the patient's disease progressed as based on CT/MRI performed 8 weeks after the first dose of treatment. This led to the discontinuation of CAM-H2. ***Conclusion:*** Patient 001-001's case demonstrates the challenges associated with advanced HER2+ breast cancer with brain metastasis. CAM-H2 therapy showed encouraging imaging results without obvious clinical benefit. This was the first patient treated in the dose escalation part of the study and the patient received a total of 100mCi of the investigational product. This dose was expected to be below the therapeutic dose level and doses were increased in subsequent study cohorts. Early progression did not allow for a higher total dose to be reached.

EP-1079

Pancreatic lesions dilemma

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Aim/Introduction: Accessory spleen/splenunculus/splenosis is common variant of normal splenic anatomy and is present in 10-12% of cases. It can present incidentally in locations that can mimic other pathology. Multimodality imaging is investigation of choice for these patients as differential includes pancreatic neuroendocrine tumours, malignant and benign pancreatic processes including metastases and inflammatory processes as well as peritoneal lesions. ***Materials and Methods:*** We present a series of complex cases that highlight the central use of Tc-99m nanocolloid and Tc-99m labelled heat-denatured RBC studies from 2 tertiary centres in conjunction with other imaging modalities in identifying splenic variants/splenosis from other pathological processes. ***Results:*** None. ***Conclusion:*** Tc- 99m nanocolloid "liver spleen" study is an under-used but low cost, safe and readily available study to differentiate splenic tissue from other pathological processes.Other radionuclide studies including Tc-99m labelled heat-denatured RBC, FDG and DOTATATE PET/CT, contrast enhanced CT and MRI scans as well as endoscopic ultrasound can all be helpful in these cases of diagnostic difficulty. ***References:*** 1.Bulushi NA, Sawafi FA (2023) Local Experience: The Role of Tc-99m Nano-Colloid Scintigraphy in the Diagnosis of Post-Traumatic Shattered Spleen. OSP Journal of Case Reports 5 JCR-5-160.2.Role of nuclear medicine imaging in differential diagnosis of accessory spleens in patients after splenectomyAndrea d'Amico, Anna Cofalik, Cesary Przeorek, Tomasz Gawlik, Tomasz Olczyk, Michał Kalemba, Alicja Modorowska, Maria Turska-d'Amico, Barbara Bobek-Billewicz, Barbara JarzabPol J Radiol. 2012 Jan-Mar; 77(1): 68-71. doi: 10.12659/pjr.882585PMCID: PMC3389951

EP-1080

An Unusual Vertebral Body Collapse

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Aim/Introduction: Kummell's disease is a rare condition initially described by Dr. Hermann Kummell in 1891, and is defined as a delayed post-traumatic secondary osteonecrosis of a vertebral body, predominantly affecting elderly subjects mostly females. Clinically, it manifests as recurrent dorso-lumbar pain several months after an often minor or unnoticed initial trauma. Osteoporosis is the main risk factor, but other risk factors have been identified such as corticosteroid therapy, diabetes, or inflammatory diseases like vasculitis or granulomatosis. ***Materials and Methods:*** A 73-year-old female patient experienced an initial painful episode at the dorso-lumbar junction which resolved spontaneously after a few weeks. At this time, a CT scan did not show any recent vertebral compression but only old compression of L1 and L4. Six months later, she consulted for progressively intensifying dorso-lumbar pain associated kyphosis. ***Results:*** A spine CT scan revealed a recent T12 collapse with a 50% loss of height, a relatively dense appearance when compared to others and an intravertebral vacuum cleft. No significant regression of the posterior wall and no infiltration of the peripheral soft tissues were shown. Bone scintigraphy 99mTc-SPECT/CT showed a faint uptake of T12 on both early and late acquisition. A biopsy of T12 revealed a macrophagic resorptive and siderophagic inflammatory reaction with signs of steatonecrosis, consistent with osteonecrosis without suspicious malignant features. A cimentoplastie was then perfomed. This set of arguments enabled us to diagnose Kummell's disease. The diagnosis is mainly based

on the clinical history of the disease with five stages: 1) initial injury, may vary in severity and mechanism; X-rays are negative, 2) post-traumatic stage, with localized symptoms and no physical activity limitation, 3) latent interval, which is asymptomatic and lasts from a few weeks to one year, 4) the recrudescent stage, relapse of pain that gradually increases and 5) terminal stage, a permanent kyphosis occurs, added to pain. One radiological sign that can help in the diagnosis of Kummell's disease is an intravertebral vacuum cleft (IVC). IVCs represent important disruption of cortical and cancellous vertebral bone, vary in their radiographic appearance depending on patient's body posture, and trend to disappear over time. ***Conclusion:*** Kummell disease is probably underdiagnosed and its incidence is likely to increase in an ageing population. Diagnosis is mainly based on the disease history, clinical presentation, and imaging. Treatment relies either on nonoperative treatment as analgesic drugs and bed rest or on surgery and interventional radiologic techniques.

EP-1081

Skeletal metastasis detection in an asymptomatic patient with elevated serum alkaline phosphate level

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Aim/Introduction: Detection of possible malignant involvement by radionuclide scan according to a patient's clinical symptoms, laboratory biomarkers, or occasionally even without them ***Materials and Methods:*** A 77-year-old man with a history of multinodular goiter operated (total thyroidectomy) one year ago. The pathology report was benign goiter, but when he was referred to the endocrinologist for periodic management of the disease, his physician accidently noticed an increase in the serum alkaline phosphatase level (ALP=536, normal range =44-147 IU/L). The patient's other tests were as follows (Ur = 49, Cr = 2.3, Ph = 3.8, Ca = 8.9). It is important to note that the patient did not mention any obvious bone pain. Whole body bone scan was requested by the attending physician for further evaluation of the patient. After an intravenous injection of 630 MBq of 99mTc-MDP, the whole body scan was performed three hours later in poster, anterior, and some spot views. ***Results:*** Several osteoblastic lesions were observed and reported at the regions of the Post. skull, Rt. lateral upper ribs, and Lt. ischium, suggesting metastatic involvement. Then the spiral chest CT was requested and showed a suspicious lesion in the superior segment of the right lung. During the evaluation by an interventional radiologist, a CT-guided biopsy was performed, and pulmonary carcinoma was diagnosed by the pathologist. Chemotherapy was prescribed for the patient in accordance with his condition. ***Conclusion:*** It is possible for bone metastasis to cause an increase in the serum alkaline phosphatase (ALP) titer or other biomarkers without even skeletal pain. Consequently, in such cases, it is recommended to perform whole body functional imaging, specifically bone scintigraphy.

EP-1082

A case report of fibrous dysplasia detected by Tc-99m MDP bone scintigraphy

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Aim/Introduction: Bone cells make an abnormal type of fibrous bone when they are affected by fibrous dysplasia caused by a gene mutation. Despite beginning to form before birth, abnormal bones are often not diagnosed until childhood, adolescence, or adulthood. As a result, this study aims to demonstrate the value of a whole-body bone scan when dealing with multiple skeletal involvement such as Paget's disease and fibrous dysplasia. ***Materials and Methods:*** A 22-year-old man presented for whole-body bone scintigraphy to assess skeletal pain and bone lesions with a history of left radius bone fractures 4 years ago and left femoral shaft fractures 2 years ago. In radiologic examination, osteolytic lesions were noted in the left femur of the patient who has been experiencing pain and numbness in his lower limbs since age 11. As a result of a biopsy performed in 2013, ABC (Aneurysmal Bone Cyst) was reported in the left lower limb. The patient complains of general body pain, especially in the ribs and pelvis, as well as movement limitation. Moreover, due to the pathological fracture of the left femur, a prosthesis has been placed there. Whole body bone scintigraphy was performed 3 hours after intravenous administration of 20 mCi 99mTc-MDP using a Siemens dual-headed gamma camera with LEHR collimators. ***Results:*** As a result of the scan, a nuclear medicine specialist reported both irregular and diffuse osteoblastic lesions in the skeletal system including the right maxilla and mandible, both sides ribs, the left hand and shoulder (with deformity), the left hemipelvis, the left lower limb (with mild deformity and proximal expansion) with high probability of fibrous dysplasia. Following the bone scan result and sites of involvements, another bone biopsy was performed on the left femur and tibia, confirming fibrous dysplasia. ***Conclusion:*** Therefore, the results indicate that a whole-body bone scan can be very useful in guiding and diagnosing rare and genetic bone conditions like fibrous dysplasia that have multiple involvements, and it may delay the diagnosis process if it is not used.

EP-1083

Gastric Metastasis from Breast Cancer Detected on ^{18}F-FDG PET-CT A Rare Finding

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Aim/Introduction: Gastric metastasis from breast cancer is a very rare occurrence with an incidence rate of only 0.04%, with most of the cases being reported postmortem during autopsy. Herein, we present the case of one such patient and describe the findings of her whole body ^{18}F-FDG PET-CT. ***Materials and Methods:*** This is the case of a 63-year-old woman who had been diagnosed with breast cancer involving the right breast which was immunoreactive for ER, PR and Her2Neu antibodies. Her previous ^{18}F-FDG PET-CT scan had revealed the presence of multiple hypermetabolic metastatic lesions in the liver and her axial & appendicular skeleton. She had received systemic therapy in the form of palbocicilib and letrozole followed buy alpelisib and fulvestrant. On her next follow-up whole body PET-CT scan, her breast primary along with her hepatic and skeletal metastasis had shown evidence of a partial response to the treatment. However, we had also detected some metabolically active and diffuse thickening of the gastric wall, which at the time seemed rather suspicious, given the patients complains on gastric fullness. It was decided to perform an upper GI endoscopy and biopsy to further evaluate these findings. ***Results:*** Her upper GI endoscopy revealed the presence of gastric mucosal edema and congestion, wrinkling and redness involving all parts of the stomach. Multiple biopsy samples were taken for histopathological

and immunohistochemical correlation. The final results from the gastric biopsy revealed the presence of metastatic breast carcinoma in the stomach. Her treatment plan was modified and she was started on capecitabine and trastuzumab deruxtecan therapy. Following this, she underwent another PET-CT for assessing the response to her new therapy. This scan revealed that the gastric wall thickening had now become metabolically inactive and the remaining skeletal lesions had also shown some response to treatment, indicating and overall partial response to therapy. ***Conclusion:*** In conclusion, ^{18}F-FDG PET-CT proved to play a pivotal role in this patients treatment as it not only helped us to stage and evaluate the disease and its response to chemotherapy, respectively, but also allowed for us to detect an unusual and often overlooked site of metastasis. This can lead to misdiagnosis of metastatic disease and insufficient treatment of the patient, which can later lead to disease progression or recurrence. Therefore, any abnormal metabolically active thickening in the stomach must be evaluated thoroughly even though it might appear innocuous.

EP-1084

Malignant Phyllodes Tumor with Sarcomatoid Lung Metastasis Detected on ^{18}F-FDG PET-CT

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Aim/Introduction: We present the case of a 40-year-old woman who had been diagnosed with a malignant form of phyllodes tumor and was on follow-up at our facility when she was incidentally detected to have lung nodules. ***Materials and Methods:*** The 40-year-old woman had been diagnosed with a malignant phyllodes tumor in the lower inner quadrant of the right breast, for which she had undergone a lumpectomy followed by adjuvant radiation therapy to the chest wall. There was no evidence of metastatic disease at the time of her lumpectomy. Following the lumpectomy from the lower inner quadrant of her right breast along with the adjuvant radiation therapy, she had followed up regularly with no new clinical symptoms.However, on her most recent visit to the oncology clinic, she was advised to undergo a routine chest CT scan, which revealed the presence of parenchymal nodules in both her lungs which had features suspicious of a neoplastic process. Based on these radiological findings and given the malignantnature of her phyllodes tumor, it was decided to perform a whole body ^{18}F-FDG PET-CT for her, to look for hypermetabolism in the lung nodules and to also look for evidence of metastasis in the rest of the body. ***Results:*** The ^{18}F-FDG PET-CT revealed the presence of hypermetabolic nodular soft tissue thickening in the post-operative bed of the right breast lower inner quadrant along with few right level I-II axillary lymph nodes. The nodules detected on the chest CT were also showing hypermetabolism and werelocated in the upper lobes of both the lungs. Apart from these, there was no evidence of any metastatic lesions in the rest of her body. A bronchoscopy guided biopsy of the lung nodules revealed the presence of atypical spindled cells arranged in a haphazard pattern within a fibrocollagenous stromawith osseous and chondroid differentiation at places. All these features were indicative of a spindle cell sarcomatoid neoplasm with chondro-osseous differentiation. ***Conclusion:*** This case is meant to highlight the utility of ^{18}F-FDG PET-CT in helping to choose which lung nodules are likely to be neoplastic and also in helping to identify which lesions are the best to biopsy based on the amount of metabolic activity and viable tumor tissue in them.

EP-1085

Case Report of a ^{18}F-FDG PET/CT after Pegfilgrastim Administration

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Aim/Introduction: It is known that pegylated G-CSF (pegfilgrastim) enhances bone marrow and spleen FDG uptake after administration following chemotherapy. ***Materials and Methods:*** In our case, a 48-year-old female was diagnosed with invasive ductal carcinoma of the left breast with cytologically proven metastases in the axillary lymph nodes. She had not received any prior therapy, including surgical resection of the primary tumor. The patient was undergoing preoperative doxorubicin hydrochloride and cyclophosphamide chemotherapy, and because of neutropenia as a side effect, was given pegfilgastrim on day 2 after each cycle of chemotherapy. 18F-FDG PET/CT was performed one week after 4 cycles of chemotherapy to assess early metabolic imaging for predicting tumor response. A weight-based dose of 18F-FDG was injected intravenously in the arm contralateral to the primary breast carcinoma and after a 60-min uptake phase, a combined PET/CT from mid-skull to mid-femur level was obtained. ***Results:*** We observed a rise in bone marrow FDG uptake in all bones after pegfilgrastim administration (SUVmax=6,3). ***Conclusion:*** Pegfilgastrim increased bone marrow uptake of 18F-FDG because of pegfilgrastim-induced stimulation of neutrophil progenitor cells, and therefore a change in 18F-FDG biodistribution must be considered before quantitative assessment of PET scans.

EP-1086

Patterns of [^{68}Ga]Ga-PSMA-11 Uptake in Synchronous Prostate Cancer and Diffuse Large B Cell Lymphoma

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Aim/Introduction: Prostate-specific membrane antigen (PSMA) overexpression in prostate cancer (PCa) correlates with PSMA-targeted radiopharmaceuticals uptake in positron emission tomography/computed tomography (PET/CT) studies. However, PSMA is known to be expressed in several other tissues/conditions, including other malignant processes, potentially leading to false-positive findings. Few reports describe PSMA uptake in lymphomas, with follicular lymphoma being the most commonly described subtype. ***Materials and Methods:*** We report a case of a 79-year-old man diagnosed in 2015 with a PCa (initial PSA level 7,56 ng/mL; Gleason 7 (4+3) and no evidence of metastases), treated solely with hormonal therapy and surveillance, due to the simultaneous diagnosis of a stage IV-B Diffuse Large B Cell Lymphoma (DLBCL) involving cervical, retroperitoneal, iliac and inguinal lymph nodes (LNs) and the bone marrow (BM). The patient underwent chemotherapy in 2015 and in 2018 (due to lymphoma recurrence), with a favourable response according to imaging and clinical criteria. In 2020, a thoraco-abdominopelvic CT performed due to rising PSA values under testosterone castrate levels, showed several abdominopelvic adenopathies and two metastatic bone lesions. A [68Ga]Ga-PSMA-11 PET/CT was requested for restaging (acquisition protocol: dynamic pelvic acquisition for ten minutes; whole-body study from the thighs to the skull base 60 minutes after injection). ***Results:*** The [68Ga]Ga-PSMA-11 PET/CT, performed in July/2020, revealed intense focal uptake in the prostate gland (SUVmax= 24,8) and in two bone

lesions (right ischiopubic ramus, SUVmax= 17,8; and T7 vertebral body, SUVmax= 18,2), attributed to local tumour and bone metastases, respectively. Additionally, the study unveiled findings atypical for PCa: diffuse and homogeneous uptake in the pelvic BM on early dynamic acquisition, not evident in the whole-body study at 60 minutes post-injection; splenomegaly with diffuse uptake moderately higher than liver. Mild PSMA uptake was also observed in abdominopelvic (SUVmax= 3,6) and retrocrural LNs, with no uptake in a supraclavicular adenopathy. The PET/CT report raised the hypothesis of DLBCL recurrence, which was later confirmed by BM biopsy. ***Conclusion:*** This case study presents potential key findings of PSMA uptake in DLBCL, specifically the splenic and BM uptake. Interpretation of PSMA uptake in the lymph nodes was challenging and equivocal, given the initial lymphoma involvement in the abdominopelvic region. The described patterns can be useful in the interpretation of similar findings in patients with no known previous or synchronous haematological disease, suggesting referral for additional studies, namely biopsy.

EP-1087

A case of osteopœcilia detected on bone scintigraphy coupled with SPECT CT

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Aim/Introduction: Osteopœcilia is a rare benign sclerosing bone dysplasia of autosomal dominant inheritance, first described by Alberg-Schönberg on radiographic findings. We report a case of osteopœcilia discovered incidentally on bone scintigraphy coupled with SPECT-CT in a patient undergoing treatment for infiltrating metastatic breast carcinoma to the sternal level ***Materials and Methods:*** A 41-year-old female patient with left breast cancer underwent baseline TAP CT and bone scintigraphy, which were consistent with secondary sternal bone localization. A follow-up bone scan performed three years later showed clear regression of the secondary sternal bone localization. Complementary SPECT-CT revealed a globally symmetrical distribution of multiple nodular osteocondensing lesions without scintigraphic translation opposite the proximal ends of the humeri and femurs, the right clavicle, osteoarticular structures of the pelvis and hands of benign appearance ***Results:*** Osteopcecilia is diagnosed radiographically. The radiological lesions described take the form of numerous rounded, ovoid areas of sclerosis present in the periarticular bone regions. Their distribution is fairly symmetrical, with a predilection for the epiphyses and metaphyses of long bones. Bone scans are generally normal, except when osteopœcilia is associated with other pathologies, notably tumours. SPECT-CT can improve its specificity in order to mask the radiological lesions of osteopecilia. In the case of this patient, the aim was to rule out other secondary bone localizations. The regression of the secondary sternal bone location on bone scintigraphy without the identification of other bone fixation abnormalities, combined with the scannographic discovery of multiple nodular osteocondensing lesions, symmetrically distributed, epiphyseal and metaphyseal location in the humeri and femurs, and in the osteoarticular structures of the pelvis and hands, led to the diagnosis of osteopœcilia. ***Conclusion:*** This observation highlights the diagnostic difficulty of osteopocilia when it is associated with tumour pathology metastatic to the bone, as in our patient's case, and the usual problem-solver role of bone scintigraphy coupled with SPECT-CT, which proved useful in making the diagnosis of osteopœcilia ***References:*** 1-Resnick D, Niwayama G. Énostose, hyperostose et périostite. In : Resnick D, Ed. Diagnostic des troubles osseux et articulaires.3e édition ; 1995, p. 4404-4411.2-Mungovan JA, Tung GA, Lambiase RE, Noto RB, Davis RP.Tc-99m MDP Absorption dans l'ostéopoïkilose. Clin Nuclear Med1994 ; 19 : 6-8.

EP-1088

Neuro-Behçet's disease - a rare disease diagnosed with the help of FDG PET-MRI

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Aim/Introduction: Behçet's syndrome is a rare, chronic, multisystem inflammatory disease that has a heterogeneous spectrum of clinical manifestations including mucocutaneous, joint, ocular, vascular, neurological, and gastrointestinal manifestations. The differential diagnosis is very broad due to the non-specific clinical and paraclinical presentation. The aim of this case report is to demonstrate the role of PET/MRI in patients treated for chronic non-specific inflammatory problems, as a comprehensive modality capable of guiding the referring physician to the correct final diagnosis. ***Materials and Methods:*** A 26-year-old man was referred for FDG PET-MRI with chronic inflammatory findings in the cerebrospinal fluid, the etiology of which was unknown. Clinically, he had six months of cephalea, facial and upper extremity paresthesias, drooping eyelids, and migratory radiculopathy. In the last three months the patient's difficulties have worsened into progressive central left-sided hemiparesis, oropharyngeal dysphagia of mild degree and newly evident oral aphthae. The examination was performed using a standard protocol for the differential diagnosis of inflammation, ranging from the pelvic floor to the vertex. Thus, PET with ^{18}F-Deoxyglucose (^{18}F-FDG), MRI contrast transversal T1 and T2 weighted sequences with water and fat signal separation using the Dixon. ***Results:*** PET/MRI scan showed increased metabolic activity in several spinal nerves, with a variable correlate of signal changes on MRI; in addition, MRI showed an intracranial focus of pathological signal in the basal ganglia and capsula interna on the right side. This finding led to a targeted MRI brain scan, which showed a cascade sign (also known as a waterfall sign) in the mesodiencephalic junction on the right side, that is described in patients with neuro-Behçet disease. In combination with other abnormalities, the patient fulfilled International Criteria for Behçet's Disease - 2014. ***Conclusion:*** This case demonstrates that PET/MRI is a robust imaging modality in the differential diagnosis of inflammation of unclear etiology, even in very rare diseases such as Behcet's disease. ***References:*** Davatchi, F., et al. "International Team for the Revision of the International Criteria for Behçet's Disease (ITR-ICBD). The International Criteria for Behçet's Disease (ICBD): a collaborative study of 27 countries on the sensitivity and specificity of the new criteria." J Eur Acad Dermatol Venereol 28.3 (2014): 338-347 Emmi, Giacomo, et al. "Behçet's syndrome." The Lancet (2024). Siva A, Saip S. The spectrum of nervous system involvement in Behçet's syndrome and its differential diagnosis. J Neurol. 2009 Apr;256(4):513-29.

EP-1089

Tc-99m Labeled Erythrocyte Scintigraphy Reveals Giant Mediastinal Cavernous Hemangioma Mimicking Malignancy on FDG PET/CT

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Aim/Introduction: Hemangiomas are benign tumors that develop from the proliferation of normal or abnormal vascular structures. While these lesions grow slowly and remain asymptomatic, they can lead to symptoms or complications depending on their location and their effects on surrounding structures. When other modalities fail to provide a diagnosis, Tc-99m labeled erythrocyte scintigraphy is a reliable imaging tool for the differential diagnosis. In this case presentation, we aimed to contribute to the literature by highlighting the role of Tc-99m labeled erythrocyte scintigraphy in the diagnosis of a mediastinal hemangioma mimicking low FDG-avid malignancy on FDG PET/CT. ***Materials and Methods:*** A 43-year-old female patient was referred to the surgical clinic after the detection of a malignant nodule in the right lobe of the thyroid gland. Contrast-enhanced CT images revealed an incidentally detected heterogeneous contrast-enhancing mass lesion with microcalcifications, extending to the left supraglottic region and surrounding the vascular structures and the esophagus down to the infracarinal level in the mediastinum. Further evaluation for malignancy investigation with FDG PET/CT revealed mild heterogeneous FDG uptake in the described mass lesion, equivalent to the mediastinal blood pool. Considering the findings, differential diagnosis included both low FDG-avid malignancies and hemangiomas, given the contrast uptake identified on preoperative CT and the equivalence of FDG uptake with the mediastinal blood pool. Due to the risk of bleeding, histopathological confirmation could not be obtained from the mediastinal mass. Therefore, Tc-99m labeled erythrocyte scintigraphy was planned for diagnostic purposes. ***Results:*** In the Tc-99m labeled erythrocyte scintigraphy, increased uptake of labeled erythrocytes was observed, and the described lesion was evaluated in favor of mediastinal cavernous hemangioma. ***Conclusion:*** Mediastinal cavernous hemangioma is a rare, benign tumor originating from vascular endothelial cells. Imaging characteristics manifest as oval-shaped masses with well-defined borders. However, invasion of adjacent organs may lead to their classification as malignant lesions. Morphological findings from CT and MRI may not always definitively rule out malignancy. Tc-99m labeled erythrocyte scintigraphy is a reliable imaging tool for the differential diagnosis. Cases of mediastinal cavernous hemangioma evaluated with Tc-99m labeled erythrocyte scintigraphy are limited in the literature, and thus, this case constitutes an important example in this context. ***References:*** 1) Cohen AJ, Sbaschnig RJ, Hochholzer L, et al. Mediastinal hemangiomas. Ann Thorac Surg 1987;43(6):656-9. 2) Dobritoiu F, Moldovan H, Oncica R, et al. Giant cavernous hemangioma of the right atrium: a rare case and literature review. Chirurgia. 2020;115(2):267-273.

EP-1090

The conundrum of radioactive iodine therapy in malignant struma ovarii: A case of extensive disease managed with radioactive iodine therapy.

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Aim/Introduction: Struma ovarii is a type of monodermal teratoma that consists of thyroid tissue. It usually presents as a vague abdominal mass with non specific complaints. Suspicion or diagnosis of struma ovarii clinically is challenging. Most of the time, it is a histopathological diagnosis, post surgery of a ovarian lesion. Sometimes, it can be presented as a metastatic disease. Total thyroidectomy is performed either to identify the primary or facilitate the management. Radioactive iodine therapy is the standard of care in management of thyroid cancer post surgery. Review of literature shows few case reports and studies related to malignant struma ovarii. And a handful of these cases were treated with radioactive therapy. Due to the paucity of data, no clear guidelines exist regarding the risk stratification and use of radioactive iodine therapy in cases of malignant struma ovarii. ***Materials and Methods:*** Here, we present a case of 37 year old patient who presented with an ovarian mass. She underwent unilateral salpingooophorectomy and based on post operative histopathology, diagnosed as struma ovarii, with follicular variant papillary carcinoma thyroid . The patient also had multiple abdominal deposits at the time of presentation. ***Results:*** The patient has underwent multiple surgeries, including total thyroidectomy, and high dose radioactive iodine therapy (7 times, cumulative dose of 1300mCi) over a period of 20 years, as part of management with good clinical, anatomical and biochemical response. Currently the patient is asymptomatic with decreasing trend of Thyroglobulin levels. ***Conclusion:*** Malignant struma ovarii is a rare tumor and can often be misdaignosed. Because of the disease rarity, the management protocol is a dilemma. Surgery of the lesions is essential of a better outcome, but not always possible in extensive disease. Radioactive iodine therapy in such conditions will help in good disease control. Malignant struma ovarii should be treated and observed in similar lines of a metastatic thyroid carcinoma as our case suggests.

EP-1091

"No More Tears (Enough Is Enough)"- A Case Highlighting the Importance of Dacryoscintigraphy

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Aim/Introduction: Dacryoscintigraphy is a simple, minimally invasive and widely available imaging technique for the assessment of epiphora and the evaluation of nasolacrimal duct patency. Despite its utility, this procedure is not commonly conducted, since its radiological counterpart, dacryocystography, tends to be more frequently requested by clinicians, provided its higher level of anatomical detail. The latter has, however, the disadvantage of being a more invasive procedure and subjecting the patient to higher radiation exposure. ***Materials and Methods:*** We present a case of a 61-year-old woman with a history of sarcoidosis, which was referred to the otolaryngology department due to an episode of exuberant acute dacryocystitis with resolution after medical treatment. Due to persistence of complaints of bilateral epiphora, worse in the left eye, the patient was referred to our department to perform a dacryoscintigraphy.After the direct instillation of a 10µL drop of 3,7 MBq of [99mTc]TcO4- in the lateral cantus of each eye, a dynamic study was acquired for 15 minutes. The dynamic acquisition was repeated after the instillation of 3 drops of saline solution. Finally, the patient was requested to blow her nose, and a final static image was acquired. ***Results:*** The study demonstrated a normal drainage of the radiopharmaceutical to the medial cantus of the left eye and lacrimal sac, with accumulation at this level after the first dynamic study. After instillation of saline solution and blowing the nose, the retention persisted at the same level, supporting the diagnosis of functional impedance at a pre-ductal level. The right eye demonstrated a normal drainage to the nasolacrimal duct and nasal cavity within the first dynamic study.These findings were consistent with the results of a dacryocystography performed shortly after. The patient was then referred for a dacryocystorhinostomy in the left nasolacrimal duct, re-establishing the communication between the lacrimal

ducts and the nasal cavity. ***Conclusion:*** This case highlights the fact that dacryoscintigraphy remains a sensitive and easy exam, studying the lacrimal drainage in a physiological and non-invasive way, and obtaining fast and reliable results, obviating the need of dacryocystography in most cases. While it has the limitation of a lower anatomical resolution, valuable in some circumstances, it has the major advantage of a much lower exposure to radiation. ***References:*** 1 - DOI: 10.1097/MNM.0b013e32834f6cf7; 2 - DOI: 10.4103/ijnm.IJNM_18_18.

EP-1092

[18F]PSMA-1007 PET/CT findings in patient with the third oligometastatic brain recurrence of prostate cancer

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Aim/Introduction: Prostate cancer (PCa) is characterized by certain metastatic patterns, with bones being the predominant localization of distant metastases. The presence of visceral metastases is usually associated with rapid progression, generalization and death. Solitary visceral metastatic lesions, especially in a brain, without further generalization, are extremely rare for PCa [1]. ***Materials and Methods:*** Whole body [18F]PSMA-1007 PET/CT was performed on patient with biochemical recurrence (BCR) of PCa. Further histological examination was conducted on the identified pathological brain lesion. ***Results:*** A 79-year-old man with PCa (T2cN0M0, initial PSA level 5.4 ng/mL, Gleason score 10 (5+5)) underwent radiotherapy combined with hormone therapy in 2009, PSA level decreased to 0.07 ng/ml. In 2011, the patient complained about constant headaches, PSA level increased to 2.8 ng/ml. Brain MRI revealed the pathological signal focus in the right frontal lobe. Microsurgical removal followed by morphological study was performed. Immunohistochemical staining showed negativity for vimentin, CD45, CK7, CK5/14, synaptophysin, chromogranin A, CDx2K, TTF1 and also for GFAP, S-100, CDx2 (excluding glial tumor), positivity for PSA, AMACR, CK18 and AR. No other metastatic foci were identified. Oligometastatic recurrence of PCa as a solitary brain lesion was confirmed. From 2011 to 2017, the patient irregularly received androgen deprivation therapy, maintaining a stable PSA level (0.4 ng/ml). In 2017, patient again noted headaches without PSA level growth. Brain MRI revealed the pathological signal focus in the right frontal lobe similar to the previously removed one. No other metastatic foci were identified. The second oligometastatic recurrence was verified after microsurgical removal followed by histological examination. In 2022, during an annual follow-up, MRI revealed the pathological signal focus in the left hemisphere of the cerebellum, interpreted as metastatic. Whole body [18F]PSMA-1007 PET/CT was performed to assess the extent of the tumor process. Solitary focal pathological uptake with SUVmax 3.3 was identified in the left cerebellar hemisphere, corresponding to the pathological signal focus on MRI. Considering the patient's history and PSMA hyperexpression on PET/CT, the third oligometastatic recurrence was confirmed. Follow up brain MRI in 2023 after stereotactic radiosurgery of metastatic cerebellum lesion showed decrease of its size. The patient remains under follow up with no signs of relapse to date. ***Conclusion:*** The presented clinical case illustrates an exceptionally rare course of prostate cancer, characterized by a series of oligometastatic brain recurrences without progression and generalization. ***References:*** 1.Barakat T., et al. Solitary brain metastasis from prostate cancer: a case report. AnnPalliatMed2016;5(3):227-232. DOI:10.21037/apm.2016.04.02.

EP-1093

Unilateral Graves' Disease

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Aim/Introduction: Graves' disease is the most frequent and expressive cause of hyperthyroidism, and is more common in women. Found at all ages, peak incidence is between 40 and 60. Unilateral involvement is rare. In this paper, we report on a case of unilateral Graves' disease and highlight the contribution of thyroid scintigraphy. ***Materials and Methods:*** Patient 52 years old, Caucasian, multiple comorbidities, body mass index of 56.8 kg/m2, with subclinical hyperthyroidism and normal thyroid gland size, elastic palpation and regular surface without cervical adenopathy. Biological tests revealed a Thyroid Stimulating Hormon (TSH) suppressed to 0.001 IU/mL, Free-thyroxine (FT4) and Free triiodothyronine (FT3) levels 1.3 and 1.5 times normal respectively, and antibodies to TSH-receptor positive at 12.94 U/L (>1.5). The patient was started on Carbimazole 5 mg per day.Cervical ultrasound revealed a diffuse anodular hypervascular thyroid in favor of thyroiditis. T99m thyroid scintigraphy revealed a thyroid with regular contours and intense, inhomogeneous fixation in the left lobe, contrasting with normal fixation in the right lobe. ***Results:*** Graves' disease is an autoimmune hyperthyroidism characterized by T and B lymphocytic infiltration [1]. Unilateral involvement not due to hemiagenesis is very rare. Few cases have been reported with preferential right lobar involvement [2]. In our case, the involvement concerned the left lobe.Clinical features resemble classic Graves' disease, but can mimic a toxic adenoma in cases of selective lobe hypertrophy. Antibody positivity, anodular heterogeneous ultrasonography and unilateral diffuse thyroid hyperfixation make the positive and differential diagnosis with other pathologies presenting unilateral involvement on thyroid scintigraphy (thyroid hemiagenesis, Hashimoto's thyroiditis, toxic adenoma, toxic multinodular goiter, subacute thyroiditis) [2].Treatment strategies are those of classic Graves' disease [2]. ***Conclusion:*** Knowing the pathophysiology of unilateral involvement would offer personalized therapies. Clinical, biological, morphological and functional imaging results must be collected to confirm the diagnosis and make a differential diagnosis. Practitioners need to be aware of this entity in order to improve management. ***References:*** [1] Y. Tomer, "Mechanisms of autoimmune thyroid diseases: From genetics to epigenetics," Annu. Rev. Pathol. Mech. Dis., vol. 9, pp. 147-156, 2014, doi: 10.1146/annurev-pathol-012513-104713. [2]S. Elamari, F. Z. Rhmari Tlemcani, I. Motaib, S. Laidi, and A. Chadli, "Grave's disease affecting one thyroid lobe: About 2 cases," Med. Nucl., vol. 46, no. 3, pp. 164-167, 2022, doi: 10.1016/j.mednuc.2022.03.001.

EP-1094

In-transit Sentinel Lymph Nodes in Melanoma - Hybrid Specifics and Clinical Significance: case reports

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Aim/Introduction: Although the incidence of in-transit sentinel lymph nodes (intSLN) in malignant melanoma (MM) is reported to be relatively low, the presence of metastatic cells in them reaches a significant percentage, with corresponding upstaging and adjuvant treatment initiation for stages IIB/C-III. Harvesting intSLNs could be a challenge for the surgeon due to "unconventional" location and small size. Hybrid SPECT/CT-detection during routine lymphoscintigraphy is of significant help, providing exact anatomy and morphology. PET/CT in the follow-up of intSLN-histologically positive patients undergoing adjuvant therapy could be of further value for early relapse detection. Our aim is to present the role of SPECT/CT for intSLN-detection in MM patients with consequent PET/CT follow-up for micrometastasis-positive (+) SLN cases. ***Materials and Methods:*** We present 4 cases of superficial-spreading MM patients with primaries on the skin of the trunk (3 - back, 1 - abdominal wall) with SPECT/CT-mapped intSLN, successful surgical gamma-probe removal and consequent PET/CT-follow-up where applicable. ***Results:*** One patient had a 4mm, pigmented, (+) intSLN in subcutaneous lumbar region and a second, negative axillary (-) SLN. Target-therapy was initiated with 3 consequtive PET/CT-studies, showing stable disease. The second patient had a 3mm, (+) intSLN in scapular region along with a (-) axillary SLN - tailored to adjuvant immune therapy with 1 follow-up PET/CT so far with no evidence of disease. Patient 3 had a (-) intSLN in dorso-lumbar region with no other „expected" drainage and was appointed for clinical observation. Patient 4 had a 4mm (-) intSLN on the front abdominal wall, FDG-non-avid on preoperative PET/CT, also for further clinical follow-up. ***Conclusion:*** The detection of in-transit SLN in MM is crucial for accurate staging, since "expected" SLN-basins could give false-negative staging. SPECT/CT is of great importance for surgical harvesting of in-transit SLN and PET/CT follow-up should be integrated in histologically positive patients for further adjuvant-treatment effect stratification.

EP-1095

Comparison of PET/CT images with ^{18}F-FDG and ^{18}F-PSMA-1007 in musculoskeletal tumors to evaluate the potential of theranostics approach

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Aim/Introduction: Diagnosis and management of metastatic musculoskeletal tumors are challenging. MRI and FDG PET/CT play a crucial role in assessing the extent of these tumors. PSMA-1007 PET/CT may be an interesting diagnostic marker due to the potential Theranostics implications. This study aimed to compare the performance of FDG and PSMA PET/CT images in patients with advanced-stage unresectable recurrent and metastatic musculoskeletal tumors. ***Materials and Methods:*** Eight patients underwent FDG PET/CT and PSMA PET/CT imaging with a 24-hour interval between studies. ***Results:*** In 5/8 patients, PSMA uptake was higher than FDG uptake. A giant cell recurrent sacral tumor in a 27-year-old male exhibited the highest PSMA uptake (PSMA SUV=100; FDG SUV=16). PSMA uptake was also higher than FDG in the following tumors: osteolytic renal cell carcinoma metastasis in the scapula of a 58-year-old male (PSMA SUV=40; FDG SUV=11); a recurrent spindle-cell neural tumor in the upper limb of a 69-year-old male (PSMA SUV=27; FDG SUV=8); myxofibrosarcoma mass in the distal leg of a 61-year-old female (PSMA SUV=18; FDG SUV=10). Interestingly, chordomas had heterogeneous PSMA and FDG uptake. The PSMA PET/CT of A 65-year-old male with multiple chordoma metastases with soft tissue invasion showed PSMA uptake higher than FDG in all lesions (PSMA SUV=32; FDG SUV=19). PSMA-avid additional sites of metastases were noted in mediastinal lymph nodes and the right hepatic lobe; FDG uptake was minimal in these metastases. In contrast, FDG uptake was higher than PSMA in a 54-year-old male with a large recurrent chordoma (30x24 cm mass) extending from L4 to the proximal left thigh (PSMA SUV=9; FDG SUV=31). FDG uptake of two males with desmoid tumors in the upper limb was higher than PSMA (PSMA SUV=4; FDG SUV=7). ***Conclusion:*** The study results show the potential advantage of using PSMA PET/CT with FDG PET/CT to provide additional information for monitoring patients and combining therapies. PSMA PET/CT demonstrated more extensive disease and has the advantage of the possibility of a Theranostic approach. ***References:*** Kleiburg F et al. PSMA as potential target for molecular imaging and treatment in bone and soft tissue sarcomas. Br J Radiol. 2023;96:20220886. This study was supported by the Fundação de Amparo à Pesquisa do Estado de São Paulo (CEPID FAPESP #2021/10265-8) and by the International Atomic Energy Agency (IAEA) technical cooperation projects for the development of Latin American Countries (IAEA/TCLAC:BRA6033-2401375).

EP-1096

Comparison of PET/CT images with ^{18}F-FDG and ^{18}F-PSMA-1007 in metastatic acral melanoma: a case report.

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Aim/Introduction: Acral melanoma (AM) is a rare form of cutaneous melanoma and affects acral areas such as the palms, soles, and nails. AM is associated with a worse prognosis compared to other subtypes of cutaneous melanoma. Despite advances in surgery, radiotherapy, and molecular targeted/immunotherapy, new treatment modalities for AM is highly desirable to improve survival. Staging and restaging AM with FDG PET/CT is essential to detect nodal and distant metastasis. However, FDG cannot be used as a Theranostic radiopharmaceutical. The possibility of investing in a Theranostic approach to these patients is desirable and radiolabeled PSMA may be a potential Theranostic tool. Here, we present a patient with AM, which progressed with brain and lung metastases, and highlight the importance of PET/CT images with FDG and PSMA-1007 for the identification of metastases and potential Theranostic approach for this challenging disease. ***Materials and Methods:*** D.R.M., a 50-year-old male, rural worker, developed AM in the 3rd left toe in January 2023. In September 2023, the patient underwent amputation of the 3rd and 4th toes and left ilioinguinal lymphadenectomy. Histopathology confirmed melanoma with vertical growth and deep invasion into the dermis as well as lymph node metastases. In January 2024, he presented a reduction in the level of consciousness and intense headaches. Cranial MRI revealed multiple brain metastases with sizes ranging from 0.6 to 4.6 cm, significant swelling, edema, and midline shift. The patient underwent restaging FDG PET/CT and PSMA PET/CT, with a 24-hour interval between studies. ***Results:*** FDG PET/CT identified mild metabolism in the brain metastases and no extracranial metastases. PSMA PET/CT impressively identified all brain metastases detected by MRI (SUVs ranging from 8 to 11) with uptake higher and more extensive than FDG uptake and no extracranial metastases. Neurological symptom control was initiated with dexamethasone, and significant improvement was observed. The patient will initiate antineoplastic therapy. ***Conclusion:*** This case highlights the importance of comparing

FDG and PSMA PET/CT in assessing patients with AM. PSMA PET/CT emerges as a promising diagnostic imaging modality for detecting distant metastasis in AM, especially brain metastases since PSMA is not normally taken up by the central nervous system and is extremely avid for AM metastases. PSMA may be a potential Theranostic tool in specific cases. ***References:*** The study was supported by Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES) and Fundação de Apoio ao Ensino e à Pesquisa do Estado de São Paulo (CEPID FAPESP #2021/10265-8).

EP-1097

Comparison of PET/CT images with ^{18}F-FDG and ^{18}F-PSMA-1007 in relapsed adenoid cystic carcinoma

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Aim/Introduction: Adenoid cystic carcinoma (ACC) is a tumor of the salivary glands, characterized by insidious growth, recurrences, and distant metastases.This study aimed to describe the findings of PET/CT images performed with ^{18}F-FDG (FDG PET/CT) and ^{18}F-PSMA-1007 (PSMA PET/CT) in patients with relapsed ACC to verify whether any of these studies are more suitable for identifying local recurrence and distant metastases. ***Materials and Methods:*** Patients were submitted to restaging PET/CT studies with FDG and PSMA-1007 with a 24-hour interval between exams before treatment. ***Results:*** Patient 1: A 29-year-old female was diagnosed with ACC of the parotid in 2016. She underwent total parotidectomy and radiotherapy. In 2021, a chest CT identified lung nodules, and the patient underwent resection of the largest lesions. In 2024, a restaging FDG PET/CT was negative for metastases while PSMA PET/CT identified mild PSMA uptake in two pulmonary nodules (0.8 cm, SUV=2.2; 0.9 cm, SUV=3.4) suspicious for ACC metastases. The patient remains asymptomatic. Patient 2: A 49-year-old male with newly diagnosed ACC in the salivary gland, underwent tumor resection and radiotherapy in 2010. In 2022 the patient recurred in the lungs, skull, and L5 and was submitted to lung nodule resections and radiotherapy to skull and L5. In 2023, FDG PET/CT revealed hypermetabolic metastases in multiple lung nodules (highest SUV=13.4) and L5 vertebrae (SUV=8.5). PSMA PET/CT showed only mild uptake in the pulmonary nodules (highest SUV=4.7) and similar uptake in L5 vertebrae (SUV=8.7). The patient is currently asymptomatic. Patient 3: A 46-year-old male with ACC in the parapharyngeal space underwent surgical resection and radiotherapy in 2008. In 2022, chest CT identified lung nodule metastases (>3.8 cm). In 2023 FDG PET/CT demonstrated hypermetabolic lung nodule metastases (>SUV=12.3) and multiple liver nodules (>2.7 cm) without FDG uptake. A PSMA PET/CT showed uptake in the same lung nodules although with lower uptake (SUV=8.8). The patient currently reports dyspnea. ***Conclusion:*** There is heterogeneity in FDG PET/CT and PSMA PET/CT uptake in relapsed ACC. Combining both PET/CT radiotracers can provide additional information for monitoring patients. PSMA PET/CT has the advantage of the possibility of a theranostic approach. ***References:*** Tan BF et al. PSMA PET Imaging and Therapy in Adenoid Cystic Carcinoma and Other Salivary Gland Cancers: A Systematic Review. Cancers 2022:14;3585. The study was supported by Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES) and Fundação de Apoio ao Ensino e à Pesquisa do Estado de São Paulo (CEPID FAPESP #2021/10265-8).

EP-1098

[^{68}Ga]FAPI Cardiac Uptake in Takotsubo Cardiomyopathy - Occasional Findings in PET/CT Imaging

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Aim/Introduction: Takotsubo cardiomyopathy (TC) is expressed as acute left ventricular (LV) systolic dysfunction as response to emotional or physical stress and is associated with high mortality. Its diagnosis requires exclusion of concurrent underlying conditions and is facilitated by multimodality cardiac imaging. Due to a limited understanding of its pathogenesis, dedicated diagnostic methods are absent. ***Materials and Methods:*** We report a case of occasional findings of LV apical and periapical [68Ga]FAPI-overexpression on PET/CT imaging in a patient with hypokinetic and ballooning LV apex and higher T1-times in CMR, as suggestive pattern of TC. ***Results:*** Static whole-body [68Ga] FAPI PET/CT was performed 60 min. post tracer injection (p.i.). Further static cardiac PET/CT images were acquired 70 min. and 120 min. p.i.. On PET/CT imaging, a dilated, balloon-shaped, hypertrophic LV apex with a diffuse [68Ga]FAPI-overexpression in the apical and periapical segments (SUVmax:13,9;SUVmean:11) was observed. Elevated [68Ga]FAPI-uptake was observed also at basal LV (SUVmax:11,8;SUVmean:7,5). Also 70 and 120 minutes p.i., a elevated [68Ga]FAPI-overexpression was recorded in the apical, periapical and in the basal LV, only slightly reduced compared to the initial scan. The patient underwent also native, late gadolinium enhancement (LGE) (0.15 mmol/kg Gadovist®), and advanced tissue characterization CMR images (1.5 Tesla) revealed a viable LV myocardium with no LGE. The CMR images depicted a ballooning LV apex with reduced apex contractility and longitudinal strain. Volumetric measurements generated a LV end-diastolic dimension of 41mm, end-diastolic volume of 99ml and ejection fraction of 59%. Furthermore, extracellular volumes (ECV) of 28% and high native T1-times of 1031ms, with an apical peak of 1200-1400ms were suggestive of a TC. ***Conclusion:*** Our incidental findings of LV apical and periapical [68Ga]FAPI-overexpression might suggest a potential diagnostic role of this emerging tracer as well as might provide insights that enhance the ability to assess myocardial functional alterations, disease progression and clinical outcomes in patients with TC.

EP-1099

^{18}F-FDG PET/CT in ulcerative colitis

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Aim/Introduction: Ulcerative colitis (UC) and Crohn's disease (CD) are chronic inflammatory bowel diseases affecting the gastrointestinal tract. Accurate assessment of disease activity is crucial for treatment selection. Endoscopy is the preferred method, but CT and MRI are also used. Nowadays, ^{18}F-FDG PET/CT has emerged as a valuable non-invasive molecular imaging tool for evaluating inflammatory bowel disease. ***Materials and Methods:*** A 34-year-old man with a history of UC underwent ^{18}F-FDG PET/CT prior to colectomy, as colonoscopy was not feasible due to high mucosal vulnerability and increased perforation risk. The CT revealed inflammatory wall thickening of the rectum, sigmoid colon, and descending colon without abscesses or perforations. The PET/CT showed a mural increased tracer uptake in these bowel segments, indicating active inflammation. UC and CD

are chronic inflammatory bowel diseases, with UC limited to the colon's mucosa and submucosa. Disease extent varies, classified as proctitis, left-sided colitis, or pancolitis. ***Results:*** Our patient presented with proctitis and left-sided colitis sparing the transverse colon, a discontinuous inflammatory pattern atypical for UC, as UC typically spreads continuously from the rectum to the rest of the colon. Diagnosis is based on a medical history, physical examination, laboratory tests, imaging, endoscopy and histology. ^{18}F-FDG PET/CT offers high sensitivity and specificity in detecting inflammation, especially in patients at increased risk of perforation, strictures or inadequate bowel cleansing. ***Conclusion:*** This case highlights the utility of ^{18}F-FDG PET/CT in UC, providing important molecular insights into the extent and activity of the disease. ^{18}F-FDG PET/CT is a promising non-invasive imaging technique in the evaluation of chronic inflammatory bowel disease in treatment selection and response assessment, especially when endoscopy is challenging or not feasible.

EP-1100

Breast lymphoma as Richter Syndrome in an elderly man 12 years after diagnosis of chronic lymphocytic leukemia.

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Aim/Introduction: Chronic lymphoblastic leukemia (CLL), the most common leukemia in elderly patients, is generally an indolent and low-grade disease, however in about 2-9% of patients may develop another more aggressive lymphoid malignancy (most commonly diffuse large B-cell lymphoma (DLBCL)), what is known as Richter's Syndrome (RS). Positron emission tomography with 18-fluorodeoxyglucose (^{18}F-FDG PET/CT) has been widely used as a noninvasive molecular imaging technique in managmento of hematologic malignancies and can be extremely beneficial in CLL patients when RS is suspected. Primary breast lymphoma (PBL) is a rare presentation of non-Hodgkin's lymphoma (NHL) (less than 1-2% of all NHL and less than 0.5% of all malignant breast neoplasms) that almost occurs in females among 60-65 years. ***Materials and Methods:*** We present the case of an 89-year-old asymptomatic man diagnosed in 2012 with CLL, clinical stage A of Binet RAI 0, with no data on tumor activity until August 2023, at which time he presented with a poorly delimited, stony, ulcerated right breast tumor adhered to the costal wall. Clinically in good general condition, afebrile, asymptomatic. An initial study was performed with breast ultrasound, computed tomography (CT) and biopsy. ***Results:*** Biopsy of the lesion showed a pathological result of DLBCL, CD10, Bcl-6 and MUM1 positive phenotype (activated phenotype). Proliferative index measured with Ki67: 90% cells. A baseline study with CT was performed, which only showed the known breast tumor. He began first-line treatment with the R-miniCHOP regimen on November 14, 2023 (punctual hypotensive reaction to rituximab that recovered with the administration of serum). The interim FDG PET-CT study after 3 treatment cycles showed a hypermetabolic mass in the right breast (3.5x9x8cm, with SUVmax 30.03) and residual lymphadenopathy in the right axilla and right retropectoral region. ***Conclusion:*** We are faced with a doubly rare case; a PBL in a man that also presents as a late-onset RS. In the literature, cases of breast involvement due to lymphoma are rare, so this patient is interesting as an illustrative case of its presentation and the usefulness of ^{18}F-FDG PET/CT in its management.

EP-1101

Exploring the diagnostic utility of Octreoscan scintigraphy in neuroendocrine tumors : a case study

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Aim/Introduction: Neuroendocrine tumors (NETs) pose a diagnostic challenge due to their diverse clinical presentations and potential for metastasis. This study aims to illustrate the diagnostic significance of Octreoscan scintigraphy in localizing primary lesions and assessing metastatic disease in NETs. ***Materials and Methods:*** Patient Selection: A 31-year-old male with a history of epigastric pain underwent a thorough diagnostic workup. Imaging Protocol: Octreoscan scintigraphy, in conjunction with CT, was performed post-administration of Tc99m Tektrotyd. Imaging scans were conducted at 1 hour and 4 hours post-injection, followed by SPECT-CT imaging. Data Analysis: Scintigraphic findings were assessed based on intensity of tracer uptake and anatomical localization. ***Results:*** Initial Presentation: The patient's chief complaint was epigastric pain persisting over two months, without apparent jaundice or other associated symptoms. Imaging Findings: Octreoscan revealed intense tracer uptake in the liver, supraclavicular region, and epigastric area, indicative of possible primary and metastatic lesions. SPECT-CT Imaging: Detailed imaging demonstrated multifocal hepatic uptake, lymph node involvement, and focal uptake in the gastric region, further characterizing the extent of disease involvement. ***Conclusion:*** Octreoscan scintigraphy emerges as a valuable adjunct in the diagnostic algorithm for NETs, offering insights into both primary tumor localization and metastatic spread. While Octreoscan provides valuable information, its limitations in identifying small primary lesions underscore the importance of complementary imaging modalities. Integrating Octreoscan with advanced techniques like PET may enhance diagnostic accuracy and facilitate optimal management strategies for patients with NETs. ***References:*** [Tenenbaum F. Scintigraphie des récepteurs de la somatostatine (Octréoscan) : exploration des tumeurs neuro-endocrines (TNE) d'origine digestive. Médecine thérapeutique / Endocrinol. 2000;2(5):423-429.[4] K. Mima, T. Bepppu, A. Murata, et al., Primary neuroendocrine tumor in the liver treated by hepatectomy: report of a case, Surg. Today 41 (2011) 165 5-1660.[5] L. M Fenoglio, S. Severini, D. Ferrigno, et al., Primary hepatic carcinoid: a case report and literature review, World J. Gastroenterol. 15 (19) (May 21, 2009) 2418-2422.Kapoor M, Kasi A. Octreotide Scan. StatPearls. Published online July 31, 2023. Accessed November 2, 2023. https://www.ncbi.nlm.nih.gov/books/NBK559330/ Kulkarni HR, Prasad V, Schuchardt C, et al. 68Ga-DOTATOC-Positron Emission Tomography/Computed Tomography in the Evaluation of Pulmonary Neuroendocrine Tumors: Diagnostic and Prognostic Implications.** World J Nucl Med. 2017;16(3):186-192. doi:10.4103/1450-1147.207276.Bouzayan L, Madani A, Malki S, et al. Primary hepatic origin of a neuroendocrine tumor: A rare case report. Ann Med Surg. 2022;84(September):104937. doi:10.1016/j.amsu.2022.104937Callans LS, Vaughn DJ, Alex Hsi R, Glatstein E, Haynes BE. Carcinoid tumors. Integr Cancer Manag Surgery, Med Oncol Radiat Oncol. 1999;13(12):345-359. doi:10.1634/theoncologist.2008-0207.

EP-1102

New-onset pancreatic involvement on a follow-up ^{18}FDG PET-CT in a patient with non-Hodgkin's lymphoma.

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Aim/Introduction: 18F-fluorodeoxyglucose-positron emission tomography/ computed tomography (18F-FDG-PET/CT) is powerful for cancer staging and detection, but this leads to a significant number of foci of doubtful interpretation; Studies have examined incidental FDG uptake in the thyroid, the breasts, the colon, and the prostate with different rates of detection (0.82-3.8% of FDG uptake, of which about 12.7-63.6% resulted in malignancy). However, almost no study has examined the frequency of new pancreatic FDG uptake and its proportion of malignance. Non-hodgkin's lymphoma (NHL) is often determined with enlarged lymph nodes and may commonly affect extranodal organs, but the involvement of pancreas is rare (approximately 5% of all pancreatic masses and 1% of all extranodal lymphomas). ***Materials and Methods:*** We present the case of an 83-year-old male patient diagnosed in April 2023 with large cell follicular B NHL with MYC and BCL2 rearrangements, proliferative index of 70%, constitutional syndrome (anorexia and loss of more than 20 kg) and lesions at the dorsal and lumbar with spinal cord involvement in cervical injuries. The initial study showed supra- and infradiaphragmatic lymph nodes, heterogeneous splenomegaly, and an intraperitoneal tumor in the right upper quadrant (probable adenopathic conglomerate); IVSB stage. Receives 1st line treatment according to the R-miniCHOP scheme for 6 cycles between April and July 2023. In 18FDG PET-CT at the end of treatment in September 2023, no significant hypermetabolic lesions were observed. We take as reference the study by Iwasa et all from February 2021, in which they analyzed the appearance of FDG uptake in the pancreatic area in patients under follow-up for cancer other than pancreatic, finding 0.3% of pancreatic foci, of which 85% were malignant. ***Results:*** In control 18FDG PET-CT in December 2023, a newly appearing hypermetabolic nodule was detected that seems to depend on the tail of the pancreas (size 2.1x2.4cm and SUVmax 22.35), highly suggestive of malignancy. An ultrasound endoscopy was performed that identified homogeneous hypoechogenic lesions with well-defined edges in the tail of the pancreas-splenic hilum; The biopsy of the lesion confirmed relapse of diffuse large B cell lymphoma, deciding treatment with Polatuzumab-R-Benda with good tolerance to date. ***Conclusion:*** The pancreatic hypermetabolic focis found in control 18FDG PET-CT in cancer patients, although rare, seem to have a high rate of malignancy, so their directed study is essential to characterize them, although the research carried out for this purpose until the date is scarce.

EP-1103

Isolated Tonsillar Kaposi Sarcoma: A Rare Case

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Aim/Introduction: Kaposi sarcoma is an angioproliferative neoplasm generally seen in immunosuppressed patients caused by kaposi sarcoma-associated herpes virus (HHV-8). There are four types of Kaposi sarcoma: classic, endemic, epidemic (HIV-related), and iatrogenic (corticosteroid-related). It typically manifests as multiple, pigmented, non-blanching lesions on the skin or at the same level, often painless but may also involve bone and organ infiltration. ***Materials and Methods:*** Here, we present a rare case diagnosed with tonsillar Kaposi's sarcoma using F^{18} FDG PET/CT imaging. ***Results:*** A 69-year-old female with a history of smoking presented to the ENT department with throat pain. She did not have B symptoms such as fever, weight loss, or night sweats. Examination revealed an ulcerovegetative mass starting from the right tonsil and extending to the base of the tongue, measuring approximately 30x20 mm. Other ENT examination findings were normal. Laboratory tests showed CRP: 13.61 (N: 0-5) and WBC: 13.14 (N: 4.5-10), with other values within normal ranges. MRI revealed a mass lesion measuring approximately 26x30 mm in the lingual tonsil on the right side, with hypertrophy of the right palatine tonsil compared to the left. F^{18} FDG PET/CT imaging showed increased metabolic activity in the soft tissue density extending from the anterior wall of the right nasopharynx to the base of the tongue, narrowing the air passage (SUVmax: 8.94). Additionally, asymmetric hypertrophy and increased metabolic activity were observed in the right tonsil (SUVmax: 7.18). Low-level metabolic activity increase was observed in multiple cervical lymph nodes bilaterally. Biopsy from the right tonsillar fossa revealed clusters of spindle cells with nuclear atypia, diffusely positive for CD34 and showing HHV-8 nuclear expression, confirming the diagnosis of Kaposi sarcoma. The patient was referred to the Radiation Oncology Clinic for radiotherapy planning. ***Conclusion:*** The treatment of Kaposi sarcoma varies depending on the type, severity, extent, and organ involvement of the disease. Currently, staging is done using CT, MRI, endoscopy, or bronchoscopy. However, the invasiveness and time-consuming nature of some of these procedures highlight the importance of PET/CT, which allows whole-body scanning. F^{18} FDG PET/CT imaging can detect increased metabolic activity due to inflammatory changes in the bilateral tonsillar region. In cases where intense metabolic activity accompanies asymmetric tonsillar hypertrophy and soft tissue thickening, Kaposi's sarcoma should be considered in the differential diagnosis, especially when investigating for primary malignancies.

EP-1104

Unexpected discovery : ectopic thyroid focus in a patient with painless subcutaneous nodular formation prior thyroidectomy

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Aim/Introduction: This case presents the unexpected detection of an ectopic thyroid focus in a 57-year-old female with metastatic invasive ductal carcinoma of the right breast. Despite a prior thyroidectomy in 2015, imaging revealed an ectopic thyroid, emphasizing scintigraphy's role. ***Materials and Methods:*** A 57-year-old Caucasian female with metastatic invasive ductal carcinoma of the right breast, undergoing post-Patey procedure chemotherapy and hormone therapy, and receiving levothyroxine following a 2015 thyroidectomy, was enrolled. Evaluation followed the discovery of a painless subcutaneous nodular formation near the thyroid cartilage. Tc-99m scintigraphy, known for distinguishing ectopic thyroid from other neck masses, was employed.Imaging Protocol:The protocol included a thyroid scan using 3mCi of Tc-99m pertechnetate, followed by low-dose SPECT-CT to characterize abnormal radiotracer uptake. ***Results:*** The thyroid gland was absent due to the previous thyroidectomy. An ectopic thyroid focus measuring 4.4 x 5.1 mm was identified anterior to the thyroid cartilage. Significant hyperfixation adjacent to the thyroidectomy site, corresponding to residual thyroid residue, was noted. ***Conclusion:*** This case emphasizes scintigraphy's significance in identifying ectopic thyroid tissue. Regular monitoring is advised for asymptomatic cases,

while levothyroxine therapy may mitigate mass enlargement. Scintigraphy's sensitivity and specificity underscore its importance in tailored patient management. A multidisciplinary approach is crucial for accurate diagnosis and personalized care in ectopic thyroid nodules. ***References:*** ersaneti, J. A., Silva, R. D. P., Ramos, R. R. N., de Matsushita, M. M., & Souto, L. R. M. (2011). Ectopic Thyroid Presenting as a Submandibular Mass. Head and Neck Pathology, 5(1), 63-66. https://doi.org/10.1007/S12105-010-0209-Z/METRICSChawla, M., Kumar, R., & Malhotra, A. (2007). Dual ectopic thyroid: Case series and review of the literature. Clinical Nuclear Medicine, 32(1), 1-5. https://doi.org/10.1097/01.RLU.0000249590.70176.58Di Benedetto, V. (1997). Ectopic thyroid gland in the submandibular region simulating a thyroglossal duct cyst: a case report. Journal of Pediatric Surgery, 32(12), 1745-1746. https://doi.org/10.1016/S0022-3468(97)90522-4Douglas, P. S., & Baker, A. W. (1994). Lingual thyroid. British Journal of Oral and Maxillofacial Surgery, 32(2), 123-124. https://doi.org/10.1016/0266-4356(94)90144-9Huang, T. S., & Chen, H. Y. (2007). Dual thyroid ectopia with a normally located pretracheal thyroid gland: case report and literature review. Head Neck, 29(9), 885-888. https://doi.org/10.1002/hed.20604Noussios, G., Anagnostis, P., Goulis, D. G., Lappas, D., & Natsis, K. (2011). Ectopic thyroid tissue: anatomical, clinical, and surgical implications of a rare entity. European Journal of Endocrinology, 165(3), 375-382. https://doi.org/10.1530/EJE-11-0461Siddique, M., & Bashir, H. (2018). 99mTc Sodium Pertechnetate Uptake in Ectopic Mediastinal Thyroid Tissue on Hybrid Thyroid Scintigraphy. Clinical Nuclear Medicine, 43(11), 820-822. https://doi.org/10.1097/RLU.0000000000002201.

EP-1105

A pitfall finding showing FDG accumulation in postoperative mass formation: Pseudomeningocele

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Aim/Introduction: Pseudomeningocele commonly occurs as a result of the accumulation of cerebrospinal fluid (CSF) outside the dura mater due to a defect formed after surgery or trauma. Despite the lack of a clear theory explaining its pathophysiology, it is thought to occur due to incomplete closure of the dura and protrusion of the arachnoid membrane through the defect. The diagnosis is made using CT or MRI imaging. In this case presentation, since there is no literature information on imaging pseudomeningocele with FDG PET/CT, we aim to share our experience incidentally detecting this significant clinical entity. it is emphasized that in cases with a history of craniotomy, pseudomeningocele should be considered in the differential diagnosis of mass-like lesions showing FDG uptake in the operative site. ***Materials and Methods:*** A 60-year-old male patient, diagnosed with lung cancer and operated on for brain metastasis, presented to the emergency department on the 10th day post-metastasectomy with complaints of headache, dizziness, nausea, and vomiting. A non-contrast brain CT scan revealed a lesion in the left occipital region consistent with pseudomeningocele. In the FDG PET/CT imaging performed to evaluate possible new systemic involvement foci after symptomatic medical treatment, a primary lesion located in the posterior segment of the right upper lobe of the lung and a mass lesion with hypermetabolic periphery and hypometabolic central area, presenting a cystic appearance, were observed in the left occipital region. The patient received cranial radiotherapy, and on the FDG PET/CT imaging performed 4 months after radiotherapy, it was observed that the hypermetabolic lesion identified in the left occipital region had regressed significantly. ***Results:*** Pseudomeningocele develops as a complication after craniotomy in approximately 4-23% of cases. In most instances, pseudomeningocele appears within days or weeks after surgery and rapidly resolves spontaneously within 1-2 days. However, in some cases, it can lead to life-threatening clinical outcomes such as rupture of the sac. While there is no standardized guideline for the treatment of pseudomeningocele, the optimal management strategy varies from conservative approaches to surgical intervention. Diagnosis typically involves the use of CT and MRI imaging, and to our knowledge, no cases demonstrating FDG uptake on PET/CT imaging have been reported in the literature. Awareness of this rare clinical entity in the interpretation of FDG PET/CT imaging, especially in individuals with a history of cerebral and medullary spinal interventions or trauma, would be beneficial and should be considered in reporting.

EP-1106

Role of HIDA scan in follow up of patients post APOLT procedure

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Aim/Introduction: Acute liver failure in children is a fatal disorder characterized by multiorgan involvement and is associated with high mortality. Liver transplant is the accepted form of treatment that has led to these patients survival. APOLT is a technique of liver transplant where a partial liver graft is implanted in an orthotropic position after leaving behind a part of the native liver for the potential advantage of immunosuppression withdrawal. Here we describe a case of partial orthotopic liver transplant in a 2-year-old child who presented to us with acute liver failure and encephalopathy. Surgery was performed where the native left liver lobe was resected and replaced with left lateral segment of the donor, and the patient was then started on immunosuppression. ***Materials and Methods:*** A 2-year-old female child presented with history of vomiting and lethargy. Labs showed a significant derangement in liver functions and coagulation. Initial ultrasound showed hepatomegaly, with reduced parenchymal echogenicity, along with moderate ascites, that supports the diagnosis of acute liver failure. After meeting the criteria for liver transplant, the patient underwent "living donor APOLT with Roux EN Y procedure and was started on immunosuppression treatment. Follow-up imaging and biopsies were performed to assess for regeneration. HIDA scan was performed to evaluate the extent of regeneration and assess the relative function of the two hemi livers. ***Results:*** The intial HIDA scan showed relatively good function of both native and grafted liver (Native: 48% Transplanted: 52%). The following scan showed slightly less uptake in the transplanted liver in comparison to the previous scan (Native: 54% Transplanted:46%). The last scan showed an interval increase in the relative uptake of the native liver. Follow-up biopsy results showed normal morphology of the native kidney and mild T-cell mediated rejection of the liver allograft. The child was gradually weaned off immunosuppression (tacrolimus). The final laboratory results after stopping immunosuppression were within normal. The patient remained well, asymptomatic and with no concerns. ***Conclusion:*** The role of HIDA scan in patients who underwent APOLT, has shown to be of notable utility in the assessment of regeneration of native liver and has helped guide pediatricians to wean the patients of immunosuppressants. ***References:*** Shrivastav M, Rammohan A, Reddy MS, Rela M. Auxiliary partial orthotopic liver transplantation for acute liver failure. Ann R Coll Surg Engl. 2019

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EP-1107

A Case of Extensive Systemic Sarcoidosis on ^{18}F-FDG PET/CT Study

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Aim/Introduction: Sarcoidosis is a multi-systemic non-caseating granulomatous disease. Intrathoracic involvement is most common and occurs in 90% of patients. Extrapulmonary manifestations include cutaneous involvement, uveitis, liver or splenic lesions, peripheral and abdominal lymphadenopathy, and peripheral arthritis.1 This case report explores a rare presentation of extensive systemic sarcoidosis on ^{18}F-FDG PET/CT study. ***Materials and Methods:*** Information for the case report was gathered from the electronic patient record and Radiology Information System. ***Results:*** The case involved a 62 year old man, who first presented with erythema nodosum and was diagnosed with sarcoidosis via cutaneous biopsy in 2013. The patient also subsequently developed bilateral anterior uveitis, intrathoracic involvement (lymphadenopathy and pulmonary nodules), and basal cerebral artery low-grade vasculitis with associated previous old infarcts. Most recently in 2022 and 2023, the patient suffered from bilateral, sequential phrenic nerve palsies requiring intensive care admission, though the cause of this has not been confirmed. An FDG PET/CT study performed in February 2024 demonstrated widespread FDG avid disease on both sides of the diaphragm, involving lymph nodes (cervical, thoracic, abdominopelvic and inguinal), liver, spleen and multiple bones. Multiple pulmonary parenchymal lesions showed variable intensities with some of these considered significant, however it is challenging to differentiate between sarcoidosis and inflammatory/infective aetiology on the study. Given the pattern of involvement on the PET/CT study and background of systemic sarcoidosis, these findings are suspicious of malignancy. In particular, lymphoma should be considered due to known sarcoidosis-lymphoma syndrome and the similarity in presentation. Histological confirmation was advised and the right inguinal nodes were deemed most accessible. The histology confirmed granulomatous inflammation suggestive of sarcoidosis. Culture results did not show any organism growth, and stains for acid-fast bacilli and fungi were negative. ***Conclusion:*** Sarcoidosis patients are at increased risk of malignancy, particularly lymphoma (known as sarcoidosis-lymphoma syndrome). Sarcoidosis and lymphoma can have similar presentations. In addition, sarcoidosis can obscure the presence of other malignancies.2 There needs to be increased suspicion for malignancy in patients with sarcoidosis, particularly those with atypical/extensive presentations or treatment resistant disease. ***References:*** 1. Sève P et al. Sarcoidosis: A Clinical Overview from Symptoms to Diagnosis. Cells. 2021 Mar 31;10(4):766. doi: 10.3390/cells10040766. PMID: 33807303; PMCID: PMC8066110. 2. El Jammal T et al. Sarcoidosis and Cancer: A Complex Relationship. Front Med (Lausanne). 2020 Nov 24;7:594118. doi: 10.3389/fmed.2020.594118. PMID: 33330555; PMCID: PMC7732692.

EP-1108

[^{99m}Tc]Tc-MIBI SPECT/CT and [^{11}C]Choline PET/CT in the perioperative parathyromatosis study - a case report

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Aim/Introduction: Recurrence of disease after parathyroidectomy and following normalization of calcium and parathyroid hormone (PTH) serum levels, could be observed in a minority of patients with primary sporadic hyperparathyroidism (pHPT). Parathyromatosis is a rare cause of recurrence of pHPT, being often described as incidental seeding of parathyroid tissue, in the neck soft tissue, after surgical procedures. It is difficult to diagnose and the adequate treatment is a challenging task, once several surgeries may be required to achieve complete remission. We present a case of recurrent pHPT in which preoperative [99mTc]Tc-MIBI SPECT/CT helped to localize parathyromatosis foci and the postoperative [^{11}C]Choline PET/CT highlighted the persistence of hyperfunctioning parathyroid tissue. ***Materials and Methods:*** Six years ago, a 26-year-old woman underwent right inferior parathyroid adenomectomy (histologically confirmed). After the apparently successful surgery, the patient remains under clinical active surveillance. Three years later, the blood test showed increased calcium (11mg/dL; normal range: 8.8-10.6) and PTH (187pg/mL; normal range: 9-72) serum levels. Ultrasound revealed the presence of multiple solid hypoechoic pericentimetric nodules, below the thyroid gland. Those nodules presented increased uptake of [99mTc]Tc-MIBI on early phase of the parathyroid scintigraphy, with slower washout on delayed phase and without uptake of [99mTc]NaTcO4. These findings were consistent with ectopic hyperfunctioning parathyroid tissue, located anterior to the trachea and below the thyroid isthmus, evaluated by cross section images of early phase SPECT/CT. In October 2023, the patient was submitted to a second surgery, guided by these findings. ***Results:*** Intraoperative PTH level decreased from 1636 pg/ml to 948 pg/mL and all removed nodules were reported on the histological study as hyperplastic parathyroid tissue, suggestive of parathyromatosis. Even though the patient has presented important reduction of post-surgery PTH levels, serum calcium and PTH were still elevated (373pg/mL and 11.2mg/dL, respectively) at time of discharge, justifying complementary investigation. Two months later, a [^{11}C]Choline PET/CT showed intense focal uptake of the tracer, located below the right lobe of the thyroid close to suture material, as well as several foci with less intense uptake than the thyroid parenchyma. At the moment, our patient hasn't been submitted to a third surgery yet, guided by the late findings of [^{11}C]Choline PET/CT that might justify the persistence of hypercalcemic hyperparathyroidism. ***Conclusion:*** Our case illustrates the well-known challenging therapeutic task of parathyromatosis and highlight the importance of hybrid functional imaging in the anatomical localization of the hyperfunctioning parathyroid tissue, helping surgery to be more effective.

EP-1109

Technitium-99m MDP Uptake in Adult-Type Granulosa cell Tumor of the Ovary: A Case Report

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Aim/Introduction: A 47-year-old perimenopausal female presented with a right breast mass diagnosed as invasive carcinoma of no special type in core needle biopsy. Post neo-adjuvant chemotherapy, metastasis workup with technetium-99m MDP Scintigraphy revealed focal uptakes in the lower ribs

and pelvis. ***Materials and Methods:*** The patient underwent SPECT/CT for further evaluation of pelvic uptakes which one of them subsequently localized to right ovary. Review of literature suggested potential tumoral etiology for MDP uptake in ovary. Consequently, excision of the right ovary was recommended concurrent with partial mastectomy ***Results:*** Pathological examination of the right ovary revealed an adult-type granulosa cell tumor. Subsequent completion surgery, including left salpingo-oophorectomy, omentectomy, and peritoneal resection, showed no evidence of tumor. ***Conclusion:*** Adult-type granulosa cell tumors of the ovary may manifest Technetium-99m MDP uptake and should be included in the differential diagnosis when encountering ovarian MDP uptake.

EP-1110

Unveiling Pitfalls: Axillary Siliconomas Mimicking Malignancy in Breast Cancer Evaluation Using ^{18}F-FDG PET

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Aim/Introduction: In recent decades, ^{18}F-fluorodeoxyglucose (FDG) positron emission tomography (PET) has been established as a powerful and useful tool in the management of breast cancer, especially during staging, detection of recurrence and evaluation of treatment response. In this case review, we aim to address one of the pitfalls of this technique. ***Materials and Methods:*** A 51-year-old woman with a personal history of bilateral breast prostheses replaced 9 years ago, who has currently been diagnosed with infiltrating ductal carcinoma in the left breast T4bN2M0 G3, estrogen receptors <5%, negative progesterone receptors and negative Her2 Ki67 40-50% whom underwent neoadjuvant treatment. ***Results:*** In the initial staging PET performed after the start of neoadjuvant therapy, high uptake was identified in left axillary and retropectoral lymphadenopathy (SUVmax 15.2) (Figure 1 red arrow) and high uptake lesion in the left breast adjacent to the breast implant (Figure 1 green arrow). The follow-up PET scan identified a decrease in the size and metabolism of the left axillary and retropectoral lymphnodes (figure 2 red arrow) and a residual lesion without significant metabolism in likelihood to a complete metabolic response; However, growth of right axillary and retroperitoneal lymph nodes of up to 2 cm with high uptake (SUVmax 19.4) was identified, from a metabolic point of view, they do not rule out malignancy (Figure 2 blue arrow). Given that the patient's initial lesions presented a good response, the possibility arises that the right lymphadenopathy has a different etiology than the tumour. Subsequently, complementary evaluation was performed using ultrasound, which confirmed that they were axillary siliconomas (figure 3 white arrows), and although the evaluation of the breast prostheses did not show rupture of the capsule, there are mechanisms where due to an increase in permeability of the capsule (called gel bleeding) thar leads to the presence of silicone in the armpit or outside the prosthesis associated with inflammatory changes. ***Conclusion:*** While ^{18}F-FDG PET is invaluable in distinguishing malignant from benign lesions in augmented breasts, our case underscores the potential for false positives. Inflammation due to silicone deposition in axillary lymph nodes can lead to high FDG uptake, mimicking malignancy. Thus, comprehensive evaluation within the clinical context and judicious use of complementary tests are essential.

EP-1111

Incidental Cold Thyroid Nodule with a False Positive Semi-Quantitative Study on Dual-Tracer Sestamibi Scan

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Aim/Introduction: 99mTc-sestamibi scan is a well-established imaging technique for hyperparathyroidism. Additionally, many studies have demonstrated its usefulness in predicting malignancy of hypofunctioning thyroid nodules. Cancer cells are characterized by a higher electrical gradient of the mitochondrial membrane, leading to increased accumulation of sestamibi compared to normal cells. We report the case of an incidental cold thyroid nodule exhibiting isointense sestamibi uptake and a positive Washout index, which was confirmed to be a follicular adenoma. ***Materials and Methods:*** The patient was a 59-year-old female with a history of chronic kidney failure requiring hemodialysis, presenting with polyarthralgia. Corrected plasma calcium was 11,1 mg/dL, phosphorus level was 5.0 mg/dL, TSH level was 0.7 µIU/mL, and PTH level was 3172 pg/ml, suggesting a tertiary hyperparathyroidism. Dual tracer 99mTc pertechnetate / 99mTc-sestamibi planar scintigraphy was conducted for a pre-surgical assessment. ***Results:*** Pertechnetate scintigraphy demonstrated a cold nodule in the right thyroid lobe. Sestamibi scan showed increased uptake with foci of tracer retention in the upper and lower poles of the left lobe and isointense uptake in the right thyroid nodule with an elevated Washout index of 61%, which corresponded to an Eu-TIRADS 4 right thyroid nodule on US. Fine-needle aspiration was non-diagnostic. Given the high suspicion of malignancy, the patient underwent total thyroidectomy and 7/8 parathyroidectomy. Subsequent pathological examination concluded to a follicular adenoma and a parathyroid hyperplasia, ruling out malignancy. ***Conclusion:*** Semi-quantitative sestamibi study is known to be superior over both visual assessment and molecular testing for pre-surgically characterizing thyroid nodules. However, some follicular adenomas may present a high cellular activity and exhibit increased sestamibi uptake, and thus inducing false-positive results and potentially triggering unnecessary surgical procedures. ***References:*** [1] Giovanella L, Campenni A, Treglia G et al. Molecular imaging with (99m)Tc-MIBI and molecular testing for mutations in differentiating benign from malignant follicular neoplasm: a prospective comparison. Eur J Nucl Med Mol Imaging. 2016 Jun;43(6):1018-26. doi: 10.1007/s00259-015-3285-1.[2] Leboulleux S, Lamartina L, Lecornet Sokol E et al. SFE-AFCE-SFMN 2022 Consensus on the management of thyroid nodules: Follow-up: How and how long? Ann Endocrinol (Paris). 2022 Dec; 83(6):407-414. doi: 10.1016/j.ando.2022.10.010.[3] Erdil TY, Turoğlu HT. Discordant uptake of Tl-201 and Tc-99m MIBI in a patient with follicular adenoma. Ann Nucl Med. 2000 Apr;14(2):135-8. doi: 10.1007/BF02988594.[4] Greilsamer T, Blanchard C, Christou N et al. Management of thyroid nodules incidentally discovered on MIBI scanning for primary hyperparathyroidism. Langenbecks Arch Surg. 2015 Apr;400(3):313-8. doi: 10.1007/s00423-015-1286-y.

EP-1112

Duodenal Diverticulum Mimicking Hepato-Biliary Malignancy on ^{18}F-FDG PET/CT

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Aim/Introduction: Duodenal diverticula are protrusions that form in the wall of the duodenum. They are common and typically asymptomatic. When discovered by different imaging modalities, they may mimic malignancy in the retroperitoneum or in the pancreas, therefore potentially prompting unnecessary medical procedures. Here, we present a case where a duodenal diverticulum, trapped between the gallbladder and the liver, displayed notably heightened 18F-FDG activity in a PET/CT scan. ***Materials and Methods:*** The patient was a 78-year-old male with a history of type 2 diabetes and a prior surgically-treated anal fistula, who presented to the internal medicine department due to recurrent thigh abscesses and polyarthralgia. Laboratory tests revealed elevated CRP(C-reactive protein) levels at 130 mg/l. Additionally, serum protein electrophoresis (SPE) revealed increased alpha 1 and alpha 2 levels along with hypergammaglobulinemia. Infectious investigations as well as immunological markers were negative. Given the unexplained inflammatory syndrome, a PET/CT scan was conducted following the injection of 205 MBq of 18F-FDG. ***Results:*** The PET/CT scan showed focal uptake in a hypodense structure located between the gallbladder and the liver, with a high SUVMAX of 8.1, initially raising suspicion of a hepato-biliary neoplasm, with no other pathological uptake of interest found elsewhere. An abdominal contrast-enhanced HRCT later revealed a duodenal diverticulum forming in the D2 portion of the duodenum, containing digestive material, interposed between the hepatic segment 4b and the gallbladder, linked to the duodenum with a fine pedicle. A consensus among radiologists and nuclear medicine physicians confirmed that the anomality observed in PET/CT was correlated to the uncomplicated duodenal diverticulum described in the abdominal HRCT. No further investigation was required. ***Conclusion:*** As observed in this case, 18F-FDG PET/CT can yield false-positive results in the presence of a duodenal diverticulum. This abnormal finding can be accounted by the elevated rate of glucose utilization by inflammatory cells within the diverticulum. To date, there have been very few reports of 18F-FDG uptake within a duodenal diverticulum. However, considering their potential risk of inducing false positive results, physicians should be aware of their presence and careful analysis of morphological slices and comparison to other imaging modalities, if necessary, can help rule out malignancy.

EP-1113

Tuberculosis Mimicking Lung Cancer on ^{18}F-FDG PET/CT in a Patient with Suspected Paraneoplastic Dermatomyositis

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Aim/Introduction: ^{18}F-FDG PET/CT is an established procedure for the evaluation of malignancy. However, FDG is not specific to cancer. Some benign conditions, such as infection or inflammation, have been reported to cause FDG uptake. Differentiating between benign and malignant lesions is challenging. Therefore, it is important to acknowledge the conditions that may mimic malignancy to reduce misinterpretation. Here we present a patient with dermatomyositis who underwent an FDG-PET scan because of suspected paraneoplastic syndrome. The FDG-avid lesion in the lung was later proved by tissue biopsy to be secondary to tuberculosis infection. ***Materials and Methods:*** A 44-year-old woman with no significant medical history, discovered painless purplish subcutaneous nodules which worsened over time. The nodules became painful, deep, and pruriginous, with erythema on the face along with muscle pain in the scapular and pelvic regions, fatigue, dysphagia, and dyspnea, prompting hospitalization. Her Creatine Kinase level was elevated at 244 UI/L (normal range: 29-168). Anti-nuclear matrix protein 2 antibodies (anti-NXP 2) were positive, while anti-transcription intermediary factor 1 gamma antibodies (anti-TIF-1 gamma) were negative. Skin biopsy confirmed the diagnosis of dermatomyositis and the patient was started on steroids and methotrexate therapy. Investigations for a paraneoplastic origin were systematically conducted, including FDG PET/CT. ***Results:*** ^{18}F-FDG PET/CT showed a lung nodule with increased FDG uptake in the superior right lobe, with no other suspected focal metabolic uptake. Bronchoscopy and analysis of the bronchoalveolar lavage with Genexpert were negative. CT-guided biopsy ruled out malignancy and revealed tuberculosis. ***Conclusion:*** While FDG-PET/CT is a valuable tool in oncologic evaluation, it is not specific for cancer, and benign conditions such as infection or inflammation can lead to false-positive results. For clinicians, it is crucial to consider alternative diagnoses, especially in patients with systemic inflammatory conditions like dermatomyositis, where paraneoplastic syndromes are a concern.

EP-1114

A Case of Incidental Brain Metastasis of Papillary Thyroid Carcinoma Showing I-131 Uptake

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Aim/Introduction: Papillary thyroid carcinoma (PTC) makes up about 80% of all thyroid cancer cases. The most common site of thyroid cancer metastasis is the lymph nodes of the neck, followed by the lung and the bones, while brain metastasis (BM) is much less common. Although PTC is generally a cancer with a good prognosis, once BM is developed, the mortality rate significantly increases up to 74%. BM is usually treated by surgical resection or external radiotherapy, whereas radioactive iodine therapy (RAIT) using I-131 is not recommended because BM often shows poor uptake of I-131. In addition, even in case I-131 accumulates in the BM, RAIT could cause adverse effects such as brain hemorrhage and cerebral edema. We present a case of BM of PTC that was detected with I-131 scintigraphy following I-131 therapy. ***Materials and Methods:*** A 43-year-old woman presenting with multiple incidental lung nodules was diagnosed with PTC after undergoing right lung middle lobectomy. She reported no significant neurological symptoms. She received total thyroidectomy to be referred to our department for RAIT against remaining lung metastases. Pre-treatment FDG PET/CT showed multiple lung metastases, but no abnormal increase or decrease of FDG accumulation in the brain. As a first course of treatment, 5.5GBq of I-131 was administered and I-131 scintigraphy was performed three days later. ***Results:*** I-131 uptakes were observed not only in the thyroid bed and lung metastases, but also in her left cranial area on planar image. This uptake was localized to her left frontal lobe on SPECT/CT, rather than the skull, indicating BM. Brain MRI with gadolinium showed enhancement in the same site identified by I-131 scintigraphy. She underwent

external radiotherapy for BM two months after her first I-131 administration, and then she took a second course of RAIT six months after the first course to treat the residual metastases. FDG PET/CT before the 2nd RAIT showed marked shrinkage and reduced uptake of lung metastases with no significant finding in the left frontal lobe. I-131 scintigraphy after the 2nd RAIT not only showed decreased uptake in the lung lesions, but also confirmed the extinction of the uptake in the brain. Blood thyroglobulin level also decreased from 249.00ng/mL to 0.42ng/mL, indicating successful treatment. ***Conclusion:*** BM of thyroid cancer itself is quite rare, and furthermore infrequently exhibits I-131 uptake. We unexpectedly observed BM on I-131 scintigraphy after RAIT. SPECT/CT was useful to distinguish BM from bone metastasis.

EP-1115

Atypical Vertebral Haemangiomas: A Diagnostic Nuclear Medicine Challenge

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Aim/Introduction: Vertebral haemangiomas are the most common benign tumors of the spine, typically found incidentally on imaging studies. Although generally asymptomatic, they can occasionally present with neurological deficits or back pain due to compression fractures or aggressive features. The majority of vertebral haemangiomas exhibit typical characteristic imaging features on computed tomography (CT) and magnetic resonance imaging (MRI), aiding in their diagnosis and differentiation from other spinal lesions. However, a subset of vertebral haemangiomas manifests atypical imaging characteristics, posing a diagnostic dilemma and potentially leading to misinterpretation or delayed diagnosis. We hereby report the pathology, etiology and imaging characteristics of atypical vertebral haemangiomas. ***Materials and Methods:*** A previously healthy young adult who presented with lower back pain, bilateral lower limb radiculopathy, claudication on the right side and spinal extension underwent a complete radiological assessment, lumbar spine MRI followed by a CT-guided biopsy and a bone scan. The patient then underwent a 99m-Tc-RBC labelled liver scintigraphy to further characterize the lesion. ***Results:*** In his initial workup, Lumbar spine MRI was done which revealed an L3 vertebral body lesion with diffuse bone marrow edema, destruction of the superior endplate and an underlying cystic focus. The patient underwent a CT-guided biopsy due to the aggressive appearance of the lesion, and although the results were inconclusive, the CT and MRI findings were still in favor of an aggressive haemangioma.To further characterize the lesion and rule out the possibility of metastasis, the patient also underwent a bone scan. The study revealed moderate to severe focal uptake in the underlying L3 vertebral body lesion. These findings were not typical for benign vertebral haemangiomas, however aggressive haemangiomas and other aggressive bone tumors can show a similar uptake pattern. RBC labelled liver scintigraphy showed abnormal prompt focal increased blood flow and soft tissue hyperemia in the L3 vertebral lesion, and mild uptake on the delayed images. ***Conclusion:*** Atypical presentations of vertebral haemagiomas may mimic malignant lesions such as metastases or primary bone tumors, necessitating a thorough understanding of their varied imaging appearances and clinical manifestations. Nuclear medicine plays a limited but potentially valuable role in the diagnosis of atypical vertebral haemangiomas. While conventional imaging modalities such as CT and MRI remain the mainstay for evaluating vertebral lesions, nuclear medicine techniques can provide complementary information, particularly in cases where the diagnosis is uncertain or when there is a need for functional characterization of the lesion.

EP-1116

Significant Improvement of Quality of Life after first dose of Peptide Receptor Radionuclide Therapy (PRRT) in a Malignant Refractory Insulinoma: a Case Report Study.

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Aim/Introduction: Malignant insulinomas are rare functional neuroendocrine tumors of the pancreas. Glycemic and tumor volume control are the two therapeutic objectives. The control of the hypoglycemic syndrome is difficult and often refractory to symptomatic treatment. Peptide receptor radionuclide therapy (PRRT) appears to be a very promising treatment for progressive metastatic insulinomas. Self-reported health-related quality of life (HRQoL) is an important outcome for the effect of a therapy in patients with neuroendocrine tumors. We present the case of a patient with malignant insulinoma and refractory hypoglycemia treated with PRRT considering the change in level of HRQoL. ***Materials and Methods:*** A 62-year-old with diagnosis of metastatic malignant mixed insulinoma-gastrinoma (Ki-67 25%) and refractory hypoglycemia despite having received several lines of treatment (somatostatin analogues, everolimus, chemotherapy, liver metastasectomy and radioembolization, as well as, cyber knife for a brain metastasis). He has been hospitalized several times with hypoglycemic coma. A 68Ga-DOTA-Somatostatin Analog Positron Emission Tomography/Computed Tomography was performed which revealed liver, nodal and bone metastases, as also, a brain metastasis with high somatostatin receptors (SSTRs) expression. He was proposed for PRRT with 177Lu-DOTATATE and he received the first cycle in December 2023. Before receiving the first and second dose of therapy he completed the quality of life questionnaire (QLQ) core module (C30) and the disease-specific QLQ-GINET21 which include QoL issues important to patients with NETs. ***Results:*** Within three days following the first cycle of PRRT, the patient experienced significant clinical improvement without any episode of hypoglycemia. Blood glucose levels were normalized. A more than 30% improvement was observed in the global health status (GHS) /QoL and physical functioning (PF) scale score between the two cycles. Also, clinically significant changes (25%-90%) were observed in the symptom scales (fatigue, diarrhea and dyspnea). Moreover, in the disease-specific QLQ-GINET21 improvement was noted in disease related worries (33%), social function scale (33%) and sexual function (25%). ***Conclusion:*** This case supports the rapid and significant improvement of PRRT in the control of hypoglycemia and quality of life in patients with malignant refractory insulinoma. ***References:*** 1. Magalhães D, Sampaio IL, Ferreira G, et al.Peptide receptor radionuclide therapy with (177)Lu-DOTA-TATE as a promising treatment of malignant insulinoma: a series of case reports and literature review. J Endocrinol Invest. 2019;42(3):249-260. 2. Edfeldt K, Hellman P, Granberg D, et al. Improved health-related quality of life during peptide receptor radionuclide therapy in patients with neuroendocrine tumours. J Neuroendocrinol. 2023;35(10):e13342.

EP-1117

Case report: Secondary syphilis multiorgan involvement in ^{18}F-FDG PET/CT mimicking lymphoproliferative syndome

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Aim/Introduction: Syphilis is a sexually transmitted infection caused by the bacteria Treponema pallidum. Over the last years there has been an increase of the incidence of this disease due to the growing infection by the human immunodeficiency virus (HIV) and the immunosuppression. It is a chronic systemic infection that has a wide variety of manifestations with a very disparate clinical course, known as "the great imitator". In this case, we expose the findings visualized in a ^{18}F-FDG PET/CT performed on a patient in the context of a secondary syphilis. ***Materials and Methods:*** An ^{18}F-FDG PET/CT study was performed due to suspicion of lymphoproliferative syndrome in a 37-year-old patient who presented skin lesions, polyarthritis, night sweats and polyadenopathy. The protocol is carried out from the skull to the proximal third of the thighs, 60 minutes after the intravenous administration of 293 MBq of ^{18}F-FDG. PET, CT and fusion images are analyzed in the axial, sagittal and coronal axis. The findings are correlated with the patient's clinical and analytical findings. ***Results:*** The PET/CT revealed increased metabolism in the lymphoid tissue of Waldeyer's ring, numerous but small bilateral laterocervical, mediastinal, axillary, retroperitoneal, iliac and inguinal lymphadenopathy, reactive metabolism in the spleen, pleural thickening, as well as lytic lesions in the right scapula and 10th left posterior costal arch. Findings of an indeterminate nature but that require confirmation through complementary study. A complete analytical study was performed, obtaining syphilis IgG+IgM antibodies: positive and Treponema pallidum particle agglutination (TP-PA): positive 1/32, so the patient began treatment with Doxycycline 100 mg every 12 hours for 2 weeks and noticed a significant improvement in symptoms and a reduction in lymphadenopathy. ***Conclusion:*** Diagnosing syphilis can be very difficult due to the wide variety of manifestations that the disease can mimic. The treatment is simple and very effective, especially when it is performed early, determining the patients' prognosis. The importance of the case lies in the fact that in a patient with indeterminate symptoms, especially in patients without clear risk factors for malignant tumor pathology, the finding of reactivity in lymphoid tissue (spleen, lymph nodes, Waldeyer's ring, etc.), as well as areas of osteitis, should make us consider syphilis in our differential diagnosis.

EP-1118

^{18}F-FAPI PET/CT imaging for Cranium Fibrous Dysplasia

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Aim/Introduction: 18F-labeled fibroblast activation protein inhibitor (18F-FAPI) is a prospective malignant tumor imaging agent, however it also shows positive results in some benign lesions. ***Materials and Methods:*** We reported a case of cranium fibrous dysplasia (FD) about a 65-year-old female patient, who undertook 18F-FDG PET/CT, 18F-FAPI PET/CT and whole-body bone image. ***Results:*** We found 18F-FAPI PET/CT can diagnose more cranial FD lesions than 18F-FDG PET/CT. This was due to the less FAPI uptake of brain, which resulted in a higher tumor-to-background ratio, thus improving diagnostic accuracy. ***Conclusion:*** This case indicates that 18F-FAPI PET/CT may be an alternative method of evaluating cranium fibrous dysplasia. ***References:*** 1. Song Y, Qin C, Liu F, et al. Fibrous Dysplasia Mimicking Skeletal Metastasis on 68Ga-FAPI PET Imaging. Clin Nucl Med. 2021;46(9):774-775. 2. Su MG, Tian R, Fan QP, et al. Recognition of fibrous dysplasia of bone mimicking skeletal metastasis on 18F-FDG PET/CT imaging. Skeletal Radiol. 2011; 40:295-302. 3. G. Jundt, "Fibrous dysplasia," in WHO Classification of Tumours, Pathology and Genetics of Tumours of the Head and Neck, L. Barnes, J. Eveson, P. Reichart et al., Eds., pp. 321-322, International Agency for Research on Cancer (IARC), Lyon, France, 2005. 4. Ainuz BY, Rizvi I, Kane AA. Craniofacial Fibrous Dysplasia of the Skull Assisted by Virtual Surgical Planning. J Craniofac Surg. 2022;33(6): e628-e632. 5. Costelloe CM, Chuang HH, Madewell JE. FDG PET/CT of primary bone tumors. AJR Am J Roentgenol. 2014;202(6): W521-31. 6. Kim M, Kim HS, Kim JH, et al. F^{18} FDG PET-positive fibrous dysplasia in a patient with intestinal non-Hodgkin's lymphoma. Cancer Res Treat. 2009;41(3):171-4.

EP-1119

Limitation of [^{67}Ga]Gallium citrate scintigraphy in the evaluation of Pott's Disease: a case report

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Aim/Introduction: Pott's disease is an uncommon extrapulmonary form of tuberculosis, involving one or more components of the spine. [67Ga]Gallium citrate scintigraphy has been used to detect active inflammatory lesion and tumours, although its clinical use is now restricted to centres without PET equipment. When the diagnosis of tuberculosis is known, it can be useful in defining the degree of disease activity, monitoring treatment response and evaluating the extent of the disease by detecting the presence of other foci of infection. ***Materials and Methods:*** We report a case of a 29-year-old man with suspected multisegmental spondylodiscitis in the context of extrapulmonary tuberculosis after radiological findings of destructive lytic lesions involving the spine (C4-D1 and D11-L1), as well as liquid paravertebral collections suspected of being abscesses in the cervical region. The patient underwent [67Ga]Gallium citrate scintigraphy in order to assess the presence of another foci of infection. Planar and SPECT/CT images were acquired 24 and 48 hours after radiopharmaceutical administration. ***Results:*** [67Ga] Gallium citrate scintigraphy demonstrated markedly increased tracer uptake in the cervical-dorsal spine (C4-D1), suggesting the presence of active infection in this region. There were no other abnormal foci of significantly increased tracer uptake at other locations, namely in the lumbar spine, where a lytic destructive lesion involving the vertebrae between D11-L1 was seen on the additional low-dose CT scan. Transpedicular percutaneous biopsies of D11 and L1 were performed, with a RT-PCR test positive for Mycobacterium tuberculosis complex, confirming lumbar involvement. ***Conclusion:*** Although commonly described as being a useful tool in the evaluation of extrapulmonary tuberculosis, [67Ga]Gallium citrate scintigraphy has the potential of missing active foci of infection, namely when involving the spine. This pitfall, in addition to its unfavourable physical characteristics, demonstrates [67Ga]Gallium citrate's limitations and further confirms the preferred usage of other tracers for tuberculosis evaluation, such as 2-$^{[18F]}$FDG.

EP-1120

[18F]PSMA-1007 PET/CT:Does the "P" stands for Paget? A case report of newly diagnosed Prostate Cancer with concurrent Paget's disease of bone.

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Aim/Introduction: Positron emission tomography/computed tomography (PET/CT) with [18F]-labeled prostate-specific membrane antigen (PSMA) ligands is emerging as a promising tool in the staging of high-grade prostate cancer (PC). In spite of its high sensitivity and specificity for detecting metastatic bone involvement, false-positive results in benign conditions such as Paget disease of the bone (PD) may occur. PD is the second most common bone disorder, and it is characterized by an increase of osteoclast cell activity, causing an excessive bone remodeling. The well-known up-regulation of PSMA on endothelial cells observed in various solid tumors suggests that the radioligand bone uptake in PD may happen during the hyperperfusion phase (osteolytic) of PD. ***Materials and Methods:*** We report a case of an 86-year-old man medically treated with abiraterone acetate after recent diagnosis of prostate cancer. In spite of normal CT scan images of the neck, chest, and abdomen-pelvis, abnormal [99mTc] HDP accumulation in the right knee, distal femur, and proximal tibia was observed at staging bone scintigraphy. The uncertain metastatic scenario led to perform [18F]PSMA PET/CT. ***Results:*** [18F] PSMA PET/CT exhibited a focal radiopharmaceutical uptake in the prostate gland (Primary Score 3). A diffuse and intense radiotracer uptake was observed on the right knee, distal femur and proximal tibia, sites of osteotropic tracer uptake. In the mid-tract of the right femur and in the distal tibia, PSMA ligand uptake mainly occurred in the bone cortex. Areas of focal uptake were also observed in the proximal right femur, in the heel and in the third right toe, resembling the typical "mosaic" pattern seen in early osteolytic-stage of PD. Correlation with co-registrated CT images showed diffuse sclerosis, coarsened trabeculae, thickened cortex, and initial bone expansion. The alkaline phosphatase and bone-specific alkaline phosphatase values were 204 U/L (46-116 U/L) and 57.8 ug/L (5.5-22.9 ug/L), respectively. ***Conclusion:*** Despite its high accuracy, rare instances of false-negative and false-positive findings have been reported in [18F]PSMA PET/CT. PSMA expression in neo-vasculature, shared in cases of metastasis as in PD, emphasizes the need for cautious PET images interpretation. This case highlights the importance of recognizing PD as a potential mimic of bone metastases of PC on PSMA PET/CT, also suggesting the need for a multimodalities diagnostic approach to ensure comprehensive clinical evaluation and targeted treatment. The observed "mosaic" uptake pattern appears to reflect the distribution of neovascularization in PD across its various stages, contributing to a more in-depth understanding of the pathology.

EP-1121

Unveiling a Rarity: Primary Pulmonary Plasmacytoma Presenting as Multiple Lung Nodules

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Aim/Introduction: Extramedullary plasmacytoma (EMP) represents a rare form of plasma cell neoplasm, characterised by localised proliferation within soft tissues, devoid of bone marrow involvement or the systemic features typical of multiple myeloma. While EMP predominantly occurs in the head and neck region, particularly in the upper aerodigestive tract, primary pulmonary plasmacytoma (PPP) constitutes an exceptionally rare subset of extramedullary plasmacytomas. In this abstract, we present a rare case of PPP presenting as multiple lung nodules, emphasizing the diagnostic intricacies and therapeutic considerations associated with this atypical manifestation. ***Materials and Methods:*** An 88-year-old woman, who has been experiencing mild asthenia and persistent dry cough for the past few months, without any other associated symptoms, was referred by her primary care physician for a chest CT scan. The scan revealed multiple bilateral lung consolidations, which persisted after antibiotic treatment. Consequently, she was referred to pulmonology, where bronchoscopy with biopsy of the lesions was performed, a 18F-fluorodeoxyglucose (18F-FDG) PET-CT along with blood tests showing normocytic iron-deficiency anaemia, hypergammaglobulinaemia, hypoalbuminaemia, elevated B2 microglobulin, and Bence-Jones proteinuria. ***Results:*** The initial diagnostic suspicion was primary lung neoplasia. To complete the staging a ^{18}F-FDG PET-CT scan was performed, revealing multiple bilateral masses and consolidations in the lungs, with heterogeneous metabolic uptake reaching a SUVmax of 6.1, suggesting a malignant origin. No hypermetabolic bone lesions or nodal disease were identified. Pathological examination revealed a plasma cell neoplasm, with positive immunohistochemical staining for CD138, CD38, and CD45, and heterogeneous positivity for Kappa and Lambda. These findings were consistent with primary pulmonary plasmacytomas. Although surgical treatment followed by radiotherapy is the mainstay for this condition, the number and extent of plasmacytomas, along with the patient's comorbidities, rendered surgery unfeasible, hence, chemotherapy was recommended. ***Conclusion:*** our case highlights the diagnostic challenges and therapeutic complexities associated with primary pulmonary plasmacytoma (PPP) presenting as multiple lung nodules. Despite its rarity, PPP should be considered in the differential diagnosis of pulmonary masses, especially in elderly patients. Comprehensive imaging studies, including PET-CT, coupled with histopathological examination, play a pivotal role in establishing an accurate diagnosis. While surgical excision followed by radiotherapy remains the cornerstone of treatment, individualized management strategies, considering the extent of disease and patient's overall health status, are imperative. In our case, chemotherapy emerged as a viable therapeutic option, underscoring the importance of a multidisciplinary approach in managing this atypical manifestation of plasma cell neoplasms.

EP-1122

Autosomal dominant polycystic kidney disease: how to locate the source of infection?

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Aim/Introduction: The infection of cysts is a common complication in polycystic kidney disease. For the diagnosis

and localization of the infection in vitro labeled leukocyte scintigraphy (LLS) with Technetium-99m can be used. ***Materials and Methods:*** A 78-year-old woman with autosomal dominant polycystic kidney disease (ADPKD), renal transplant, and multiple comorbidities, was admitted with poor general condition. Blood cultures detected Klebsiella pneumoniae and Candida albicans. According to the antibiogram result antibiotic intravenous treatment with meropenem was initiated obtaining a good clinical response. Abdominal ultrasound revealed multiple bilobar hepatic and renal cysts. The presumptive origin of the bacteremia was a cortical renal cyst in the right kidney with echogenic content suggestive of hemorrhagic or infectious complication. The nuclear medicine department proposed to realize a LLS to assess the localization of the complicated cyst, with the aim of considering nephrectomy of the transplanted kidney. ***Results:*** The leukocyte scintigraphy with 370 MBq of autologous leukocytes labeled in vitro with 99mTc-HMPAO was performed, obtaining whole-body images at 30 minutes and 2 hours post-injection (Figure I), and an abdomino-pelvic SPECT obtained at 2 hours (Figure II) and at 24 hours (Figure III). The LLS with 99mTc-HMPAO showed increased uptake at the level of a hepatic cyst located in segment IVb. Based on this finding, it was decided to continue treatment with carbapenems for 6 weeks and they decided to disregard the kidney removal. ADPKD is the most common inherited kidney disease. Computed tomography (CT) and magnetic resonance imaging (MRI) have limitations for localizing and differentiating infected cysts, especially for small cysts. LLS with 99mTc-HMPAO is the most useful technique for identifying focal inflammatory or infectious processes detecting leukocyte diapedesis and chemotactic processes in immunocompetent patients. Antibiotic treatment should be discontinued whenever possible prior to the performance off LLS. The advantages of the LLS are diagnosing cyst infection with higher sensitivity, differentiating an hemorrhagic cyst from an infected cyst and avoiding iatrogenic effects to contrast used in CT and MRI. ***Conclusion:*** Hepatic cysts in ADPKD are the most frequent extrarenal complication. Early diagnosis avoids complications from infection and reduces antibiotic treatment, thereby reducing the possibility of developing multi-resistant bacteria. Techniques such as LLS with 99mTc-HMPAO are highly useful for detecting cyst infections with better sensitivity. This technique is the preferred complementary imaging when conventional tests fail to detect the infection's origin and as an initial diagnostic tool in patients not candidates for intravenous contrast.

EP-1123

Bilateral breast metastasis of small cell lung cancer: A rare case

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Aim/Introduction: Small cell lung cancer accounts for 10-15% of lung cancers. It isthought to develop from submucosal located neuroendocrine (Kulchitsky) cells.It is the fastest growing and most rapidly spreading type of lung cancer. The most common sites for distant metastasis are the brain, bone and liver. Here, we present a rare case of small cell lung cancer with bilateral breast metastasis in a 63 years old female patient observed by F^{18} FDG PET/CT. ***Materials and Methods:*** We used mammography, MRI, F^{18} FDG PET/CT and biopsy data ***Results:*** In the biopsy of the right breast performed on the patient whose mammography showed suspicion of malignancy in both breasts, aninvasive carcinoma, thought to be small cell carcinoma, was detected. Breast MRI showed many masses suspicious for malignancy in both breasts. In the F^{18} PET/CT examination performed in our clinic; in both breasts, left lung,anterior-lateral abdominal wall, transverse colon, cervical-mediastinal-axillarylymph nodes that FDG uptakes suspicious for malignancy were observed. Theleft breast biopsy was found to be compatible with small cell carcinoma. Thepatient was evaluated as metastatic small cell lung cancer. Cisplatin-etoposideregimen was started. The pathology of the left lung biopsy was not diagnostic.Cranial MRI showed many nodular lesions thought to be metastatic. The patientwas diagnosed with metastatic small cell lung cancer without requiring a repeatlung biopsy. In the F18-FDG PET/CT examination performed in our clinic afterthe 4th cycle of cisplatin-etoposide treatment, an appearance and metabolicactivity involvement (SUVmax: 2.65) that may be compatible with a residue inthe nodular area with pleural extension in the lower lobe bronchus periphery ofthe left lung were observed. Other findings observed in the F-18 PET/CTexamination before chemotherapy were not observed in the examinationperformed for interim evaluation. In addition, no involvement in the brain wasdetected in the cranial MRI examination performed at the same time. Later, thepatient's cisplatin-etoposide regimen was completed for 6 cycles, and thefindings in the F^{18} PET/CT examination performed in our clinic for treatmentresponse evaluation were similar to the previous PET/CT examination. Thepatient is still under follow-up of the oncology clinic. ***Conclusion:*** Small cell lung cancer is a type of cancer that has a poor prognosisand frequently metastasizes. In our scan, the number of cases with bilateralbreast metastases in the literature is below 5. Breast tissue should not be ignoredin F^{18} FDG PET/CT, especially in female patients diagnosed with small celllung cancer.

EP-1124

Three Different Etiologies in Three Similar Looking Intrathyroid Nodules: Role of Tc-99m Sestamibi Scintigraphy & SPECT-CT in a Patient with Primary Hyperparathyroidism (PHPT)

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Aim/Introduction: Hyperoxaluria occurs due to an inborn error of metabolism or due to a small bowel bypass. It mimics primary hyperparathyroidism as patients develop recurrent renal calculi made of calcium oxalate or chronic kidney disease. We discuss a rare case of concomitant hyperoxaluria and primary hyperparathyroidism. ***Materials and Methods:*** A 46-year-old woman, presented with recurrent episodes of pancreatitis, renal calculi, bone pain and arrhythmia. Biochemical evaluation revealed severe hypercalcemia 15.6 mg/dl (normal range: 8.4-10.2 mg/dl), elevated intact parathyroid hormone (iPTH) level of 394 pg/ml (normal range: 15-68.3 pg/ml) and a 25(OH) vitamin D level of 13.1 ng/ml (normal range: 25-80 ng/ml). A working diagnosis of PHPT was considered and localization was attempted. ***Results:*** An ultrasound of the neck was inconclusive for parathyroid adenoma, however, showed few thyroid nodules. A 4D-CT showed an early arterial enhancing lesion at the location of the left inferior parathyroid. Tc-99m sestamibi scintigraphy, however, revealed an abnormal focal area of radiotracer uptake on the early and delayed phase static images, in the right lobe with complete washout of the radiotracer from rest of the thyroid gland on delayed phase images. On the SPECT-CT image, three

well defined tracer avid lesions were detected; largest measuring 6.0x4.5 mm, in the lower half of the right lobe of the thyroid gland, with visible thyroid parenchyma surrounding it. The other two lesions measured 5.0x2.0 mm (left superior parathyroid) & 3.0x1.0 mm (intrathyroidal). Apart from this, no other suspicious lesions were noticed. One of these was thought to be an intrathyroidal parathyroid adenoma. The patient was planned for right hemithyroidectomy and excision of left inferior parathyroid adenoma. The histopathology was rather surprising in this case as the left superior and right inferior lesions were parathyroid adenomas, the 3 intrathyroidal lesions included NIFTP, multifocal micropapillary PTC (tall cell variant) and intrathyroidal parathyroid adenoma. The left inferior parathyroid lesion, as described on 4D-CT turned out to be thyroid follicular nodular disease. ***Conclusion:*** The learning point in this case is the importance of Tc-99m sestamibi scintigraphy with SPECT-CT in the accurate anatomical localization and detection of other equally important thyroid findings. This case also highlights the limitation of 4D-CT case plus the fact that all these three different etiologies may have the same morphological and radiotracer uptake characteristics.

EP-1125

Thyroid Nodule or Intrathyroidal Parathyroid Adenoma ?: The Role of Tc-99m Sestamibi Scintigraphy & SPECT-CT, 4D-CT and Needle FNA PTH

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Aim/Introduction: An intrathyroidal parathyroid adenoma is an important cause of surgical failure and recurrent/ persistent primary hyperparathyroidism (PHPT). An intrathyroidal parathyroid adenoma is a parathyroid gland, located entirely within the thyroid parenchyma which may or may not have a capsule of its own. This entity should be differentiated from subcapsular/ intracapsular parathyroid glands as the kind of surgery required may differ. Here-in, we highlight that this entity is an important pitfall of Tc-99m sestamibi scan and requires careful interpretation of a 4D-CT scan. ***Materials and Methods:*** A 36-year-old man with a history of recurrent bilateral renal calculi was found to have primary hyperparathyroidism (PHPT) with a serum calcium of 11.8 mg/dl (normal range: 8.4-10.2 mg/dl), an intact parathyroid hormone (iPTH) level of 124 pg/ml (normal range: 15-68.3 pg/ml) and a 25(OH) vitamin D level of 13.1 ng/ml (normal range: 25-80 ng/ml). ***Results:*** An ultrasound of his neck did not localize the adenoma. A Tc-99m sestamibi scan was done but there was no evidence of any abnormal focal uptake on the early and delayed phase static images. However, the SPECT-CT image revealed that there was an intra-thyroidal nodule in the right lobe of the thyroid gland, measuring 5.1x3.5 mm, however the uptake was indiscernible. Given the unequivocal biochemical diagnosis, the possibility of an intrathyroidal parathyroid adenoma was considered. A 4D-CT was performed to visualize the contrast dynamics, however, that was initially reported as normal. A thorough review of the imaging revealed an arterially enhancing nodule in the right lobe of the thyroid with early washout. A decision to perform a needle FNA aspirate and send it for PTH analysis was taken. The PTH from the aspirate came out to be >5000 pg/ml, clinching the diagnosis. The patient underwent a right hemithyroidectomy and the lesion was identified on cutting open the specimen. Histopathology confirmed the lesion as an adenoma and the serum calcium and iPTH normalized postoperatively. ***Conclusion:*** The learning point in this case is the pitfall on Tc-99m sestamibi imaging even with SPECT-CT, the careful interpretation of 4D-CT by an experienced radiologist, the role of needle FNA PTH as a problem solver in such tricky cases with unequivocal biochemical diagnosis.

EP-1126

Celiac Disease and Pernicious Anemia: A Rare Association revealed by Metabolic Super Bone Scan

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Aim/Introduction: Celiac disease is an autoimmune disorder affecting multiple organs, often manifesting with gastrointestinal symptoms and malabsorption. Diagnosing it in adults can be challenging due to its varied presentation and is often incidentally discovered due to complications related to malabsorption syndrome. The association with pernicious anemia is rare, with only occasional reports of the two conditions occurring together. We report the case of a patient with pernicious anemia in whom a bone scan helped guide the diagnosis of associated celiac disease. ***Materials and Methods:*** We present the case of a 52-year-old patient with a history of pernicious anemia since childhood, managed with Vitamin B12 supplementation, who presented with fatigue, anorexia, and a general deterioration in health, associated with diffuse bone pain. An initial thoracic and abdominal CT scan revealed multiple lytic bone lesions throughout the skeleton. A whole-body bone scan was performed 2 hours following the administration of 740MBq of 99m Tc-hydroxymethyldiphosphonate in order to assess the findings of the CT and orient a potential biopsy site. ***Results:*** The bone scan revealed diffuse increased and homogeneous uptake throughout the axial and peripheral skeleton, contrasting with the absence of uptake in the kidneys and soft tissue, describing the classical aspect of a "Metabolic Super Bone scan". Bone densitometry showed osteoporosis. A full blood panel revealed hypoalbuminemia, hypocalcemia, hypophosphatemia, and elevated PTH levels, indicating the diagnosis of malabsorption syndrome. Serology and intestinal biopsy confirmed the diagnosis of celiac disease, and the patient was put on a gluten-free diet with a good response. ***Conclusion:*** Celiac disease can lead to numerous bone complications such as osteoporosis, osteomalacia, and secondary hyperparathyroidism. These complications can be prominent, making the diagnosis challenging. Bone scan can help assess the diagnosis and orient further investigation by revealing osteoblastic activity at the cellular level. In our patient, the metabolic superbone scan revealed a secondary hyperparathyroidism to a malabsorption syndrome, findings that led to the correct diagnosis.

EP-1127

The use of FLT PET/MRI in differentiating recurrent rectal cancer from post-therapeutic changes.

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Aim/Introduction: Evaluation of recurrent rectal cancer may represent a diagnostic challenge. Mass lesions in the presacral space occur in up to half of patients after treatment. FDG PET can be used to exclude recurrent tumour from fibrosis, because fibrosis has low metabolic activity. However some benign processes such as sinus tract may also show high metabolic activity.

Fluorothymidine (FLT) is a radiopharmaceutical used mainly in brain tumours, but its use has been tested in other tumours. It has been found to be able to detect colorectal cancer. Furthermore, inflammation has been shown to have no significant effect on FLT uptake in gynecological cancers. ***Materials and Methods:*** A 67-year-old man with rectal cancer was referred for a follow-up FDG PET/MRI after neoadjuvant chemoradiotherapy and total mesorectal excision with coloanal anastomosis. There was a mass lesion in presacral space in the level of anastomosis with very high metabolic activity (SUVmax 17,6). We weren't able to differentiate between recurrent tumour and early postoperative changes. Follow up FDG PET/MRI showed persistent metabolic activity. For ruling out recurrent tumour FLT PET/MRI was suggested. ***Results:*** On FLT PET, the activity in the region of the mass was mild (SUVmax 3,6), only slightly above surrounding tissues. This finding was favourable for inflammatory changes and not a recurrent tumour. The patient received no treatment. Benign etiology was confirmed by follow-up. After 3 years FDG PET/MR showed no progression of metabolic activity or lesion size on MRI. Thus, this lesion was evaluated as inflammatory changes around the anastomosis with a possible small fistula without abscess formation. ***Conclusion:*** This case report demonstrates the potential of FLT PET in deciding between tumour recurrence and inflammatory changes in patients after treatment for rectal cancer. ***References:*** 1). Pennings, Jan P., et al. "Beware of false-positive FDG PET/CT interpretations for presacral recurrent rectal cancer." Clinical Nuclear Medicine 44.5 (2019): e342-e344. 2. Kim, Chanwoo, Deog Yoon Kim, and Il Ki Hong. "Presacral anastomotic sinus after low anterior resection mimicking recurrent rectal cancer." Clinical Nuclear Medicine 45.3 (2020): e171-e173.3. Yamamoto, Yuka, et al. "Detection of colorectal cancer using ^{18}F-FLT PET: comparison with ^{18}F-FDG PET." Nuclear medicine communications 30.11 (2009): 841-845.4. Cho, Linda P., Chun K. Kim, and Akila N. Viswanathan. "Pilot study assessing ^{18}F-fluorothymidine PET/CT in cervical and vaginal cancers before and after external beam radiation." Gynecologic Oncology Reports 14 (2015): 34-37.

EP-1128

A rare case of leptomeningeal involvement in variant ATTR amyloidosys: the utility of Tc99m-DPD bone scintigraphy

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Aim/Introduction: Amyloidosis is a multi-organ systemic disease caused by tissue deposition of misfolded protein aggregates of amyloid fibrils. The two most common forms of systemic amyloidosis with cardiac involvement are: Light Chain Amyloidosis (AL) caused by the deposition of immunoglobulin light chain and Transthyretin Amyloidosis (ATTR). ATTR is classified in two variants: wild type ATTR (wtATTR) caused by age-associated deposition of misfolded non-mutated transthyretin fibrils and variant ATTR (vATTR) due to mutation of the transthyretin gene. It is weel knew that bone-avid tracers (Tc99m-PYP/DPD/HMDP) are capable of visualizing amyloid deposits in tissues, particularly in the heart. ***Materials and Methods:*** A 45-year-old woman makes an initial admission to the emergency department for paresthesia, bilateral low back pain, stenotic deficit in the hemiface and left limbs and autonomic dysfunction symptoms (xerostomia, dysgeusia and dysuria). CT-angiography and Magnetic-Resonance angiography shown multiple subarachnoid hemorrhages of the convexity. Brain infections were escluded after Cerebrospinal fluid and blood analysis. Biopsy of the Dura Mater and right frontal lobe shows diffuse immune-reactivity of moderate intensity for transthyretin (ATTR-TIE), and no evidence of immunoreactivity for immunoglobulin light chains. A subsequent genetic analysis highlights c.259G>C variant (p.Gly87Arg) in heterozygosity of the TTR gene. Small-caliber fiber involment is reported at the Sudoscan. To evaluate the presence of cardiac involvente, echocardiography and ECG (both negative) and bone scintigraphy were performed according to standard procedures (740 MBq of Tc99m-DPD ev). ***Results:*** 99mTc-DPD bone scintigraphy showed no clear uptake at the cardiac site on planar investigation, Perugini Score 0, confirmed by complementary SPECT/CT of the chest. Intense and diffuse osteotropic radiopharmaceuticals uptake to all body soft tissues (axial and appendicular) with poor/absent visualization of the skeleton is reported, compatible with tissue amyloidotic deposition/altered wash out. ***Conclusion:*** Bone scintigraphy is useful in all cases of vATTR amyloidosis with or without signs of amyloidotic cardiomyopathy. The absence of cardiac involment, together with a diffuse soft tissue uptake, influences therapeutic options. In fact, the indications of new target drugs also differ according to the various organs involvement (heart vs peripheral nervous system).

EP-1129

Tuberculosis Lymphadenitis Mimicking Malignancy

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Aim/Introduction: Tuberculosis (TB) remains a major health issue in developing countries, however its diagnosis can be challenging and can be confused with malignancy or other granulomatous diseases. ***Materials and Methods:*** We will present a 62-year-old female with sarcoidosis who presented with new-onset headaches, fatigue, night sweats, and weight loss. ***Results:*** Cranial MRI revealed space-occupying lesions, initially suggesting metastasis and prompting surgical consideration. However, lesion regression post-steroid therapy led to a provisional diagnosis of neurosarcoidosis. FDG PET/CT identified hypermetabolic lesions in lymph nodes, lungs, liver, spleen, and colon. A lymph node biopsy confirmed tuberculous lymphadenitis, and colonoscopy showed granulomatous changes, suggesting TB. Liver biopsies were negative for malignancy, and the patient commenced quadruple anti-TB therapy. ***Conclusion:*** Although pulmonary TB is the most common form of the disease, TB can spread to any tissue or organ hematogenously, lymphatically, or through contiguous spread. Hepatobiliary TB is a rare extrapulmonary form, and can mimic malignancies, causing diagnostic delays due to its vague symptoms. In cases of multiple hypermetabolic liver lesions, especially in the immunocompromised, TB should be considered (1,2). FDG PET/CT is invaluable for detecting tuberculous lymphadenitis and is a complementary tool in the diagnosis of extrapulmonary tuberculosis. It can identify lesions missed on morphological imaging, allows for the selection of biopsy site and can differentiate between active and inactive lesions by detecting early treatment response. However, FDG PET/CT cannot

reliably differentiate tuberculosis lymphadenitis from lymphoma, sarcoidosis, or metastatic lymph nodes. Particularly in countries where tuberculosis is prevalent, considering tuberculous lymphadenitis as a differential diagnosis in patients with enlarged lymph nodes and the role of lymph node biopsy in the diagnosis in the light of FDG PET/CT findings is crucial (3,4). ***References:*** 1) Wang X, Shi X, Yi C, et al. Hepatic tuberculosis mimics metastasis revealed by ^{18}F-FDG PET/CT. Clin Nucl Med. 2014;39:325-7 2)Di Renzo C, Tabrizian P, Kozuch DE, et al. Abdominal Tuberculosis Mimicking Cancer Clinically and on Fluorodeoxyglucose (FDG)-Positron Emission Tomography (PET) Imaging: A Two-Case Series. Am J Case Rep. 2020;21:e918901 3)Liao F, Huang Z, Xu R, et al. Analysis of misdiagnosis and ^{18}F-FDG PET/CT findings of lymph node tuberculosis. J Xray Sci Technol. 2022;30:941-951 4)Yu WY, Lu PX, Assadi M, et al. Updates on ^{18}F-FDG-PET/CT as a clinical tool for tuberculosis evaluation and therapeutic monitoring. Quant Imaging Med Surg. 2019;9:1132-1146.

EP-1130

Head&Neck Paraganglioma in 68Ga-PSMA PET/CT - A Case Report

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Aim/Introduction: Prostate-specific membrane antigen (PSMA) is a transmembrane glycoprotein overexpressed in prostate carcinoma. Gallium-68 (68Ga)-PSMA-directed positron emission tomography/computed tomography (PSMA PET/CT) is a non-invasive imaging modality mostly used in biochemical recurrence and staging in intermediate or high-risk prostate cancer due to its high sensitivity and specificity when compared to other non-specific radiotracers. However, despite its name, PSMA is not specific to prostate tissue, and PSMA uptake in other nonprostatic malignancies and benign conditions have been reported. ***Materials and Methods:*** We present a case of a 65-year-old male patient diagnosed with prostatic adenocarcinoma Gleason 7 (4+3), treated with radical prostatectomy that presented with biochemical recurrence. ***Results:*** PSMA PET/CT revealed a suspicious tracer-avid right laterocervical mass (SUVmax=31.6). Further characterization with magnetic resonance imaging raised suspicion of a cervical paraganglioma, a rare neuroendocrine tumour, characterized by cellular over-expression of somatostatin receptors that was confirmed after biopsy. The patient presented slightly raised chromogranin A, normal urine metanephrines and no apparent clinical or functional symptoms. 68Ga-DOTATOC PET/CT showed intense focal tracer uptake adjacent to the right carotid artery bifurcation (SUVmax=68.8), compatible with paraganglioma. Surgical removal of the tumour was proposed. ***Conclusion:*** Recently published prostate cancer guidelines recommended PSMA PET/CT as the front-line imaging modality for initial staging of unfavourable intermediate or high-risk prostate cancer, evaluation of biochemically recurrent or progressive disease, and eligibility for PSMA radioligand therapy. This clinical case illustrates a rare case of a paraganglioma detected in 68Ga-PSMA-PET/CT, a possible pitfall, since PSMA is expressed in a range of different structures and lesions, both physiologic and pathologic. Therefore, a familiarity of the common patterns of prostate cancer progression, in addition to knowledge of common pearls and pitfalls may increase confidence in interpreting PSMA PET/CT and suggesting further investigation in these cases.

EP-1131

Possible Pitfall on PET/CT with ^{18}F-FDG 10 Years After Surgical Correction of Bilateral Vesicouretral Reflux

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Aim/Introduction: Positron emission tomography with computed tomography (PET/CT) with 2-deoxy-2$^{[18F]}$-fluoro-D-glucose (^{18}F-FDG) is an important tool in staging and evaluating response of various oncological pathologies. However, its specificity is limited since many physiological and benign processes have high avidity for ^{18}F-FDG. The main causes of glycolytic hypermetabolism that is not associated with malignant pathologies are physiological processes or lesions of an inflammatory/infectious nature, benign tumours, hematomas/seromas and fractures, and their distinction is often challenging. ***Materials and Methods:*** We present a case of a 12-year-old female child, with a history of bilateral vesicourethral reflux (VUR) with surgical correction at the age of 3, referred to our centre after right adnexectomy for an immature teratoma of the right ovary. ***Results:*** She underwent chest CT without changes suspicious of secondary involvement. The ^{18}F-FDG PET/CT study revealed tenuous radiopharmaceutical uptake in endometrial topography, of probable physiological nature (catamenium) and two retrovesical/parauterine areas of ^{18}F-FDG hypermetabolism, more evident in complementary images acquired after 2 hours (SUVmax initial = 9.3 -> late SUVmax = 12.1), correlated with changes resulting from endoscopic VUR correction surgery. ***Conclusion:*** This clinical case illustrates an unusual pattern of high ^{18}F-FDG uptake, resulting from a surgical intervention which occurred several years previously, that can present as a challenge in interpreting the PET/CT study and constitutes a pitfall if secondary involvement is mistakenly considered to be suspected in a patient with recently diagnosed malignancy. We therefore seek to raise awareness for the necessity to maintain a high suspicion index for the existence of potential false positives, namely through the collection of a detailed clinical history, integration with other imaging tests, knowledge of biodistribution patterns and secondary involvement, as well as imaging and functional characteristics of the lesions.

EP-1132

Vascular Lymphomatous Involvement on ^{18}F-FDG PET/CT: An Unusual Pattern

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Aim/Introduction: Less than 1/3 of lymphomas present as extra-nodal involvement, with the gastrointestinal tract and skin being the most common sites of presentation. Primary testicular lymphoma (PTL) represents only 1% of all non-Hodgkin's lymphomas (NHL), despite being the most common testicular neoplasm in the elderly. Its evolution is usually aggressive with a poor prognosis and involvement of the central nervous system (CNS). The most common clinical presentation is increased testicular volume and local pain. Diagnosis is generally based on scrotal ultrasound followed by biopsy with anatomopathological and immunohistochemical analysis. The recommended treatment is orchidectomy and systemic chemotherapy, along with intrathecal chemotherapy (to reduce CNS recurrence), followed by radiotherapy to the contralateral testicle. ***Materials and Methods:*** We present a case of an 87-year-old man, with a history of prostate carcinoma who underwent radiotherapy, without

constitutional symptoms, who, due to an increase in left testicular volume, underwent a scrotal ultrasound which revealed a 27mm testicular nodule, reason why he underwent radical orchidectomy. ***Results:*** The anatomopathological examination was compatible with the diagnosis of diffuse large B-cell non-Hodgkin's lymphoma (NHL-DLBCL). A bone marrow biopsy was performed without signs of neoplastic involvement. A whole-body positron emission tomography/computed tomography (PET/CT) study was also performed with 2-deoxy-2[18F]-fluoro-D-glucose (^{18}F-FDG) for staging. Intense uptake of the radiopharmaceutical was identified along the course of the left testicular vein and the ipsilateral lumboaortic chain, which begins at the level of the axial plane of D12/L1 and extends to the distal portion of the left inguinal canal, suggestive of lymphoproliferative involvement. The patient was initially proposed for systemic chemotherapy. ***Conclusion:*** Primary testicular lymphoma is a rare entity. ^{18}F-FDG PET/CT has limited value in the differential diagnosis and characterization of testicular masses, however, as in other subtypes of NHL, it is the imaging method of choice for staging PTL, due to high avidity for ^{18}F-FDG. This case illustrates an unusual pattern of lymphomatous involvement along the course of the testicular vein, characteristic of PTL but uncommon in other testicular neoplasms.

EP-1133

A rare case of primitive neuroectodermal tumor on ^{18}F-FDG PET/CT

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Aim/Introduction: Ewing sarcoma/primitive neuroectodermal tumors (ES/PNET) are high-grade malignant neoplasms. Very rarely, it may occur in the thoracopulmonary region and mediastinum. They originate from bone and soft tissue. ES/PNET include Ewing sarcoma, extraskeletal Ewing sarcoma, Askin tumors of the chest wall, and primitive neuroectodermal tumors of bone or soft tissues. On computerized scanning, ES/PNET usually presents as a large, unilateral, heterogeneously growing mass containing cystic necrotic areas. Lymph node metastasis is also rare. Distant metastasis is rare at diagnosis in thoracopulmonary ES/PNET. Surgical excision, chemotherapy and radiotherapy combination are the standard treatment methods. ES/PNET group tumors have a poor prognosis. Askin et al reported median survival after tumor diagnosis as only 8 months. Recent studies demonstrate a significant improvement in 5-year overall survival exceeding 60% to 65% for localized ES/PNET with the combination of surgical excision, intensive chemotherapy, and high-dose radiotherapy. The most important prognostic factors are known as tumor size, presence of distant metastasis at presentation, and surgical resection margin.We present a rare case ES/PNET. ***Materials and Methods:*** After fasting and resting for six hours, the patient received 305 MBq of F^{18} FDG intravenously when their fasting bloodglucose level was <200 mg/dL. The patients were examined using a dedicated PET/CT scanner. ***Results:*** Case report: A 43-year-old male patient applied with the complaint of a mass in the thoracic region. Thoracic computed tomography revealed a mass of 21x15 cm in size, invading the left thorax wall and extending into the thorax cavity. The biopsy result of the patient was reported as Ewing Sarcoma/PNET. In the F^{18}-FDG PET/CT taken for staging purposes, heterogeneous pathological F^{18} FDG uptake (SUV max: 10.48) was observed in a 22x16 cm mass that invaded the right thorax wall and caused destruction in the adjacent ribs. No metastasis was detected. The patient underwent surgical treatment . As a result of pathology, it was confirmed as ES/PNET. Ki67 proliferation index was determined as 90%. The patient died in the second month after surgery due to bleeding and infection complications. ***Conclusion:*** Ewing sarcoma/primitive neuroectodermal tumors (ES/PNET) are high-grade malignant neoplasms. These malignancies can very rarely occur in the thoracopulmonary region and even more rarely in the mediastinum. On 18F FDG PET/CT, it is observed as giant masses with cystic necrotic areas showing heterogeneous ^{18}FDG uptake. Not detecting metastasis on PET/CT is associated with a better prognosis.

EP-1134

Brown tumor: A rare complication of a hyperparathyroidism - A case report

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Aim/Introduction: A brown tumor (BT) is a rare, but severe complication of primary or secondary hyperparathyroidism. It is a benign bone lesion, caused by increased osteoclastic activity, due to overproduction of parathyroid hormone (PTH), causing hypercalcemia and hypophosphatemia. BTs may appear in any bone, with higher incidence in ribs, clavicles, extremities and pelvic bones. It is crucial to distinguish them from other bone diseases, especially from bone metastases, when detected by bone scan. ***Materials and Methods:*** We present a case of a 38 years old female patient that was referred to our institution for bone scan because of osteolytic changes in the left hip, previously seen on pelvic X-Ray scan. Bone scan revealed intensive pathological accumulations in the proximal diaphysis of the left femur, as well as in the distal metadiaphysis of the right femur. The histopathological finding was consistent with a giant-cell tumor. Serum levels of both PTH and ionized calcium were elevated (PTH=436pg/mL; ionized calcium=3.4mmol/L). Therefore, a dual-phase 99mTc-MIBI parathyroid scan was indicated and it showed a presence of parathyroid adenoma under the lower pole of the left thyroid lobe. The whole body 99mTc-MIBI scan acquired 2 hours after i.v radiotracer application, besides the pathological accumulation in the neck region, revealed pathological accumulations in the trochanter region of the left femur and the distal metadiaphysis of the right femur. ***Results:*** The distribution of the pathological accumulations on the whole body 99mTc-MIBI scan corresponded to the pathological accumulation pattern found in the previously conducted 99mTc-MDP bone scan. After the surgical intervention and histopathological confirmation of the parathyroid adenoma, serum PTH and calcium levels were in normal ranges, and BTs detected on control 99m Tc-MIBI whole body scan were diminished. ***Conclusion:*** Due to its intense osteoclastic activity BTs can be easily misdiagnosed as bone metastases presenting as 'hot spots' on bone scans, making it difficult to differentiate between them. In this case report we emphasize the utility of 99mTc-MIBI WBS, as a useful diagnostic technique for detecting skeletal lesions in the setting of the metabolic bone disease, as a complication of hyperparathyroidism.

EP-1135

Bilateral Vertebral Artery Vasculitis: Case report and literature review

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Aim/Introduction: Giant cell arteritis (GCA) is an immune-mediated disease affecting medium and large-sized extracranial arteries. Vertebral artery involvement in GCA is rare with few cases published; women are more commonly affected than men. We report a case of vertebral arteritis confirmed via 2-deoxy-2-^{18}F-fluoro-D-glucose positron emission tomography/computed tomography (FDG PET/CT). ***Materials and Methods:*** Vertebral arteritis is part of the spectrum of Giant Cell Arteritis (GCA); itself often challenging to diagnose and with negative biopsy results. We present a relatively frail 83 year old female presenting with neck pain and stiffness, accompanied by elevated acute phase protein levels. Magnetic resonance imaging (MRI) revealed mild synovial thickening.She underwent scan on GE Discovery MI 5-ring digital PETCT scanner; scanned vertex to thighs 60 min after 194 MBq (3.5 MBq/kg). QClear600 PET recons used for SUVmax analysis. Low dose free breathing CT without IV contrast for AC. Blood Glucose = 5.6 mmol/l.Normal background liver SUV max = 1.8 ***Results:*** FDG PETCT exhibited moderate avidity using EANM/SNMMI criteria in both vertebral arteries extending to the basilar tip, more on the right but bilateral, indicative of inflammatory activity. Notably, some peri-articular uptake was also noted so accompanying inflammatory arthropathy was suspected. Good symptomatic relief seen with treatment (and post treatment scan will be shared if available).Our case underscores the diagnostic utility of FDG PETCT in confirming vertebral arteritis, particularly in cases where temporal artery biopsy would be challenging and, as in this case, likely inconclusive. Furthermore, it highlights the potential of FDG PETCT to visualize ongoing arterial inflammation, guiding therapeutic decisions in this challenging clinical scenario. ***Conclusion:*** Prompt recognition and management are imperative to mitigate the risk of complications such as transient ischemic attacks and irreversible neurological deficits. This case demonstrates the crucial role of hybrid imaging techniques in enhancing our understanding of arteritis pathophysiology and optimising patient care strategies. ***References:*** (1). Justesen et al. Bilateral Vertebral Artery Vasculitis - A rare manifestation of Giant Cell Arteritis and a difficult diagnosis made possible by PETCT. Diagnostics (Basel). 2021 May; 11(5): 879. (2) Ros Prunte MK, et al. Giant Cell Arteritis with vertebral artery involvement - baseline characteristics and follow-up of monocentric patient cohort. Front. Neurol., 26 June 2023.

EP-1136

When All Else Fails: Compassionate Use of Terbium-161 PSMA in the Treatment of Metastatic Prostate Cancer

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Aim/Introduction: Multiple clinical trials and published data have demonstrated the benefit of Lutetium-177 PSMA on PSA levels and survival of patients with metastatic, castrate-resistant prostate cancer (mCRPC). Limited data is available documenting the therapeutic effect of Terbium-161 (Tb-161) PSMA in patients with mCRPC1,2. Ongoing trials are available regarding its utility in dose escalation and efficacy studies. We describe our experience with Tb-161 PSMA in a 66-year-old male with metastatic, castrate-resistant prostate cancer referred for Lutetium-177 PSMA radioligand therapy due to increasing PSA refractory to docetaxel and worsening clinical symptoms. His baseline Eastern Cooperative Oncology Group (ECOG) performance status was 2. ***Materials and Methods:*** His PSA prior to Lutetium-177 PSMA was elevated. Baseline Technetium-99m HYNIC PSMA scintigraphy demonstrated widespread PSMA-avid skeletal metastases more than liver uptake. His baseline bone marrow reserve and renal function were acceptable for treatment. ***Results:*** After four Lutetium-177 PSMA cycles, his PSA had increased and a further three cycles of Lutetium-177 PSMA were administered. After seven cycles, his ECOG status improved to 1, his PSA had nearly halved from baseline, his post-therapy imaging demonstrated stable disease, and his bone marrow reserve remained stable. Multiple logistical issues with Lutetium production and delivery resulted in a delay in receiving his eighth treatment cycle. Owing to the potential negative impact on the patient's clinical progress, he was treated with two cycles of Tb-161 PSMA. Post therapy imaging showed adequate uptake of Tb-161 PSMA in the known areas of disease. The patient's ECOG performance status subsequently regressed to 4 with a PSA doubling time of two months. The patient declined any further treatment and was referred to radiation oncology for palliative management. The patient demised shortly thereafter. ***Conclusion:*** Terbium-161 PSMA radioligand therapy is a potential alternative to Lutetium-177 PSMA in the treatment of mCRPC. Further research into its effect on various outcome parameters and side effect profiles would be beneficial for the future of radioligand therapy in mCRPC management. ***References:*** 1. Buteau JP, Kostos LK, Alipour R, Jackson P, McIntosh L, Emmerson B, Haskali MB, Yeung T, Xie S, Medhurst E, Ravi R. VIOLET: A phase I/II trial evaluation of radioligand treatment in men with metastatic castration-resistant prostate cancer with [161Tb] Tb-PSMA-I&T. 2. Rosar F, Maus S, Schaefer-Schuler A, Burgard C, Khreish F, Ezziddin S. New horizons in radioligand therapy: 161Tb-PSMA-617 in advanced mCRPC. Clinical Nuclear Medicine. 2023 May 1;48(5):433-4.

EP-1137

Role of [^{67}Ga]Ga-citrate scintigraphy in systemic sarcoidosis

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Aim/Introduction: Sarcoidosis is a systemic inflammatory disease of unknown aetiology characterized by the development of noncaseating epitheliod granulomas in various organs and tissues.[67Ga]Ga-citrate scintigraphy has proved to be a sensitive technique in the assessment of disease activity and extension, particularly useful in departments where 2-[^{18}F]FDG PET/CT is not available.The authors present a clinical case illustrating the usefulness of of [67Ga]Ga-citrate scintigraphy in the evaluation of sarcoidosis. ***Materials and Methods:*** Description of clinical case. ***Results:*** A 31-year-old woman with a history of weight loss (approximately 10 kg) over the last year, alopecia, skin lesions on the arms and back, and a right cervical mass with progressive growth in the last 3 months was admitted to the Internal Medicine Department. Blood test results demonstrated markedly increased plasma angiotensin converting enzyme levels, thrombocytopenia, leukopenia with neutropenia and lymphopenia, hypergammaglobulinemia and vitamin D deficiency. HIV and EBV were negative. The Interferon Gama Release Assay was negative. Computed tomography (CT) showed multiple adenomegaly in various territories, with pulmonary and hepatic microdularity and nodular splenomegaly. A biopsy of a right inguinal node was

compatible with the diagnosis of sarcoidosis.Given the clinical context, [67Ga]Ga-citrate scintigraphy was performed to assess disease activity and extension. 370 MBq of [67Ga]Ga-citrate were administered and images were obtained at 48 and 72 hours after injection, as well as SPECT/CT of the pelvis and SPECT of the knees at 48 hours. This exam showed multiple hot spots in the soft tissues (nodal involvement), skin (left arm), peripheral skeleton of lower limbs in close proximity to joints; lacrimal and salivary glands (producing the "panda" sign); and irregular distribution of radiopharmaceutical in liver and spleen.These findings confirmed the diagnosis of systemic sarcoidosis and immunosuppressive therapy was instituted. The patient showed significant clinical and analytical improvement. ***Conclusion:*** [67Ga]Ga-citrate scintigraphy is the scintigraphic method of choice in the evaluation of the activity and extension of sarcoidosis, being also helpful in clinical management for starting or altering treatment, especially when PET/CT is not available.

EP-1138

Intrapancreatic accessory spleen mimicking pancreatic tumor: role of [^{99m}Tc]Tc-nanocolloid scintigraphy

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Aim/Introduction: Accessory spleen is present in 10% of human population and is usually located in the area of the splenic hilum or near the tail of the pancreas1. [99mTc]Tc-nanocolloid is a radiopharmaceutical that is taken up by reticuloendothelial cells in the liver and spleen, allowing for visualization of these organs. Our aim is to highlight the role of [99mTc]Tc-nanocolloid scintigraphy in the differentiation between an intrapancreatic accessory spleen and a pancreatic tumor, particularly in cases where other imaging modalities may be inconclusive. ***Materials and Methods:*** We report a case of 61-year-old man with prostatic cancer who underwent computed tomography (CT) study to exclude metastatic disease. The abdominal CT showed a solid nodular lesion in the tail of the pancreas with contrast enhancement. Since the radiologist could not differentiate between an accessory spleen and a pancreatic tumor, a [99mTc]Tc-nanocolloid scintigraphy was requested. 185 MBq of the radiopharmaceutical were administered and planar scintigraphy and SPECT/CT images were obtained at 30 minutes after injection. ***Results:*** The planar images showed an area of increased uptake below the spleen. The SPECT/CT study demonstrated that this activity was coming from the suspicious lesion located in the pancreatic tail, so the diagnosis of an intrapancreatic accessory spleen was confirmed. ***Conclusion:*** The [99mTc]Tc-nanocolloid scintigraphy provides an easy and inexpensive method for the definitive diagnosis of an intrapancreatic accessory spleen, preventing patients from undergoing unnecessary major surgery in cases where a pancreatic tumor is suspected. ***References:*** 1-Freeman JL, Jafri SZ, Roberts JL, et al. CT of congenital and acquired abnormalities of the spleen. RadioGraphics.1993;13:579-610.

EP-1139

Tumor Thrombus From Follicular Thyroid Cancer On F^{18}-FDG PET/CT; Case Report

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Aim/Introduction: Thyroid carcinoma with major vascular tumor thrombosis is a rare finding. The incidence of tumor thrombus in thyroid carcinoma is between 0.2% and 3.8%. Vascular invasion, or venous tumor thrombus, in thyroid cancer is a risk factor for distant metastases or early relapse. ***Materials and Methods:*** After 60 minutes of administering FDG intravenously, a whole-body PET/CT scan was acquired, extending from the base of the skull to the mid-thigh. ***Results:*** A 68-year-old female patient with follicular thyroid cancer had a total thyroidectomy and a total neck dissection. Pathology revealed a widely invasive tumor, an infiltrating thyroid capsule with focal extension into surrounding soft tissue, and IJV occluded by the tumor.Post-operative FDG PET/CT study revealed linear intense FDG avid metabolically active enhancing tumor thrombosis distended the right brachiocephalic vein as well as SVC reaching to the right atrium and filling its lumen with SUV max~12.1. Numerous bilateral pulmonary nodules are detected with SUV max~3.3. In addition, there are enlarged FDG-avid right para-tracheal and small-sized, low-grade FDG-avid left supra-clavicular nodes. Moreover, bony lesions involving the sternum, both iliac bones, right humeral shaft, and spine of SUV max~11 are also noted. A cardiovascular surgical consultation was done, but the option of surgical intervention was refused due to the critical situation. ***Conclusion:*** F^{18}-FDG PET/CT plays an important role in proper staging as it helps in the detection of tumor thrombus and its extension, as well as the detection of distant metastases.

EP-1140

Shunt malfunction with multilevel CSF leaks on serial imaging: a case report

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Aim/Introduction: Radionuclide cerebrospinal fluid (CSF) shunt studies provide a simple, effective, and low-radiation-dose method for evaluating CSF shunt patency and function. However, despite its value, these studies are not commonly performed nowadays, leading to challenges in maintaining proficiency in this skill. Here, we represent a 39-year-old woman with clinical suspicion of lumboperitoneal (LP) shunt malfunction who had multilevel CSF leaks on two sets of radionuclide CSF studies. ***Materials and Methods:*** Following injection of 250MBq Tc-99m diethylenetriaminepentaacetic acid via a lumbar puncture needle into the thecal sac, serial imaging of the head, thorax, and abdominal regions were acquired. SPECT/CT imaging was also performed. ***Results:*** The radionuclide CSF study demonstrated multifocal sites of CSF leaks and large CSF-omas within the lower cervical/thoracic, lumbar, and right posterior flank regions. Careful examination of the SPECT/CT images has also aided in confirming the CSF leakage and collections beyond the shunt tract, as suspected in the planar images. ***Conclusion:*** This case highlights the value of radionuclide CSF imaging for the evaluation of shunt function, particularly in patients with recurrent symptoms or equivocal anatomic imaging findings. It underscores the necessity of maintaining our skills in such traditional radionuclide studies which are not performed frequently nowadays. A thorough examination of SPECT/CT images is also crucial for accurate diagnosis and management of CSF shunt complications.

EP-1141

Multıple Skeletal Muscle Metastases In Neuroblastoma: A Rare Case

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Aim/Introduction: Neuroblastoma, the most common extracranial solid tumor of childhood, originates from neural crest cells and predominantly affects children under the age of 5. Most neuroblastomas are found in the abdomen and adrenal glands, but they can occur anywhere along the sympathetic nervous system. Common sites of metastasis include bone, bone marrow, lymph nodes, and liver. Metaiodobenzylguanidine (MIBG), a noradrenaline analogue, is used for imaging neuroectodermal-origin tumors. Here, we present a case of skeletal muscle metastasis rarely seen in the course of neuroblastoma, detected by MIBG scintigraphy. ***Materials and Methods:*** In January 2023, an 17-month-old female patient diagnosed with neuroblastoma and treated with 8 cycles of chemotherapy was referred to our clinic for I-123 MIBG scintigraphy. No pathological findings were observed on whole abdomen ultrasound, but focal increased MIBG uptake was observed in the left lower abdomen, left side of bladder, and both lower extremities at the level of the proximal shaft of the femur and the proximal level of the right tibia. SPECT/CT images obtained from the pelvis and lower extremities revealed increased MIBG uptake within soft tissue densities measuring 15 mm in diameter between the left gluteal muscle structures, within muscle structures at the lateral section of the proximal right femur and the medial section of the proximal left femur, and within muscle structures posterior to the right tibia measuring 18x11 mm in diameter. The described findings were interpreted as favor of metastasis. The patient is under follow-up at the Pediatric Hematology-Oncology Clinic. ***Results:*** MIBG scintigraphy is often used in determining the primary focus of neural crest originated tumors, staging the tumor, detecting metastases, investigating the effectiveness of treatment, and investigating residual and recurrent disease. Skeletal muscle metastasis of neuroblastoma is very rare and has been reported in a limited number of cases in the literature. ***Conclusion:*** SPECT/CT images play an important role in distinguishing between commonly observed bone metastases and rarely seen skeletal muscle involvement, which can alter the stage of the disease.

EP-1142

Normocalcemic Parahtyroid Carsinoma: A Rare Case

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Aim/Introduction: Parathyroid carcinoma is a quite rare disease that presents with severe hyperparathyroidism.It comprises about 1% of all hyperparathyroidism cases. Typically, carcinomas are >3 cm in size and PTH levels are in the thousands. Serum Ca level greater than 14 mg/dL and accompanying metabolic bone disease support the diagnosis. Pathological findings may be insufficient to differentiate between parathyroid adenoma and carcinoma. Here, a very rare case of parathyroid carcinoma with widespread bodily pain and incidental fracture detected on parathyroid imaging was presented. ***Materials and Methods:*** In the examinations of a 47-year-old female patient who applied with the complaint of difficulty in walking; BMD values were L1-L4=-6.2, femur=-4.9, serum PTH level was 1897 pg/mL (N:15-65). Serum Ca level was 10.06 mg/dL (N:8.6-10.2) and 25-OH Vitamin D level was 8 (< 10, very low). On physical examination, a hard fixed palpable mass was detected in the neck, located in the right lobe of the thyroid. Cervical US reported as; a hypochoic solid lesion with a heterogeneous internal structure, 42x31x21 mm in size, containing cystic/necrotic areas, located intrathyroidally in the right lobe. The findings were primarily evaluated in favor of parathyroid carcinoma. The patient was referred to our clinic and underwent MIBI whole-body scanning in addition to dual-phase parathyroid scintigraphy. The early and late images showed parathyroid pathology with MIBI uptake on the right lobe. MIBI uptake was seen inferior to normal bladder activity in the whole-body scan, prompting pelvic SPECT/CT imaging. It revealed that the observed MIBI uptake was from bladder activity, while findings consistent with a fracture line were noted in the bilateral ischiopubic ramus. The patient underwent parathyroidectomy, right lobectomy and ipsilateral neck dissection. The patient, with normal PTH and calcium levels post-operative, is under follow-up at the Endocrinology Clinic. ***Results:*** Parathyroid carcinoma should be considered in patients with a palpable mass in the neck, PTH value 3-10 times the upper limit, severe hypercalcemia, lesion size >3 cm on cervical US, accompanying bone and kidney findings. Since the disease may progress with local invasion and relapses, surgery is performed more extensively. Normocalcemia in our case was attributed to very low levels of 25-OH vitamin D. Incidental bilateral ischiopubic fracture was detected with SPECT/CT performed after MIBI whole-body scan. ***Conclusion:*** Considering that MIBI is also used as a tumor imaging agent, we think that whole-body scan should be performed in selected patients in addition to routine parathyroid scintigraphy.

EP-1143

Finding Meckel's Diverticulum: a clinical perspective

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Aim/Introduction: Meckel's diverticulum is the most common congenital anomaly of the gastrointestinal tract and is present in 1 to 3% of the general population. It develops due to incomplete obliteration of the omphalomesenteric duct in the embryo and it is the most frequent location of ectopic gastric mucosa. Only 35% of Meckel's diverticulum present clinical symptoms, of which 60% have ectopic gastric mucosa, increasing the percentage to 98% in those who have bleeding complication. ***Materials and Methods:*** A 4-yeard-old child is brought to the emergency department presenting with melena, abdominal pain, weakness, and pale skin. The blood test showed severe normocytic normochromic anemia. After blood transfusion, the patient remains hemodynamically stable with resolution of the melena. The abdominal ultrasound identified an image of intussusception in the ileal region. Given the high suspicion of Meckel's diverticulum a ectopic gastric mucosa scintigraphy was performed. ***Results:*** A dynamic and sequential ectopic gastric mucosa scintigraphy was performed after intravenous administration of a 55.5 MBq dose of 99mTc-pertechnetate under camera, obtaining dynamic images of the abdomen every second for 60 seconds followed by every 30 seconds for 15 minutes and static images at 45 and 60 minutes in which an area of focal hypercaptation of the tracer was observed that appears simultaneously with gastric and duodenal activity, in the right iliac fossa, which is sugestive of ectopic gastric mucosa in that location. We used 99mTc-pertechnetate as the radiopharmaceutical for the scan, which is the choice due to its high affinity for gastric mucosa. The radiopharmaceutical

is absorbed by the mucinous cells of the gastric mucosa and then secreted into the intestinal lumen. After confirming the Meckel's diverticulum, the surgeons performed a laparotomy with intestinal resection and latero-lateral anastomosis. The pathology study described the piece of small intestine with Meckel's diverticulum, in which extensive gastric heterotopia. ***Conclusion:*** Gastric mucosa scintigraphy is the most widely used test for the location of Meckel's diverticulum as a preoperative study, having a sensitivity of 85% and a specificity of 95% (1). Since gastric mucosa is responsible for most complicated diverticula with bleeding or perforation, it is a useful tool for diagnosis and decision-making in the surgical management of these patients. ***References:*** 1. Spottswood SE, Pfluger T, Bartold SP, Brandon D, Burchell N, Delbeke D, et al. SNMMI and EANM Practice Guideline for Meckel Diverticulum Scintigraphy 2.0. J Nucl Med Technol [Internet]. 1 de septiembre de 2014;42(3):163-9. Disponible en: http://tech.snmjournals.org/content/42/3/163.abstract.

EP-1144

Crossing Borders: Ovarian Cancer Metastasizing To The Brain A Case Report

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Aim/Introduction: Brain metastases of ovarian cancer seldom occur and are rarely taken into consideration during differential diagnosis. We present the case of a patient with ovarian carcinoma (OC) associating a brain lesion visible on [18F]-Fludeoxyglucose Positron Emission Tomography - Computed Tomography ([18F]-FDG PET-CT). ***Materials and Methods:*** Our patient is a 74-year-old female with a long history of FIGO III high-grade BRCA negative OC, in follow-up for more than 9 years, with multiple local recurrences. She underwent radical hysterectomy and adjuvant chemotherapy. Now she presented with fatigue, vertigo and disorientation. The patient had slightly elevated CA-125 level, raising concerns for disease progression. Therefore, she was scheduled for [18F]-FDG PET-CT. ***Results:*** The PET study showed focal glucose uptake in the left fronto-parietal cortex with a discrete hyperdense lesion and surrounding oedema on the computed tomography (CT) images. There was also an increased glucose uptake in the vaginal stump, compatible with local recurrence of the tumour. Cerebral magnetic resonance imaging (MRI) study revealed a heterogenous gadolinium enhanced lesion with smooth irregular margins, in the left parietal lobe with diffusion restriction and surrounding oedema, highly suggestive for a metastatic lesion. The patient underwent neurosurgery and the specimen tested positive for poorly-differentiated ovarian cancer cells consistent with high-grade serous carcinoma metastasis. Although [18F]-FDG PET-CT has a limited role in brain tumours due to high physiological neuronal glucose uptake[1], it is still advisable to perform scans from the vertex rather than the tentorium. In addition, for some patients with certain risk factors (later diagnosis, recurrences), brain MRI should be considered as part of follow-up. As brain MRI is not routinely performed in patients with OC, true incidence of brain metastases in these patients may be underestimated, with limited evidence in the literature [2]. ***Conclusion:*** Brain imaging is rarely included in OC follow-up protocols, but our practice ensures a thorough examination. For oncologic patients with long courses of disease, a comprehensive [18F]-FDG-PET-CT scan from the vertex may be a better option to assess disease progression. Keywords: [18F]-FDG PET-CT, brain metastasis, ovarian cancer, serous carcinoma, brain imaging ***References:*** 1. Purohit BS, et al. FDG-PET/CT pitfalls in oncological head and neck imaging. Insights Imaging. 2014;5(5):585-602. 2. Pakneshan S, et al Brain metastasis from ovarian cancer: a systematic review. J Neurooncol. 2014;119(1):1-6.

EP-1145

Peculiar Findings at [18F]-FDG PET-CT in a Typical Pulmonary Carcinoid

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Aim/Introduction: Pulmonary carcinoids account for less than 30% of all carcinoid tumors and only 1-2% of all pulmonary malignancies. Histologically, they are classified as typical carcinoid, atypical carcinoid, small cell lung carcinoma and large cell neuroendocrine carcinoma. ***Materials and Methods:*** We present a case of a 56-year-old female with a history of a well-differentiated, typical pulmonary carcinoid tumor located in the left superior pulmonary lobe, for which she underwent a lobectomy with lymphadenectomy. After five disease-free years, she presented with a left posterior thoracic wall mass, originating from the ninth left rib. Biopsies taken from the mass indicated an atypical pulmonary carcinoid metastasis, with a proliferation index (ki67) of 10%. A bone "whole-body" scan with 99mTc-HDP revealed multiple osteogenic foci of high uptake located in several vertebrae, the rib cage and in the pelvic bones, suggestive of bone metastases. ***Results:*** The patient underwent a positron emission tomography with computed tomography (PET-CT) scan with [18F]-FDG to further assess the disease extension, which revealed multiple active lesions located in the thyroid, pancreas, liver and bone. The thyroid had multiple heterogeneous, hypodense lesions avid for [18F]-FDG with a SULmax up to 5.83. In the liver there were several hypodense lesions, the biggest and the most active located at the limit of the second and third hepatic segment, with a SULmax of 4.82 and diameter of 23/25 mm. In the pancreas there was an expansive solid mass, located at the conjunction of the istm and pancreatic body with a diameter of 13/12 mm, that showed a moderate glucose uptake (SULmax of 2.0)1. The numerous bone metastases previously described, showed high avidity for [18F]-FDG. Biopsies from the thyroid lesions suggested pulmonary well-differentiated carcinoid metastasis (Ki67 of 2%, Chromogranin A and Synaptophysin positive), while the pancreatic biopsy displayed inflammatory histological features. The patient is undergoing chemotherapy, with the last bone scan showing no new focal lesions. ***Conclusion:*** The findings of our case report emphasizes the importance of [18F]-FDG PET-CT scan in the long-term management of typical pulmonary carcinoid tumors, as it displays heterogeneity of differentiation; [18F]-FDG PET-CT can detect various metastases even those who showcase a low proliferation rate and with an unusual localization, hence modifying the therapeutic strategy. Keywords: pulmonary carcinoid, distant metastases, [18F]-FDG PET-CT.

EP-1146.

Amyloidosis Insights: Right Ventricle and Atrial Radiolabelled Bisphosphonates Uptake in Cardiac Scintigraphy

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Aim/Introduction: Atrial and right ventricular uptake on cardiac scintigraphy is not yet routinely analyzed when a patient with suspected cardiac amyloidosis (CA) is evaluated. This is a new topic that may shed more light on prognosis of the disease. The aim of this case report is to raise awareness of these issues so that the diagnostic algorithm and the best method of treatment can be determined. ***Materials and Methods:*** We present a case of an 86-year-old male patient whose echocardiography suggested hypertrophic cardiomyopathy: left ventricular thickness with mild ventricular dysfunction - ejection fraction 45%, biatrial and right ventricular dilatation. The patient had a history of paroxysmal atrial fibrillation (AF), but at his last hospitalization ECG showed sinus rhythm with left axis deviation, left bundle branch block and secondary repolarization changes. ***Results:*** "Whole body" scan with subsequent SPECT/CT was performed after intravenous administration of 99m-Technetium-Hydroxydiphosphonate. Planar and "whole-body" scans showed intense extraosseous uptake in the cardiac projection area with a visual Perugini score of 3 and a heart-contralateral lung ratio of 2.3. High diffuse biventricular and mild right atrial uptake of radiotracer were noted on SPECT/CT.Recent research in the field of CA suggests that the extent of right ventricular impairment may be critical in fully assessing the disease and determining the most effective treatment strategy. Patients with biventricular uptake are associated with extensive amyloid accumulation and often have poor overall outcome and reduced life expectancy[1]. Some recent research suggested that atrial bisphosphonates uptake, especially in the left atrium, is linked with atrial fibrillation[2]. In our case, bisphosphonates uptake was only detected in the right atrium wall.This could be interpreted as a consequence of mechanical stress on the heart as well as an indicator of progressive disease, considering that the patient had a history of paroxysmal AF. ***Conclusion:*** Scintigraphy with radiolabelled bisphosphonates is a suitable, non-invasive method for the detection of TTR amyloid deposits in the heart muscle, which allows successful differentiation between various forms of CA. In particular, distribution of bisphosphonate uptake can be of prognostic significance, especially if detected in the right ventricle or the atrial wall. ***References:*** 1. Dorbala, Sharmila. "Right Ventricular Bone-Avid Tracer Uptake: A Novel Risk Marker in Transthyretin Amyloid Cardiomyopathy." Circulation, vol. 149, no. 15, 2024, pp. 1169-71. 2. Hussain, Muzna, et al. "Association Between Atrial Uptake on Cardiac Scintigraphy With Technetium-99m-Pyrophosphate Labeled Bone-Seeking Tracers and Atrial Fibrillation." Circulation. Cardiovascular Imaging, vol. 15, no. 5, 2022.

EP-1147

The diagnostic value of Tc99m-human serum albumin scintigraphy in the investigation of Protein Losing Enteropathy

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Aim/Introduction: The Tc 99m-human serum albumin (HSA) scintigraphy is a noninvasive method, with low radiation exposure, low cost, easily accessible and can be used to detect Protein losing enteropathy(PLE) ***Materials and Methods:*** We report a case of a 54-year-old man with PLE, who was hospitalized due to generalized edema, ascites, and several hypoalbuminemia(1,7mg/dl). Cardiac insufficiency, cirrhosis, and nephrotic syndrome have been excluded. The measurements of fecal alpha-1-antitrypsin were increased. As part of the PLE, a series of examinations were performed. Further investigation was requested with HSA-Tc 99m scintigraphy. The radiolabeling of the HSA with 99mTc is not well established and there is no available kit so it was done in vitro labeling. The protocol used contained 0.1mg of HSA, stannous chloride 0.2 mg mixed with 30mCi Na 99mTc04.The labeling efficiency and stability were determined with TLC developed in acetone. The patient was placed in a supine position under the gamma camera. The region of interest was the abdominal region. After intravenously injection of 30mCi HSA -Tc99m dynamic images started immediately. Serial static images were obtained for the first 30 min and at 1,2,4,6 and 24 h. In order to obtain more anatomical information, SPECT imaging was performed at the 1st and 3rd hour and abdomen computer tomography (CT) was performed before and after the administration of gastrografin. ***Results:*** Physiological activity is visible in the liver, spleen, kidneys, bladder and blood vessels. No uptake by stomach and thyroid was noted. In the HSA -Tc 99m scintigraphy, increased uptake of the radiopharmaceutical was observed in intestinal in the left abdominal quadrant. The findings were correlated with those from the CT before and after administration of gastrografin, indicating involvement of the jejunum region. The patient underwent mesenterium laparoscopic biopsy followed by intraoperative full intestine endoscopy and excision of 10 cm length of jejunum. Pathology evaluation revealed lymphoid follicles and polyclonal plasmocytic infiltration in the mesenterium whereas jejunum biopsies revealed non-specific inflammation and moderate lymphatic vessel dilation. The patient was given iv methylprednisolone and showed significant clinical improvement with normalization of a1 antithrypsin levels in the stool. ***Conclusion:*** PLE is characterized by a loss of serum protein into the gastrointestinal tract (GIT)due to different etiologies. Localizing the site of protein loss in the GIT is very important for diagnosis and therapeutic management and in this direction can help the Tc99m-HSA scintigraphy.

EP-1148

Case report: unveiling an infrequent metastatic site in differentiated thyroid cancer with iodine-124 PET/CT

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Aim/Introduction: Differentiated thyroid cancer (DTC) typically has a favourable prognosis1; standard of care treatment may include total thyroidectomy followed by radioactive iodine (RAI) therapy.

Distant metastases can occur in a small percentage of cases, most commonly involving the lungs and skeleton. Renal metastases are rare and tend to occur years after primary tumour resection, most often in female patients aged >45 years, and usually in the setting of multifocal metastatic disease2. Conventional peri-RAI imaging includes iodine-123 or -131 whole-body SPECT/CT, however iodine-124 PET/CT has also emerged as a valuable tool for staging and detecting DTC lesions with higher accuracy2. This advanced technique allows for an individualised treatment approach, and we present here a case highlighting its use in an uncommon metastatic presentation. ***Materials and Methods:*** A 68-year-old female with follicular thyroid carcinoma underwent two-stage thyroidectomy, followed by RAI in 2017 (3.7 GBq/100mCi) and 2019 (5.5 GBq/148.6mCi; cumulative dose 9.2GBq/248.6mCi). In 2020, she presented with a progressive rise in serum thyroglobulin (Tg), and FDG PET/CT revealed a lytic lesion in the left femur which was treated with stereotactic radiotherapy. In 2023, she presented with a new, rising Tg level, increasing >10-fold in under 12-months. ***Results:*** Paired iodine-124 and FDG PET/CTs were performed, revealing iodine-avid osseous metastases in the right mandible, a right-sided rib, and left proximal femur. Additionally, at least three iodine-avid soft tissue lesions were present involving both kidneys, with no definite structural changes visualised on low-dose CT. Only the left femur lesion was minimally FDG-avid. Subsequently, the patient received another 7.3 GBq (197.3mCi) of RAI; the post therapy scan revealed moderate-to-intense uptake at the dominant left upper pole renal lesion (SUVmax 47.8), with mild activity in the remaining right renal lesions (SUVmax 9.6) and osseous metastases. ***Conclusion:*** In our patient, I-124 PET/CT revealed a rare DTC metastatic site involving bilateral kidneys which may otherwise have gone undetected. I-124 PET/CT is a valuable addition for staging of patients with recurrent DTC, in this case outperforming conventional imaging techniques2. In our institution, pre-RAI I-124 PET/CT staging is our standard clinical practice. ***References:*** 1. Song HJ, Xue YL, Xu YH, Qiu ZL, Luo QY. Rare metastases of differentiated thyroid carcinoma: pictorial review. Endocr Relat Cancer. 2011 Aug 30;18(5):R165-74. doi:10.1530/ERC-11-0068. PMID:21632805.2. Zampella E, Klain M, Pace L, Cuocolo A. PET/CT in the management of differentiated thyroid cancer. Diagn Interv Imaging. 2021 Sep;102(9):515-523. doi:10.1016/j.diii.2021.04.004. Epub 2021 Apr 27. PMID:33926848.

EP-1149

Omental Hernia as a Potential Cause of False Positive GI Bleeding on Tc-99m RBC Scintigraphy

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Aim/Introduction: Gastrointestinal bleeding scintigraphy is a noninvasive study used to determine the presence of active bleeding, localize the bleeding site, and estimate the bleeding volume for prognostic purposes in patients with suspected gastrointestinal bleeding. However, it is important to note that false positive results can occur due to various reasons. This case highlights the significance of considering anatomical anomalies and non-bleeding pathologies such as an omental hernia when interpreting 99mTc-RBC scintigraphy results for gastrointestinal bleeding. ***Materials and Methods:*** A 45-year-old woman recently diagnosed with obscure gastrointestinal bleeding was referred to our center for 99mTc-RBC scintigraphy for additional assessment. Dynamic images were taken for 60 minutes and the SPECT/CT acquisition was performed at the end of early dynamic images at 60 minutes. Delayed dynamic images was also taken every 3 hours for 20 minutes till 24 hours. ***Results:*** The early dynamic images showed an accumulation of radiotracer in the hypogastric region, which was remained unchanged over time. The zone of 99mTc-RBC uptake was also evident on delayed dynamic images. The CT component of the study revealed that the zone of activity was localized to a fat density mass in the abdominal wall, which was determined to be an omental fat herniation. It is important to note that the patient had a history of hysterectomy for a non-cancerous condition, and the physical examination showed an abdominal bulge in the hypogastric region, which had been previously confirmed as an omental hernia through an ultrasound examination. ***Conclusion:*** Omental hernias are rare conditions that can be difficult to diagnose. They occur when omental fat protrudes through an opening in the abdominal wall or into another part of the abdomen, potentially leading to complications such as bowel obstruction or strangulation. Gastrointestinal bleeding is a common clinical issue that requires prompt and accurate diagnosis. 99mTc-RBC scintigraphy is a valuable tool for localizing the source of bleeding in patients with obscure gastrointestinal hemorrhage. However, false positive results can occur due to various factors, including anatomical anomalies and non-bleeding pathologies. Other potential pitfalls which have been reported include varices, abdominal/gluteal hematomas, aortic aneurysms, and hemangiomas. In this case, the omental hernia caused compression on adjacent blood vessels, resulting in altered blood flow and mimicking gastrointestinal bleeding on 99mTc-RBC scintigraphy. This case emphasizes the importance of considering anatomical anomalies and non-bleeding pathologies when interpreting 99mTc-RBC scintigraphy results for gastrointestinal bleeding.

EP-1150

Non-malignant 68Ga-FAPI-46 uptake in two cases of TENIS syndrome: comparison with ^{18}F-FDG

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Aim/Introduction: TENIS syndrome, characterized by elevated thyroglobulin levels and negative iodine scintigraphy, poses a diagnostic challenge in thyroid cancer management. While 18F-FDG PET/CT has traditionally been the standard imaging modality for assessing TENIS syndrome, recent studies have shown promising results with 68Ga-FAPI PET/CT. This novel imaging technique targets fibroblast activation protein and has emerged as a potential alternative for these cases. However, it is important to understand the potential pitfalls and limitations of 68Ga-FAPI PET/CT. This case report aims to highlight some of these pitfalls and challenges, comparing the findings with concurrent FDG PET/CT. ***Materials and Methods:*** Two middle-aged women with a history of TENIS syndrome and high serum thyroglobulin levels underwent both 68Ga-FAPI-46 PET/CT and 18F-FDG PET/CT scans to search for possible metastasis sites. ***Results:*** Neither the 68Ga-FAPI PET/CT nor the 18F-FDG PET/CT scans revealed any suspicious tumoral involvement. However, a few non-malignant uptakes were observed on the FAPI study. The atrophic parotid gland exhibited FAPI uptake, which was not consistent with the FDG scan. This finding correlated with chronic parotiditis observed on the CT images. Additionally, increased uptake was observed in the gallbladder on the FAPI scan, while no uptake or pathological findings were seen on the FDG or CT images. Intense uptake in the FAPI scan and moderate FDG uptake were

observed in the degenerative changes of the L5-S1 facet joint, with sclerotic changes visible on the CT images. The uterus demonstrated intense uptake in the FAPI scan, while only mild uptake was seen in the FDG, and no underlying pathology was evident on the CT images. It is important to note that this post-menopausal woman had no history of gynecological disease. ***Conclusion:*** Fibroblast activation protein inhibitor (FAPI)-targeted radiopharmaceuticals are being explored as potential alternatives to FDG for tumor-specific imaging. However, it has been observed that these radiopharmaceuticals can also accumulate in benign diseases and normal tissues. This is due to the expression of fibroblast activation protein (FAP) during various physiological processes such as embryogenesis, wound healing, inflammation, and fibrosis. Therefore, when interpreting a FAPI study, it is crucial to consider non-malignant causes of FAPI uptake.

EP-1151

Silent Right Coronary Hypoplasia in Young Adult. A SPECT MPI Case Report

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Aim/Introduction: Coronary artery anomalies (CAAs) are congenital malformations with potential for serious consequences. Right coronary artery hypoplasia (RCAh), a specific type, can present with diverse symptoms or remain silent. Tragically, undiagnosed CAAs have been linked to sudden cardiac death in young athletes, highlighting the need for early detection. Noninvasive imaging, like SPECT myocardial perfusion, aids in diagnosis, assessment and risk stratification (1-3). ***Materials and Methods:*** We present a 22-year-old male recently diagnosed with incomplete right bundle branch block (iRBBB) on a routine medical checkup; he was subsequently referred for a thorough cardiovascular investigation. CT Angiography confirmed RCAh with superdominant left coronary artery (LCA). He subsequently underwent Myocardial Perfusion Imaging (MPI) SPECT. We followed a 1-day stress-rest MPI SPECT protocol with 8mCi/20mCi of 99mTc-SESTAMIBI. Image acquisition was EKG gated. Image processing and review was done using a commercial FDA approved software while interpretation was done following the EANM guidelines. Additionally, stress MPI surface volume was fused with the coronary tree from the CT coronary angiography to better visualize the anatomy-perfusion relationship. ***Results:*** Despite no symptoms, MPI stress testing revealed a mild chronic infero-septal hypoperfusion with moderate ischemia (Summed Difference Score = 6) at stress in the RCA territory, in accordance with the anatomical anomaly. The ischemic deficit was 9% of the left ventricle, with 6% attributed to the RCA territory. Gated stress images showed impaired endo-systolic thickening in the same region with slight septal hypokinesis that improved at rest. Stress and rest left ventricle ejection fraction (LVEF) were 58% and 59% respectively with a transient ischemic dilatation (TID) index of 1.02. ***Conclusion:*** Despite his young age and lack of overt symptoms, SPECT MPI identified moderate ischemia in this patient with RCAh. This finding, combined with the anatomical anomaly, underscores the importance of early diagnosis and risk stratification in individuals with CAAs, particularly young athletes or individuals pursuing careers involving physical activity.

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EP-1152

Exceptional Finding: Thigh Myxofibrosarcoma Metastasizing to the Breasts

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Aim/Introduction: Myxofibrosarcoma is a rare type of soft tissue sarcoma that typically arises in the extremities of elderly patients. Metastasis to distant sites is uncommon, with the lungs being the most common site of spread followed by regional lymph nodes, pleura and bone. Here we are reporting what we believe to be the first case of myxofibrosarcoma originating in the thigh and metastasizing to the breast. ***Materials and Methods:*** A 60-year-old woman with a documented history of myxofibrosarcoma originating in the left thigh was referred to our facility. The patient underwent limb amputation, followed by chemoradiotherapy, and has been regularly monitored using conventional imaging modalities. In the most recent CT scan, concerning lesions were identified in the right lung, along with masses in both breasts. To further evaluate these findings and explore potential metastatic sites, a whole-body FDG PET/CT scan was conducted. ***Results:*** The FDG PET/CT scan revealed a hypermetabolic metastatic pulmonary nodule in the upper lobe of the right lung. Additionally, a few breast masses with mild metabolic activity and signs of pectoralis muscle involvement on the left side were observed bilaterally. Given the rarity of distant metastasis in myxofibrosarcoma, particularly to the breast, the patient was referred for a biopsy to investigate the possibility of secondary cancer. Surprisingly, the core needle biopsy of the breast masses and immunohistochemistry findings indicated metastatic myxofibrosarcoma with the primary tumor originating in the thigh. Subsequently, the patient underwent chemotherapy, leading to the observed shrinkage of the masses on the follow-up CT scan. ***Conclusion:*** We report the very first case of myxofibrosarcoma originating in the thigh and metastasizing to the breast. This case highlights the importance of considering unusual sites for metastasis in patients with soft tissue sarcomas. Further research is needed to better understand the mechanisms underlying metastasis in these tumors and to improve treatment outcomes for patients with advanced disease.

EP-1153

Chylous Ascites Flare-Up Revealing Cirrhosis: Role of Lymphoscintigraphy

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Aim/Introduction: Chylous ascites (CA) is defined as a leakage of triglyceride-rich lymph into the abdominal cavity, with an accumulation of lipid-rich, milk-like peritoneal fluid. The diagnosis of CA is made on the basis of clinical symptoms, and confirmed by an analysis of the fluid obtained by abdominal puncture. CA results from diverse underlying cause such us postoperative complications, cirrhosis, and malignancies. The lymphoscintigraphy stands out due to its ability to visualize the lymphatic system, and offers precise localization of anatomical defects in the lymphatic system associated with chyloperitoneum when combined with SPECT-CT. We present the case of a patient who developed chylous ascites after laparoscopic surgery in which lymphoscintigraphy was used to exclude the diagnosis of chylous ascites. ***Materials and Methods:*** Single-case study was conducted on a 15-year-old boy with abdominal adenopathies of unknown origin. He underwent a biopsy excision of the hepatic hilum adenopathies along with a cholecystectomy due to the discovery of a multilithiasic gallbladder. In the immediate postoperative, he presented an abdominal distension. A liquid puncture was realized showing a milky fluid rich in triglycerides; confirming the suspicion of chyle leak for which he was placed on a low-fat diet. Meanwhile the patient developed cholestasis icterus with progressive liver failure. The diagnosis of cirrhosis was confirmed by a liver biopsy. Lymphoscintigraphy was performed after the injection of 0.2ml of 37MBq 99mTc-Nanocolloids, using a tuberculin syringe, under sterile conditions, at the level of the first interdigital space of both feet. Static acquisitions were performed during 7 hours and repeated after 24h, in order to localize the lymphatic breach. ***Results:*** The lymphoscintigram showed fairly prompt ascent of radio colloid up both lower limbs, with the absence of pathological accumulation of radiotracer in the abdominal cavity excluding the presence of chyloperitoneum. We also noted the absence of physiological visualization of the hepatic area compatible with cirrhosis.Our findings were confirmed by second analyses of the peritoneal liquid that showed a normalization of the triglycerides level. ***Conclusion:*** Lymphoscintigraphy should be considered as a valuable tool in the management of CA thanks to its capability to whole-body assessment of lymphatic vessels in all three spatial planes. This non-invasive technique allows the identification of the site of lymphatic leakage in order to promptly begin the correct therapy, and also to eliminate with certitude a doubtful diagnosis of chylous peritoneum.

EP-1154

Intense Uptake of 68Ga-DOTANOC Unveils High Somatostatin Receptor Expression in a Follicular Lymphoma

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Aim/Introduction: Somatostatin receptor (SSTR) imaging with 68Ga-DOTA-conjugated peptides is the gold standard imaging method to detect differentiated neuroendocrine tumors (NETs). SSTR expression by lymphomas has been reported in the literature, although their expression is significantly lower when compared to NETs. ***Materials and Methods:*** We present a case of a 44-year-old female patient, who started to refer left lower back pain with inguinal/hypogastric irradiation, along with drenching night sweats, and sporadic self-limited (2 to 5 minutes) episodes of palpitations associated with thoracic discomfort, nausea and dizziness. Blood pressure was normal and other symptoms were denied, namely headaches. There was no prior relevant clinical background. Regarding family history, the patient had a sister who died from renal carcinoma, and two second cousins diagnosed with pituitary adenoma and glioblastoma. An abdominal/pelvic CT was performed and a 6 cm, well-defined, left para-aortic bulky mass at L1-L2 level suspicious of a paraganglioma was discovered. Analytical parameters were normal, including endocrine tumor markers and urine amine levels. The 68Ga-DOTANOC PET/CT showed intense radiotracer uptake in the retroperitoneal mass (SUVmax 23.8), as well as in a small para-aortic lymph node. ***Results:*** Laparoscopic surgical excision of the bulky lesion was performed, and histological results revealed a grade III-A Non-Hodgkin Follicular Lymphoma. Other studies were performed to complete staging, including an 18F-FDG PET/CT, which revealed high uptake on three para-aortic lymph nodes (SUVmax 9.3). The patient underwent 6 cycles of chemotherapy, and a complete metabolic response was documented on 18F-FDG PET/CT. Until this date, the patient remains disease-free, after a 3-year follow-up time. ***Conclusion:*** This case report demonstrates the importance of keeping differential diagnosis in mind when reporting 68Ga-DOTANOC PET/CT scans, and alerts to the potential risk of misinterpreting other tumors as NETs, if a representative biopsy is unavailable. The expression of SSTRs by lymphomas remains a subject that needs further study, particularly uptake specificity among different lymphoma subtypes. Additional investigation is also required to understand if PRRT could represent a valid treatment option for lymphoma subtypes with higher SSTR expression, namely as a palliative intent.

EP-1155

Mapping the uncharted:FDG PET/CT detection of breast cancer metastases to rare anatomical sites

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Aim/Introduction: Breast cancer is the most common malignant neoplasm in women resulting in high mortality and morbidity. Breast carcinoma comprises a heterogeneous array of diseases characterized by varied tumoral behavior, treatment responsiveness, and prognosis, up to 30% of patients develop metastatic disease during progression or follow-up. Breast cancer can disseminate to various organs, with prevailing metastatic sites encompassing bone, lungs, liver, and skin. The metastasis of breast cancer to atypical anatomical sites can pose a diagnostic conundrum. Discerning the diverse presentations of metastatic breast disease is pivotal in directing patient care and prognostication. Here we report a case of Carcinoma breast with cutaneous and pancreatic metastasis. ***Materials and Methods:*** A 31 year old female with no comorbidities presented with lump in left breast since 6 months.There was no h/o associated pain/nipple discharge/lump in opposite breast.HRSG both breasts was done which revealed large ill defined multicystis multiloculated collection with low level internal echoes and thin sepate within and subcutaneous edema in left breast with enlarged left axillary lymph nodes.Histopathological examination was suggestive of carcinoma left breast.IHC was suggestive of triple negative and Ki67:80%.In view of severe bone pain, Bone scan was done which revealed increased bone turnover suggestive of underlying bone metabolic disease and there was increased focal osteoblastic activity involving inferior angle of left scapula and distal 1/3rd shaft of left femur in anterior cortical/subcortical region without cortical disruption which revealed probability of malignant lesion as low.Patient underwent left MRM followed by 9 cycles of CT and

16# radiotherapy. ***Results:*** FDG PET/CT was done to assess disease status. PET-CT revealed FDG avid well-defined few (2 in number) soft tissue lesions in right breast with cutaneous thickening. Also noted was FDG avid left supraclavicular and left axillary level I and II lymph nodes. There were multiple FDG avid cutaneous deposits in the right anterior and left lateral chest wall with a well-defined hypodense lesion in the tail of the pancreas which on further biochemical and histopathological correlation came out as metastatic disease. ***Conclusion:*** This case endeavors to elucidate the imaging characteristics of uncommon/ infrequent sites of breast metastases through this captivating case, thereby revisiting this rare clinical phenomenon. FDG PET/CT stands as a pivotal asset in the orchestration of breast carcinoma management. Its significance spans across staging, evaluation of treatment response, and post-treatment surveillance, enriching patient care through the provision of vital insights crucial for treatment strategizing and surveillance.

EP-1156

Ga-68 PSMA Brain Parenchyma Uptake in Encephalomalacia Secondary to Ischemia

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Aim/Introduction: Prostatespecific membrane antigen (PSMA) is a type-II transmembrane glycoprotein that is overexpressed in prostate cancer(PCa). Ga-68 PSMA PET/CT is a modality that is increasingly used in PCa cases. Although initially believed to be specific to the prostate, PSMA radioligand uptake has subsequently been reported in a variety of nonprostatic disorders. We present a rare finding of PSMA radioligand uptake in the brain parenchyma in a 57-year-old male with encephalomalacia secondary to previous ischemia. ***Materials and Methods:*** The patient was diagnosed with PCa (Gleason score 4+5) in 2017. He received radiotherapy and hormonotherapy and was followed up with Ga-68 PSMA PET/CT. In the PET/CT imaging performed in January-2024, no PSMA avid lesion was detected, which would suggest the presence of a malignant focus. However, radiotracer activity was observed in the patient's right parietal cortex. Retrospective examinations showed that the patient had been admitted to the hospital in February-2023 with complaints of loss of strength in the left arm and leg, as well as slurred speech. Radiological imaging performed during this period revealed findings that were secondary to acute ischemia in the right brain hemisphere. In the follow-up imaging, a hypodense area compatible with encephalomalacia secondary to ischemia was observed at the parietal lobe level of the right cerebral hemisphere. ***Results:*** The use of PSMA-labeled radiotracers has revealed that PSMA expression is not specific to PCa and can also occur in other conditions. This can lead to potential complications in the interpretation of PSMA-targeted imaging. Ga-68 PSMA PET/CT is an effective diagnostic tool in the detection of brain metastases and primary brain tumors because normal brain tissue does not show any significant uptake of PSMA tracer due to the intact blood-brain barrier. However, if there is a defect in the blood-brain barrier, it can lead to the accumulation of the tracer at the site of infarction/bleeding, which can mimic brain metastasis. This is because the increased permeability of the tracer and the neovascularization process that occurs in such regions can lead to nonspecific tracer avidity. Therefore, it is essential to note that unexpected PSMA radioligand retention can occur in the brain parenchyma after ischemic events. Hence, it is crucial to take a detailed anamnesis to help interpret unexpected findings, such as this condition. ***Conclusion:*** Nuclear medicine physicians should keep such alternative clinical situations in mind, as misinterpretation of PSMA PET/CT studies may lead to unnecessary further examination and/or treatment.

EP-1157

Dramatic response of multiple skeletal metastases of PTC to a single dose of radioiodine proved by FDG PET/CT and FAPI PET/CT

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Aim/Introduction: Thyroid cancer is a prevalent endocrine malignancy that often leads to bone metastases in advanced stages. Radioactive iodine therapy using I-131 is a well-established treatment for differentiated thyroid cancer, targeting residual thyroid tissue and distant metastases. However, the response to I-131 therapy in patients with bone metastases can vary. This case report aims to document a significant response to I-131 therapy in a patient with thyroid cancer and bone metastases. ***Materials and Methods:*** A middle-aged woman with a history of papillary thyroid carcinoma (PTC) and total thyroidectomy was referred to our center for radioiodine therapy. Based on her high-risk status and stimulated serum thyroglobulin (Tg) levels, she received 150mCi of I-131. The post-treatment scan revealed thyroid remnant in the left thyroid bed and multiple bone metastases. Interestingly, these bone metastases did not show any changes in the corresponding CT slices of SPECT/CT images. The patient's serum Tg levels started to decrease and reached 1.35 ng/dL after a year. Another 200 mCi of I-131 was administered to treat the known metastatic disease. Surprisingly, the post-treatment scan showed tracer accumulation only in the left parotid gland, with no evidence of metastasis elsewhere in the body. ***Results:*** The patient was monitored with ultrasonography and serum Tg levels, which remained stable and normal, respectively. A diagnostic whole-body iodine scan yielded negative results. Additional scans using ^{18}F-FDG PET/CT and 68Ga-FAPI showed no uptake at the previously detected metastatic sites. ***Conclusion:*** This case report highlights the effectiveness of radioiodine therapy in treating metastatic PTC, with potential for cure. The response to treatment can vary depending on factors such as radiosensitivity, disease extension, and patient characteristics. Early detection of distant metastasis is crucial for a better treatment response. The absence of structural lesions at the metastatic sites suggests that they may be located in the marrow, making them more susceptible to I-131. This case underscores the importance of early detection and treatment for a more effective response to therapy. In conclusion, this case demonstrates the successful use of radioiodine therapy in treating metastatic PTC, with potential for cure. It also emphasizes the significance of regular monitoring and early detection of distant metastasis for an improved treatment response. Further research is needed to determine the optimal treatment approach for patients with TENIS syndrome and differentiated thyroid cancer.

EP-1158

F^{18}-FDG PET/CT in primary malignant melanoma of the cervix uteri

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Aim/Introduction: Primary malignant melanoma of the cervix uteri has only been reported in a few cases in the literature,

especially in those examined using F^{18}-FDG PET/CT. Despite its rarity, F^{18}-FDG PET/CT is deemed crucial in the management of cervical melanoma, serving as a vital imaging modality for primary staging, detecting distant metastases, and ruling out metastasis from a primary melanoma elsewhere in the body. We present a rare case of a woman diagnosed with malignant melanoma of the cervix uteri. ***Materials and Methods:*** A 54-year-old woman presenting with vaginal bleeding and abdominal pain underwent gynecological examination, revealing a large pelvic mass in the cervix uteri. Biopsy was performed, confirming the presence of malignant melanoma supported by immunohistochemical positivity for MelanA and SOX10. A F^{18}-FDG PET/CT scan was conducted for primary staging, revealing metastatic disease with a sizable pelvic tumor mass with pathologically increased uptake along the border and central areas, indicative of a centrally necrotic organ-spanning cervical tumor. Pathological F^{18}-FDG uptake in metastatic sites such as the lung, liver, bone, lymph nodes, and intramedullary regions was observerd. ***Results:*** Malignant melanoma of the cervix uteri is exceedingly rare, with poor prognosis often due to late diagnosis. Diagnosis and treatment remain challenging due to limited clinical studies, but surgery is the preferred option. Prognosis is heavily influenced by the FIGO stage at diagnosis. This abstract emphasizes the importance of imaging modalities like F^{18}-FDG PET/CT in diagnosis, staging, and treatment evaluation, particularly in the context of emerging immunotherapies for advanced or metastatic melanoma. Additionally, F^{18}-FDG PET/CT plays a significant role in assessing melanoma therapy response, particularly in patients receiving advanced or metastatic melanoma treatments like immunotherapies. ***Conclusion:*** This case highlights the utility of ^{18}F-FDG PET/CT in rare cases such as primary malignant melanoma of the cervix uteri, providing important molecular insights into the extent and activity of the disease. This non-invasive imaging technique aids in treatment selection and response assessment.

EP-1159

Rare involvement of Tarsal, Metatarsal and Phalanges in a Case of Erdheim Chester disease.

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Aim/Introduction: Erdheim-Chester disease (ECD) is a rare entity. ^{18}F-FDG avid involvement were seen in most of the long bones as expected with involvement of flat bones below ankle which is extremely rare finding. ***Materials and Methods:*** none ***Results:*** A 46 year male who is a known case of Erdheim-Chester disease (ECD) was referred for PET/CT to look for the extent of disease. On FDG PET/CT (A) the MIP image showed increased FDG uptake in multiple appendicular long bones and right scapula. (B and C) Axial PET/CT showed increased FDG uptake with sclerosis of bilateral calcaneum and talus. (D and E) Axial PET/CT showed increased FDG uptake with sclerosis of left navicular bone. (F and G) Axial PET/CT showed increased FDG uptake with sclerosis of left first phalynx.Erdheim-Chester disease (ECD) is a type of non-Langerhans's cell histiocytosis with multi-system involvement with almost 50% of the patient showing BRAFV600E mutation leading to histiocytosis pathogenesis of inflammation and fibrosis due to activation of mitogen-activated protein kinase pathway. Almost 95% of the patients present with skeletal involvement. Involvement of ECD is commonly noted in long bones with very rare reports of involvement below ankle joint,. Symmetrical sclerosis of the metaphysis and diaphysis of the long bones are considered pathognomonic radiological changes for ECD.We report a case of ECD with rare bilateral involvement of bones below the ankle. ***Conclusion:*** This case highlights the use of ^{18}F FDG PET-CT in rare diseases like Erdheim-Chester disease to evaluate the extent of disease to rare sites like below ankle involvement.

EP-1160

Splenic Angiosarcoma: A Rare Case

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Aim/Introduction: Angiosarcoma accounts for approximately 1% of soft tissue sarcomas, itself being a rare malignancy. They are aggressive tumors originated from lymphatic or vascular endothelial cells. Treatment is challenging, and prognosis is poor; especially in cases with metastasis at the time of diagnosis. Here, we present a rare case of splenic angiosarcoma detected with F^{18} FDG PET/CT. ***Materials and Methods:*** A 54-year-old female presented to an external center with complaints of fatigue and weakness. After detection of pancytopenia, abdominal ultrasound has been performed and it revealed splenomegaly, with the spleen measuring 135x75 mm. Within the splenic parenchyma, iso-hypoechoic lesions with a thin peripheral halo, the largest measuring 47x44 mm, were observed. Bone marrow biopsy revealed a neoplasm composed of spindle cells with eosinophilic cytoplasm, hyperchromatic nuclei lacking distinct nucleoli, staining positive for CD34, CD31, ERG, FLI-1, and CD99, reported as compatible with angiosarcoma. F^{18} FDG PET/CT images obtained at our clinic revealed significantly enlarged spleen with increased metabolic activity within multiple hypodense nodular lesions, predominantly hypometabolic (necrotic?) in the upper mid-section (SUVmax: 8.06). Skeletal involvement included lytic/sclerotic lesions in the sternum, vertebral column, both humeri, pelvic bones, both femurs, and proximal bilateral tibiae, with diffuse intense increased metabolic activity involving bone/bone marrow (SUVmax: 8.73). The patient was diagnosed with metastatic splenic angiosarcoma and received GCSF + 6 cycles of paclitaxel therapy. Response evaluation is planned at the end of treatment. The patient is currently under Oncology Clinic follow-up. ***Results:*** While the etiology of angiosarcoma is not fully understood, risk factors such as chronic lymphedema, history of radiation exposure, environmental carcinogens, and certain familial syndromes have been reported. The most common sites of involvement are the skin, breast, bone, and liver. Splenic involvement has been reported in a limited number of cases in the literature. ***Conclusion:*** When anemia of unknown cause and accompanying splenomegaly are detected, splenic angiosarcoma should not be overlooked in the differential diagnosis when evaluating F^{18} FDG PET/CT images.

EP-1161

Cardiac metastases in Malignant Melanoma Detected on FDG PET/CT

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Aim/Introduction: Cardiac metastases is usually found in 6-20 % of autopsies with malignant melanoma leading to 4.4 % of these cardiac metastases and other causes being lymphoma, sarcoma and leukaemia. Malignant Melanoma is the tumor with the highest propensity for hematogenous spread to the heart, with

autopsies in melanoma demonstrating cardiac metastases in up to 65 % of the cases.We present a case of malignant melanoma with cardiac metastases in ^{18}F-fluorodeoxyglucose positron emission tomography PET/CT scan. ***Materials and Methods:*** none ***Results:*** A 59 year old female patient presented with complaints of bleeding, vaginal discharge and pain in perineal region since last 2 years. MRI pelvis showed a mass lesion arising from vulva favoring a neoplastic etiology. Posterior vaginal growth biopsy was suggestive of malignanat melanoma. Patient underwent posterior exenteration surgery and also received IGRT (Image-guided radiation therapy). FDG PET/CT was done for response assessment and revealed residual metastatic disease with metabolically active primary soft tissue density lesion with hypodensity involving ischiorectal fossa abutting posterior wall of rectum and anal canal (B,F) along with lesions in lungs, bilateral breast , liver , spleen (D,H) ,bones and lymph nodes(involving both sides of diaphragm)and brain(E,I) as shown in maximum intensity projection (A) and tranaxial CT and fused PET/CT slices. An interesting finding was observed with FDG avid lesions in the interventricular septum and left ventricular wall of the heart in transaxial CT and fused PET/CT slices(C,G).Imaging has an critical role in clearly defining the location, extension, and hemodynamic consequences of cardiac metastases. Cardiac MRI helps in pathological tissue characterization within the cardiac muscle and pericardium and in most cases shows inhomogenously hyperintense signal in T1 and T2 weighted images based on melanin content. FDG PET/CT can distinguish pathologic areas from normal myocardial tissue combining anatomical and metabolic information and therefore has typically shown high 18F-FDG uptake in malignant cardiac tumors and vice verse. In this case we would like to accentuate the presence of cardiac metastases in a case of malignant melanoma, which is a rare visualization in routine clinical practice and especially at the site of interventricular septum, which are reported only in few cases in literature.However such a finding of 18F-FDG PET/CT is rarely reported. ***Conclusion:*** This is a rare finding in routine practice and can help nuclear medicine physicians to confidently report rare findings like cardiac metastases in cases with high propensity for such metastatic pattern.

EP-1162

A Case Of Multiple Myeloma Presented In The Pathological Fracture In Ulna

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Aim/Introduction: Multiple myeloma is a malignant neoplasm characterized by the clonal proliferation of abnormal plasma cells in the bone marrow. The average age of patients diagnosed with MM is approximately 70 years. It tends to cause lytic lesions on bone especially in axial skeleton. ***Materials and Methods:*** The 81-year-old female patient without a history of trauma presented to our hospital with complaints of pain in the left forearm for the past three months. The patient, who was observed to have a fracture in the proksimal ulna on X-ray, was referred to our clinic for bone scintigraphy to evaluate for pathological fracture. In the three-phase bone scintigraphy performed, increased activity uptake was observed in the proximal ulna in all three phases. Additionaly focal mild increased activity uptakes were observed in the anterior of the left 2nd costa and the posterior of the 10th costa. In the MRI imaging, a lesion measuring approximately 5x2.3 cm with a soft tissue component causing the fracture in the proximal segment of the ulna, showing mild contrast enhancement, was described, and histopathological correlation was suggested. The pathology of the excisional biopsy of the lesion described in the ulna reported neoplastic cells showing diffuse strong positivity with CD138 and MUM-1 exhibited monoclonal staining with both kappa and lambda, predominantly with kappa, consistent with plasma cell dyscrasia. The patient is under the follow-up of the Hematology clinic with a diagnosis of multiple myeloma. FDG PET/BT was requested for the staging of multiple myeloma. In the F^{18} FDG PET/CT images, a lytic lesion and focal increased FDG uptake were observed in the left 10th rib. No lesion was observed since the ulna was excised and no lesion or FDG uptake was observed in the 2nd costa. Except an isolated lesion in the ulna and a solitary lytic lesion in the costa, there were no findings suggestive of myeloma in other areas of the body. The patient diagnosed with multiple myeloma is under the control of the Hematology Clinic for the treatment and follow-up. ***Results:*** In patients with myeloma, pathological fractures are commonly seen as a result of lytic lesions, especially in the axial skeleton. In our patient, atypical localization of a pathological fracture and findings consistent with multiple myeloma were observed. ***Conclusion:*** Differential diagnosis of multiple myeloma should be considered in older patients presenting with pathological fractures without a history of trauma even in atypical localizations.

EP-1163

Value of F^{18} FDG-PET/CT in a Patient with Positive anti-TIF1 Gamma Antibody

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Aim/Introduction: Dermatomyositis (DM) is a rare systemic disease belonging to the idiopathic inflammatory myopathies. Adult-onset DM with anti-TIF1 gamma antibody is associated with cancers. ***Materials and Methods:*** We present a case of a woman who presented with cutaneous manifestations of adult-onset DM. A fluorodeoxyglucose positron emission tomography/computed tomography (F^{18} FDG PET/CT) was sent to exclude occult malignancy. ***Results:*** F^{18} FDG PET/CT showed abnormal hypermetabolic soft tissue lesions adjacent to the left-sided uterus and along the peritoneal lining, leading to tissue biopsy and a final diagnosis of high-grade serous carcinoma of the ovary. ***Conclusion:*** Our report supported the value of F^{18} FDG PET/CT as a tool for malignancy screening and staging in DM patients with anti-TIF1 gamma antibody.

EP-1164

Intrathymic ectopic parathyroid adenoma in an adolescent patient

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Aim/Introduction: Primary hyperparathyroidism (PHPT) is a relatively rare condition in adolescence, particularly before the age of 14, being adenomas the predominant cause. The clinical presentation varies widely, posing diagnostic challenges. In the case that we present below, we will discuss the clinical presentation, diagnostic evaluation, management strategy, and outcomes of this pathology, aiming to contribute to the understanding and management of PHPT in adolescence ***Materials and Methods:*** A 16-year-old female without significant medical history, with dizziness, was diagnosed of persistent

hipercalcemia and hyperparathyroidism for the last year (Calcium up to 14.9mg/dl and iPTH 732 pg/ml). Cervical and abdominal ultrasound, where normal. Parathyroid scintigraphy showed a hypercaptant lesion in the anterior mediastinum, with differential diagnosis of ectopic parathyroid adenoma, thymoma, teratoma, or lymphoma. Further evaluation was performed, because the patient reported migrainous headaches and vasovagal dizziness of several years, without symptoms of motor plate disease. A PET-CT ^{18}F-FDG was performed revealing a nodular image in the anterior mediastinum with soft tissue density of approximately 3 x 2 cm, without metabolic activity, suggesting thymus. ***Results:*** After discussing the case in a multidisciplinary committee, surgical intervention of the lession was performed without complications. The histopathological findings revealed an intrathymic ectopic parathyroid adenoma with a mitotic index of <1/50 CGA, no necrosis, intact capsule, and a proliferative index (ki67) of <1%, without evidence of malignancy.After surgery calcium and iPTH levels normalized. (calcium 10.2 mg/dl and iPTH 34.1 pg/ml). ***Conclusion:*** we presented a rare case of PHTP in adolescence with an atypical location. We discussed its clinical presentation, diagnostic challenges, and management. Through a multidisciplinary approach involving endocrinology, radiology, nuclear medicine, hematology, and surgery, the patient underwent surgery successfully. Histopathology revealed a benign adenoma. The surgical treatment normalized calcium and iPTH levels. This case underscores the importance of considering unusual causes of hypercalcemia, particularly in young individuals, and highlights the efficacy of a collaborative approach. Further studies and long-term follow-up are warranted to elucidate the optimal management strategies and outcomes in similar presentations ***References:*** 1. Jerushalmi J, Frenkel A, et al. Physiologic thymic uptake of ^{18}F-FDG in children and young adults: a PET/CT evaluation of incidence, patterns, and relationship to treatment. J Nucl Med. 2009 Jun;50(6):849-53. doi: 10.2967/jnumed.108.058586. Epub 2009 May 14. PMID: 19443604
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EP-1165

2-$^{[18F]}$FDG PET/CT Imaging in the diagnosis of Pacemaker Infection: a Case Report

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Aim/Introduction: Infections associated with cardiovascular implantable electronic devices (CIEDs) can pose significant clinical and diagnostic challenges, particularly in patients with complex medical histories and multiple comorbidities. Timely and accurate diagnosis is essential for effective management. PET/CT with 2-$^{[18F]}$FDG (FDG-PET/CT) has emerged as a rapidly evolving diagnostic modality for infectious diseases. Nevertheless, the ideal timing for imaging in CIEDs infection remains uncertain. We aimed to review the role FDG-PET/CT had in identifying a pacemaker infection in a patient with a complex clinical condition. ***Materials and Methods:*** We present the case of a 59-year-old woman with a history of arterial hypertension, dyslipidaemia, type 2 diabetes mellitus, ischemic stroke with residual aphasia and hemiparesis, pacemaker implantation in 2002 (non-functioning) and unexplained complaints of weight loss, evening fever and arthralgia for the previous 6 months. She was admitted into the intensive care unit of our institution with a septic shock of assumed intra-abdominal origin, acute renal injury and haematological dysfunction (severe thrombocytopenia). Initial workup raised suspicion of acute cholecystitis and she was started on empirical antibiotherapy and aminergic support. Blood cultures were positive for multisensitive E.coli and antibiotherapy was switched. However, doubts regarding alternative infection origins remained in clinical assessment, and subacute endocarditis was suspected due to electrocatheter thickening and non-specific mass near the tricuspid valve on transthoracic echocardiography. Due to clinical instability and the risk of iatrogenic complications post-transesophageal echocardiography (TEE), FDG-PET/CT was requested. ***Results:*** FDG-PET/CT demonstrated a pattern strongly suggestive of electrocatheter infection, with hypermetabolism in its intracardiac trajectory, more intense at the tricuspid valve plane, in the region of the left subclavian and up to the pacemaker generator.Tricuspid valve endocarditis originating from an infected pacemaker lead was confirmed through TEE, which revealed an adherent mass to the ventricular electrocatheter compatible with vegetation. Antibiotherapy was adjusted to Ceftriaxone plus Gentamicin and the patient underwent pacemaker excision, which proceeded without complications. The patient remains hospitalised, has currently completed 6 weeks of antibiotherapy and maintains proper rhythm without need for pacemaker re-implantation. ***Conclusion:*** Our case underscores the utility of FDG-PET/CT imaging in diagnosing CIED infections, especially when conventional diagnostic modalities yield inconclusive results or the patient's clinical condition limits more invasive diagnostic methods. By revealing metabolic patterns indicative of infection, FDG-PET/CT was a crucial contribution to effective CIED infection management, underscoring the need for standardised protocols to optimise patient care.

EP-1166

The reason of downstaging in a prostate cancer patient with a superscan like Bone Scan. Over 6 months long post-surgical observation in prostate cancer patient with myelofibrosis.

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Aim/Introduction: The accurate primary staging of prostate cancer prior to primary therapy is crucial, advanced bone metastatic disease is related to less favorable outcome and a different therapeutical approach. Myelofibrosis is a bone marrow condition in which superscan like Bone Scan can occur. ***Materials and Methods:*** A 69-year-old patient diagnosed with prostate cancer (Gleason (4+4) in prostate biopsy) was referred for bone scintigraphy. Whole-body planar scintigrams and SPECT/CT showed increased bone metabolism similar to that seen in the superscan image. In the questionnaire completed before the study, the patient did not mention conditions that could explain the pattern of radiopharmaceutical accumulation. Disseminated skeletal metastasis would disqualify the patient from radical prostatectomy. Due to the relatively low PSA concentration (7 ng/ml) and superscan like image with increased radiotracer uptake in the epiphyseal area, an additional interview was conducted. The patient revealed that he suffered from myelofibrosis (the first diagnosis of bone marrow disease was made about 6 years earlier, then a significantly enlarged spleen was observed, lowering the left kidney). The pattern of increased bone metabolism was caused by this disease. The patient was qualified for laparoscopic

prostatectomy. Systemic treatment (e.g., chemotherapy) adequate to the disseminated process metastatic disease could worsen patient's condition because of myelofibrosis. ***Results:*** Postoperative histopathological examination confirmed prostate adenocarcinoma, Gleason 7(4+3). 3 months after the surgery the PSA concentration was 0.03ng/ml. Such a large postoperative decrease in PSA concentration would not be in the case of advanced skeletal metastases. The patient remains under oncological, urological, and hematological supervision, 6 months after the surgery the PSA concentration was 0.04ng/ml. ***Conclusion:*** Additional medical interview and precise interpretation of the specific pattern radiopharmaceutical accumulation contributed to qualify the patient for surgical treatment. ***References:*** 1.Oon SF, Singh D, Tan TH, Lee A, Noe G, Burbury K, Paiva J. Primary myelofibrosis: spectrum of imaging features and disease-related complications. Insights Imaging. 2019 Aug 7;10(1):71. doi: 10.1186/s13244-019-0758-y. PMID: 31388788; PMCID: PMC6684717.2.EAU Guidelines. Edn. presented at the EAU Annual Congress Milan 2023. ISBN 978-94-92671-19-6.

EP-1167

Bone scan in evaluating isolated alkaline phosphatase elevation: a case-report

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Aim/Introduction: Bone scans (BS) are valuable for assessing bone involvement in malignant, metabolic, and traumatic diseases, as well as investigating clinical/laboratory findings suggestive of bone pathology. Alkaline phosphatase (ALP), primarily produced in the bone and liver, typically elevates alongside other cholestasis markers in hepatic disease. Therefore, isolated ALP elevation is usually seen in bone disease. However, there is no established diagnostic approach for isolated elevated ALP. Our aim was to highlight the crucial role of BS in detecting the etiology of isolated ALP elevation, through a case-report. ***Materials and Methods:*** An asymptomatic 24-year-old man with a history of resolved giant cell hepatitis during infancy, presented with persistent and isolated elevation of ALP on laboratory tests. Previous imaging studies were normal, and no family history of bone disease was identified. Suspecting bone pathology, he was referred for a whole-body BS with [99mTc]Tc-HDP. ***Results:*** The BS revealed diffuse hyperactivity throughout the entire skeleton (skull, right scapula, right humerus, ulnas, ribs, right iliac, femurs and tibias). Given the absence of oncologic history, this pattern of generalized osteoblastic activity suggested a metabolic bone disease. We considered some differential diagnoses:Paget's disease could present with this scintigraphic pattern and is often asymptomatic in younger patients. However, it is not very prevalent in this age group and therefore not the most likely diagnosis.Camurati-Engelmann syndrome, characterized by hyperactivity in the diaphysis of long bones, is usually symptomatic and diagnosed during childhood, making it unlikely in this patient. McCune Albright Syndrome, characterized by fibrous dysplasia, café-au-lait spots, and endocrine pathology, was considered. However, the absence of café-au-lait spots made it unlikely.Fibrous dysplasia without genetic alteration, typically presenting with asymmetric and intense hyperactivity in the skull, scapulas, ribs, iliac bones, vertebral column, and long bones, was considered as a potential and likely diagnosis.The patient was referred to endocrinology, where a thorough clinical examination revealed a small café-au-lait spot on the back. Subsequently, genetic and endocrinologic laboratory tests were requested. The final diagnosis of McCune Albright syndrome was made based on the BS pattern, the observation of a café-au-lait spot, and an increase in TSH, T3, and prolactin levels. ***Conclusion:*** The BS, with its high sensitivity and capability to assess the entire skeleton, plays a critical role in assessing isolated cases of elevated ALP. When combined with medical history, laboratory tests, and other imaging studies, the BS significantly contributes to achieving an accurate diagnosis.

EP-1168

Pathological findings in a Nodular Goitre associated to Basedow's disease induced by Radioiodine (RAI) treatment: a case report

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Aim/Introduction: A 63-years-old male with thyroid nodular goitre and synchronous Basedow's disease without ophthalmopathy on high-dose thyrostatic treatment was referred for RAI after refusing surgery ***Materials and Methods:*** Prior RAI, a large"cold"right nodule(5cm diameter) was investigated with FNAB showing benign cytology: TIR2(according to Italian Thyroid Cytology classification System, 2014).After personalized dosimetry,RAI treatment was performed with 1110MBq of 131I and again six months later, for disease persistence, with 1872MBq of 131I. Stable hypothyroidism was obtained and corrected by oral levothyroxine.One year later, due to tracheal deviation and the onset of compressive symptoms from the right nodule, mini-invasive treatment with Microwave thermoablation was proposed ***Results:*** As ordinary procedure, the nodule was submitted to FNAB which demonstrated: "Colloid-haematic material, some foamy histiocytes and rare aggregates of thyroid follicular cells with marked nuclear asymmetries.The morphological appearance may be attributed to previous radiometabolic treatment. TIR3a(according to SIAPEC-AIT Consensus Cytology 2014)".Due to the peculiar cytology, FNAB was repeated 4months later: "Presence of some small aggregates, microfollicular structures with voluminous atypical cells,markedly hyperchromatic nuclei with irregular profiles. Colloid absent.Cytological finding consistent with Indeterminate high-risk lesion:TIR3b(according to SIAPEC-AIT Consensus Cytology 2014). Comment: The finding appears similar to what was observed in the previous fine needle aspiration, and although it may be related to previous radiometabolic treatment, as previously suggested, it does not definitively exclude a proliferation (adenoma with bizarre nuclei? Hyalinizing trabecular adenoma? Other?)."To further evaluate the nature of the nodule, thyroid scintigraphy with 99mTc-MIBI was performed demonstrating a Wash-out Index of -41%.Due to this complex scenario, the patient eventually decided to undergo total thyroidectomy.Final pathology demonstrated: "Multiple sections of thyroid parenchyma located on the right side of a predominantly cystic nodular area delimited by scleroialinosis,with foci of macrophage necrosis loaded with hemosiderin pigment, giant-cell granulomas of foreign-body type incorporating cholesterol crystals, evident calcific deposits.Within the scleroialinosis area, there is a rim of cells with abundant eosinophilic cytoplasm and atypical, voluminous, often pleomorphic nuclei, which appear interpretable initially as atypia induced by radiometabolic therapy. The remaining parenchyma shows evident scleroialinosis with associated cystic areas and the presence of cellular elements with

eosinophilic cytoplasm and voluminous, sometimes pleomorphic nuclei." ***Conclusion:*** To our knowledge, no current literature provides an insight on pathological abnormalities induced by RAI on thyroid tissue.This case has showed a so peculiar pattern, where different diagnostic and therapeutic options come into play to obtain, in a complex and varied clinical presentation, the best management choice.

EP-1169

The Added Value Of [99mTc]-EDDA/HYNIC-TOC Scintigraphy In The Management Of Bilateral Glomic Tumor

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Aim/Introduction: Glomus tumors are characterized as mesenchymal neoplasms with a slow growth rate, representing a minority of less than 2% among soft tissue tumors. Head and neck paragangliomas (HNPs) are rare vascular neuroendocrine tumors arising from neuroendocrine cells of the neural crest, affecting both genders equally. The majority of cases are diagnosed between the ages of 40 and 60, with approximately 10% presenting as multiple or bilateral tumors. The aim of this case is to demonstrate the clinical utility of [99mTc]-EDDA/HYNIC-TOC. Other molecular imaging investigations that can be used in the evaluation of paraganglioma include [123I]-MIBG scintigraphy, PET-CT with $^{[18F]}$-flubrobenguane, $^{[18F]}$-DOPA, $^{[18F]}$-FDG, [68Ga]-DOTATOC and [68Ga]-DOTATOC. ***Materials and Methods:*** A 37-year-old patient presented to the ear, nose and throat department in 08.2021 with palpable, painless laterocervical masses for evaluation. Initial assessment included a cervical CT scan, which revealed two iodophilic, non-homogeneous lesions located at the carotid glomus. The lesions were classified as Shamblin class II on the right side and Shamblin class I on the left side. In August 2021, an Angio-MRI examination detected nodular tissue with non-homogeneous T2 hyperintensity without diffusion restriction, and no apparent vascular involvement on time-of-flight (TOF) arterial sequence. In the same month the MRI was followed by a contrast enhanced CT scan of the thorax, abdomen, and pelvis which revealed no abnormal findings. The patient was periodically evaluated presenting stable disease and no treatment was initiated. For more accurate evaluation the patient was referred for somatostatin analog scintigraphy (SRS). ***Results:*** In October 2023 a [99mTc]-EDDA/HYNIC-TOC scintigraphy "whole-body" acquisition and SPECT-CT were performed showing high radiotracer uptake in the nodular lesions located at the bifurcation of the common carotid artery, bilateral, with stable dimensions, 33/21/34 mm in the right side and 24/25/38 mm in the left side compared to the MRI performed in august 2021. No other sites of pathological radiotracer uptake were visualized indicating stable disease. Due to the high expression of somatostatin receptors and the associated surgical risk, treatment with a somatostatin analog (SSA) was initiated. Notably, throughout the investigative process, the patient remained asymptomatic. ***Conclusion:*** Accurate evaluation of neuroendocrine tumors like paragangliomas can present challenges, especially when they are asymptomatic. SRS has shown notable sensitivity in detecting HNPs and has significantly influenced patient management, particularly by enabling the initiation of SSA therapy in individuals with high surgical risk.

EP-1170

Unveiling the Utility of $^{[18F]}$FDG PET/CT for Response Assessment in a Rare Case of Large Vessel Vasculitis

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Aim/Introduction: Takayasu arteritis (TAK) is a rare, chronic, granulomatous large vessel vasculitis (LVV), predominantly affecting young women. Typically, LVV affects the aorta and its major branches, often leading to severe complications, including stroke, myocardial infarction, mesenteric ischemia, and limb claudication, usually contributing to substantial morbidity among affected individuals. Monitoring TAK during treatment presents challenges, as none of the clinical symptoms and laboratory tests is entirely specific for LVV. ***Materials and Methods:*** We present the case of a 51-year-old male patient, who presented in 2022 an onset including fever of unknown origin (FUO), abdominal pain and irritative cough. Initial biochemical tests revealed elevated inflammatory markers and iron-deficiency anemia. The patient underwent a series of viral, bacterial and immune serological tests and transesophageal echocardiography to exclude infectious arteritis and endocarditis. Bone marrow biopsy eliminated the possibility of a myeloproliferative disorder. Corticoid therapy was initiated, but with no clear result. Serial computed tomography (CT) examinations was performed, with no specific morphological findings, but revealing the enlargement of the spleen.Given the complexity of the case and the persistence of the inflammatory syndrome upon discontinuation of corticosteroids, a ^{18}F-Fluorodeoxyglucose $^{[18F]}$FDG PET/CT scan was recommended to establish the diagnosis and further guide the treatment plan. ***Results:*** $^{[18F]}$FDG PET/CT revealed diffuse and increased metabolic activity in the superior wall of aortic arch and the right lateral wall of descending aorta, suggesting inflammatory arteriopathy. Considering that other pathologies were excluded through gastroenterological, hematological, infectious and cardiological investigations, the most plausible etiology remained a subtype of LVV. These imaging findings are consistent with the biochemical changes and symptoms observed prior to PET-CT examination, it was decided to initiate treatment with high- dose immunotherapy and corticotherapy, leading to decrease of inflammatory markers. One year after the initial diagnosis a follow-up $^{[18F]}$FDG PET/CT examination was performed revealing near-complete regression of metabolic activity within affected vessels was noted, which correlated with the clinical improvement. ***Conclusion:*** In summary, our case emphasizes the utility of $^{[18F]}$FDG PET/CT as a valuable imaging tool in the management of TAK, providing essential information for diagnosis, disease activity and treatment response monitoring, through its capacity to identify inflammatory infiltration prior to morphological and vascular structural changes with high sensitivity.

EP-1171

Role of Lung Perfusion Scan in Jeune Syndrome: A Case Report

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Aim/Introduction: Jeune syndrome as knowns as asphyxiating thoracic dystrophy is a rare congenital disorder associated with

multi-organ involvement, including skeletal abnormalities. Radiographic findings are small, bell-shaped, narrow chest, with horizontally oriented ribs, resulting in pulmonary hypoplasia. The condition often cause respiratory distress and recurrent respiratory infections in early childhood. Priority management in this situation is supporting respiratory function. Several articles report surgical approach to correct the thoracic cavity size. We report case of Jeune syndrome scheduled for thoracic wall expansion. ***Materials and Methods:*** A 6-months-old male patient with multiple skeletal abnormalities correspond with Jeune syndrome was several times hospitalized due to recurrent pulmonary infection. No abnormalities were found on renal and hepatic function. The patient was referred for pulmonary function evaluation prior to surgery. An 8-projection lung perfusion scan with Tc- 99m MAA 1.85 MBq showed normal radioactivity distribution on both lung, therefore a ventilation scan would be unnecessary. ***Results:*** Surgical approach were reported beneficial for Jeune syndrome. Chest expansion procedure conducted in patient showing imaging of normal lung is consider to be safe and effective method. Despite poor anatomical details, lung perfusion scan provide functional information with lower radiation exposure compared to CT angiography. ***Conclusion:*** Lung perfusion scan is a safe, relatively non-invasive, and advantageous procedure to evaluate lung function in pediatric patient prior to surgery. ***References:*** Ciofetta G, Piepsz A, Roca I, Fisher S, Hahn K, Sixt R, Biassoni L, De Palma D, Zucchetta P; Paediatric Committee of the European Association of Nuclear Medicine. Guidelines for lung scintigraphy in children. Eur J Nucl Med Mol Imaging. 2007 Sep;34(9):1518-26. doi: 10.1007/s00259-007-0485-3. PMID: 17602223. Drubach LA, Jenkins KJ, Stamoulis C, Palmer EL 3rd, Lee EY. Evaluation of Primary Pulmonary Vein Stenosis in Children: Comparison of Radionuclide Perfusion Lung Scan and Angiography. AJR Am J Roentgenol. 2015 Oct;205(4):873-7. doi: 10.2214/AJR.14.13581. PMID: 26397339. de Vries J, Yntema JL, van Die CE, Crama N, Cornelissen EA, Hamel BC. Jeune syndrome: description of 13 cases and a proposal for follow-up protocol. Eur J Pediatr. 2010 Jan;169(1):77-88. doi: 10.1007/s00431-009-0991-3. Epub 2009 May 10. PMID: 19430947; PMCID: PMC2776156. Oberklaid F, Danks DM, Mayne V, Campbell P. Asphyxiating thoracic dysplasia. Clinical, radiological, and pathological information on 10 patients. Arch Dis Child. 1977 Oct;52(10):758-65. doi: 10.1136/adc.52.10.758. PMID: 931421; PMCID: PMC1544803.

EP-1172

Diagnostic Value of F^{18}-FDG PET/CT in Malignances Associated with Neurofibromatosis Type 1- a Case Report

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Aim/Introduction: Neurofibromatosis (NF) is a neurocutaneous syndrome characterized by the development of tumors of the central or peripheral nervous system, with Type I (NF1) being accounted for 96% of all cases. Mutations in the neurofibromin 1 tumor suppressor gene were identified in different soft-tissue sarcomas, such as undifferentiated pleomorphic sarcoma (UPS) and malignant peripheral nerve sheath tumors (MPNST). The aim of the paper is to highlight the potential use of F^{18}-FDG PET/CT scan in differentiating malignant lesions associated with NF1. ***Materials and Methods:*** We present the case of a 33-years-old male patient diagnosed with NF1 in September 2021 through resection of neurofibromas on the scalp and right thigh.In February 2023, IRM imaging revealed multiple subcutaneous neurofibromas in the abdominal and pelvic area, as well as a large retroperitoneal tumor mass infiltrating the left hemiabdomen. This condition resulted in significant pain and functional impairment of the left limb.The tumor was excised along with the resection of the femoral nerve, which was considered the origin of the tumor, left nephrectomy and left hemicolectomy; the immunohistochemical assay established the diagnose of undifferentiated pleomorphic sarcoma. Excision of multiple infradiaphragmatic plexiform neurofibromas was performed. ***Results:*** Postoperative evaluation using F^{18}-FDG PET/CT detected a low metabolically active residual tumor at the level of the left iliac fossa, invading the iliac crest, small intestine, abdominal wall and ipsilateral iliopsoas muscle, multiple pulmonary, hepatic and bone lesions with increased values of radiopharmaceutical uptake, as well as paravertebral, mediastinal, mesenteric, prostatic, muscular and soft tissue neurofibromas. The patient undergoes ten cycles of palliative chemotherapy with Epirubicin and Ifosfamide. In march 2024, a follow-up F^{18}-FDG PET/CT scan revealed complete remission of the hepatic lesions, a residual pulmonary nodule in the left upper lobe showing metabolic inactivity, as well as inactive residual lesions in bones. Multiple neurofibromas were detected, some of which were newly appearing, with varying degrees of radiotracer uptake. The expansive tumor found in the left iliac fossa shows minimal uptake of the radiotracer and remains stable in terms of size and metabolism. ***Conclusion:*** Studies have shown that F^{18}-FDG PET/CT scan provides increased accuracy in differentiating MPNSTs from benign neurofibromas. This case outlines the importance of molecular imaging studies in the management of NF1 patients, raising suspicion of malignant lesion polymorphism, both MPNST and UPS, through correlating the differences in radiotracer uptake with the partial response to chemotherapy.

EP-1173

Pericardial Cystic Parathyroid Adenoma: an Uncommon Feature in Primary Hyperparathyroidism

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Aim/Introduction: Parathyroid adenomas are the main cause of primary hyperparathyroidism (PHP). Since the only curative treatment is surgical resection, the preoperative localization is essential. The available localization studies comprise cervical ultrasound, computed tomography (CT), magnetic resonance imaging (MRI), parathyroid scintigraphy, and hybrid imaging, the latter providing a more precise and specific characterization of parathyroid lesions. While the prevalence of ectopic parathyroid glands can extend to 20% within the general population, only a few number of cystic adenomas have been documented (ranging between 1-5%) with an even lower reported incidence of intrapericardial parathyroid adenoma (1%). ***Materials and Methods:*** Case presentation: A 79 year old female, diagnosed with PHP in 2019, with abnormal total calcium and parathyroid hormone (PTH) levels. The patient's medical history revealed a well-differentiated follicular adenoma situated in the left thyroid lobe, confirmed through fine needle aspiration biopsy in 2012. The patient's follow-up included regular cervical ultrasound examinations, with negative results for parathyroid nodule. Since 2019, there has been a progressive increase in both calcium and PTH levels, with the highest values of 14 mg/dL and 781 pg/mL, respectively. The patient was referred to our facility for 99mTc-MIBI-SPECT/CT imaging. ***Results:*** The dual phase scintigraphy

with 99mTc-Sestamibi showed no pathological uptake suggestive for a parathyroid adenoma on either early or late acquisition. The SPECT-CT examination, however, revealed the presence of a mixed (fluid and calcified structure), having no radiotracer uptake, located within the pericardium. Usually, the radiotracer uptake in the pericardium is challenging to detect due to the high concentration of 99mTc-Sestamibi in the myocardium. Furthermore, considering the patient's medical history and recognizing that cystic adenomas typically do not exhibit radiotracer uptake, even on F^{18}-choline PET-CT, the diagnosis of pericardial parathyroid adenoma was established. Following SPECT-CT imaging, the patient underwent contrast-enhanced CT, which confirmed the lesion's characteristics. ***Conclusion:*** This case demonstrates the high degree of clinical polymorphism of PHP and its functional-imaging aspects. While various imaging modalities are available for localization, hybrid imaging emerges as a valuable tool for precise localization and metabolic characterization of parathyroid lesions. Thus, the patient's medical background, the extent of biochemical alterations, and the results of other localization studies are crucial for an accurate interpretation.

EP-1174

Endoscopic administration of iodine capsule(I-131) for the treatment of Differentiate thyroid cancer in a child with swallowing difficulty.

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Aim/Introduction: Endoscopic administration of I131 capsule for the treatment of Differentiate thyroid cancer (DTC) following thyroidectomy in a child with swallowing difficulty. ***Materials and Methods:*** We present an 11-year-old girl with history of intellectual disability, behavioral difficulties , and denial swallowing solid food, diagnosed with papillary thyroid carcinoma. She underwent total thyroidectomy and central bilateral lymph node dissection. The histological examination showed to well with metastatic involvement in 20 out of 54 dissected lymph nodes. In accordance with the histological type and staging of the disease, the child is referred to the Department of Nuclear Medicine of the hospital for radioactive iodine (RAI) therapy . The coexistence of swallowing difficulties and the inability to cooperate with the child pose challenges in administering the iodine 131 considering that in our country, the therapeutic radioactive iodine is only available in capsule for oral use.The case was discussed at the Oncology Board of the Hospital, it was decided that the necessity of RAI treatment . At the medical meetings conducted with the participation of endocrinologists, nuclear medicine physicians, radiophysicists, gastroenterologists, surgeons, and anesthesiologists were determined that the safest, and most effective method of administering the I131capsule is directly into the stomach via endoscope. Being incapable of cooperating with the patient, the histological type of the cancer, and her anthropometric characteristics, it was decided to administer 45 mCiI131. For the same reason, a 24h iodine uptake test and a diagnostic I123whole-body scan were not performed. ***Results:*** The administration procedure took place in the radioisotope therapy room. Specialized endoscopic and anesthetic equipment was utilized. All necessary measures were taken to prevent potential radiation exposure. The radioactive capsule (Thyrocap) was administered into the child's stomach with the assistance of an endoscopic guide. After the procedure, visual confirmation was obtained via endoscopy that the capsule was in the stomach and with measurement of the radiation dosage rate in the child's body. She remained in the room for 2d. She was discharged in good general condition. The post treatment whole-body scan revealed intense I131 uptake in the thyroid bed, indicating the presence of thyroid remnants and physiological distribution of the radiopharmaceutical in the body. The endoscopic administration was successfully completed without any reported incidents of radioactive contamination or unnecessary radiation exposure to personnel and caregivers. ***Conclusion:*** Successful treatment of DTC in a child with developmental, psychomotor issues, and swallowing difficulties through endoscopic administration of radioactive iodine capsule

EP-1175

The Value Of Molecular Imaging Techniques In Recurrent Multiple Paragangliomas Management

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Aim/Introduction: Paragangliomas (PGLs) are tumors originating from extra-adrenal chromaffin cells and are rarely found in the retroperitoneum. A positive diagnosis relies on serum hormone testing, radiological and molecular imaging evaluations, which are essential prior to surgical intervention. Surgical excision remains the only curative therapeutic method, therefore there is an important need for accurate staging and precise evaluation of the disease. ***Materials and Methods:*** We present the case of a 44-year-old patient, diagnosed in 2006 with retroperitoneal PGL with locoregional invasion, who subsequently underwent surgical intervention. For 10 years, the patient did not present for regular follow-up investigations. In 2016 the patient manifested abdominal pain, and the imaging studies showed retroperitoneal recurrences with bladder invasion, bone and lymph node metastases. Total cystectomy was performed en bloc with right prostatovesiculectomy. In 2017, a [123I]-MIBG scintigraphy revealed vertebral metastases with reduced radiopharmaceutical uptake. Chemotherapy and osteoclast inhibitors treatment were initiated. The patient was referred to our clinic and several imaging investigations were performed for treatment response evaluation, two PET-CT scans in 2017 and 2019, completed by somatostatin receptors scintigraphy in 2020. ***Results:*** In 2017, the $^{[18F]}$-FDG PET-CT examination showed metabolically active metastatic lymph nodes localized in specific regions, including the left para-aortic (corresponding to the L3-L4 vertebral region), right external iliac and left internal iliac. The patient continued the treatment with cyclophosphamide, vincristine, dacarbazine (CVD), and zoledronic acid with partial response on the CT scan performed in 2018. The follow-up PET-CT in 2019 confirmed the reduced dimensions of the metastatic lymph nodes but revealed increased metabolic activity in the para-aortic nodes and progression in both metabolic

activity and size of the right external iliac node. In 2020, the follow-up scintigraphy with radiolabeled somatostatin analog [99mTc]-EDDA/HYNIC-TOC, revealed high radiotracer uptake with minimal metabolic and dimensional progression of the lymph nodes involvement, while metastatic bone lesions remained stable. The increased uptake of [18F]-FDG in the metastatic lesion compared to the uptake of the radiolabeled somatostatin analog suggests a more aggressive nature of the tumor. ***Conclusion:*** Molecular imaging plays a critical role in the management of patients diagnosed with PGL, providing vital information to accurately assess the disease extent and characterize the expression patterns of key molecular targets such as SSTR and norepinephrine transporters. This imaging approach is instrumental in guiding the selection and optimization of targeted therapies, including PRRT or [131I]-MIBG, thus improving the precision and effectiveness of treatment in patients with PGL.

EP-1176

[18F]-FDG Avid Pulmonary Nodules in the Follow-Up of a Patient with Colon Cancer: Think About Amyloidosis

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Aim/Introduction: [18F]-FDG PET/CT examination performed for the follow-up of patients with oncological pathology may give false positive results in patients with associated chronic lung diseases.Pulmonary amyloidosis is not rare, but a less diagnosed clinical variant. Three forms of pulmonary amyloidosis are known: nodular, diffuse alveolo-septal or tracheobronchial.Nodular pulmonary amyloidosis has a benign evolution but is difficult to differentiate from a malignant lung tumor or metastasis. In this situation, the [18F]-FDG PET/CT can provide valuable information and guide the therapeutic plan. ***Materials and Methods:*** We present the case of 83 y.o. caucasian female with chronic obstructive pulmonary disease (COPD), multiple comorbidities, and history of colonic adenocarcinoma, followed periodically by CT scan for a right pulmonary nodule of uncertain etiology (bronchoscopy and cytological examination negative). Because the suspicion of lung metastasis was high, PET/CT [18F]-FDG was perform. The result showed two metabolically active lung pulmonary nodules present bilaterally with a subpleural disposition in the upper lung lobes (the left nodule being newly appeared). Atypical lobectomy was performed for the right pulmonary nodule, which had higher metabolic activity. Immunohistochemical examination showed pulmonary amyloidosis. A multidisciplinary team dedicated to amyloidosis performed multiple clinical examinations, echocardiography (equivocal for cardiac amyloidosis), biochemical profile (negative), pyrophosphate scintigraphy (Perugini score of 1) and concluded that amyloidosis is an isolated pulmonary nodular form, not requiring specific treatment. In December 2023, a control PET/CT was performed. ***Results:*** The PET/CT scan showed a left upper lobe pulmonary a nodule with dimensional progression and markedly increased metabolic activity. The patient was reoperated, the histopathological result identified lung adenocarcinoma with rare amyloid deposits. Despite the similar appearance of the remaining nodule to the amyloidotic one, its evolution was unexpected. [18F]-FDG PET/CT studies in patients with nodular pulmonary amyloidosis indicated a heterogeneous metabolic activity, and conclude that lesions with increased metabolic activity suggest neoplasia (MALT, plasmacytoma, or adenocarcinoma). Nodular amyloidosis can reach dimensions of up to 15 cm with a subpleural disposition, similar to our case. This makes it more difficult to follow-up patients with oncological pathology and PET/CT with specific tracers could help discriminate neoplastic lesions from amyloidosis. ***Conclusion:*** [18F]-FDG PET/CT in pulmonary amyloidosis is insufficiently studied. Often this method gives false-positive results for neoplasia, but remains a key investigation, providing information related to the potential hematologic disease, synchronous neoplasia and associated inflammatory-infectious complications.

EP-1177

Tumor thrombus in the internal jugular vein due to metastatic poorly differentiated thyroid carcinoma

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Aim/Introduction: Poorly differentiated thyroid carcinoma (PDTC) is a clinical entity that has a morphology and biologic behavior between well-differentiated and undifferentiated carcinomas. The initial presentation of PDTCs usually involves a large local invasion and extrathyroidal expansion. PDTCs typically spread to the brain, bones, and lungs. Cases with a gross thrombus of the internal jugular vein (IJV) are incredibly uncommon. We report a case of PDTC patients with IJV tumor extension found by multimodality imaging. ***Materials and Methods:*** A 56-year-old woman underwent surgery due to an ultrasound confirmed multinodular goiter that presented as benign on a fine needle aspiration biopsy and cytology. A near-total thyroidectomy was performed because of the invasive spread to the surrounding structures. ***Results:*** Histopathology revealed PDTC G3/NG3 (pathological stage pT3B, pNX, pMX); Stage II. Following surgery, a sonographic assessment and a computed tomography (CT) scan, despite the remnant thyroid tissue, revealed an extensive thrombus in the left IJV measuring 8.5 cm. Anticoagulant therapy was given to the patient two weeks prior to the administration of radioiodine. One week after the ablation with 100 mCi of 131-I, WBS was performed, where we detected remnant thyroid tissue, iodine avid tumor thrombus in the left IJV, as well as lung metastasis. ***Conclusion:*** IJV tumor thrombus is a rare metastasis of PDTC; thus, patients with thyroid cancer should be assessed for tumor thrombosis, particularly with multimodality imaging, as it has prognostic implications.

EP-1178

The Diagnostic Role of 2-[18F]FDG-PET/CT in Chronic Recurrent Multifocal Osteomyelitis (CRMO): a Case Report

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Aim/Introduction: Chronic recurrent multifocal osteomyelitis (CRMO) is a rare nonbacterial inflammatory disorder that can affect any bone, potentially leading to bone destruction if untreated. The diagnosis requires excluding other causes, particularly infectious and malignant aetiologies. Given the limited awareness of CRMO, the diagnosis can be challenging. We aim to raise awareness of this condition and emphasize the importance of 2-[18F]FDG-PET/CT (FDG-PET/CT) in the diagnosis. ***Materials and Methods:*** We report the case of a 9-year-old female patient with a history of action tremors and developmental coordination and speech disorders since the age of 5. At 7-years-old she was admitted into the Paediatric ward due to left-sided torticollis, neck and lower limb

pain and slowing gait speed over the preceding weeks. Laboratory findings revealed anaemia and elevated ferritin and erythrocyte sedimentation rate. Serological tests and autoantibodies were negative. A cervical CT scan showed heterogenous density of the posterior arch of the C1 vertebra, with cortical bone discontinuity. Further characterization by cervical MRI showed T2 hyperintensity in the left lateral aspect of the C1 vertebra's arches and an adjacent poorly defined collection, raising suspicion of juvenile idiopathic arthritis or infectious arthritis. ***Results:*** A FDG-PET/CT scan was requested and demonstrated hypermetabolism in the C1 vertebra, left iliac bone, lower right and upper and lower left tibial epiphyses and 2nd left metatarsal, with associated bone density changes in the CT component of the study. These findings were suggestive of active inflammatory/infectious processes. Since inflammatory/infectious lesions in multiple bone locations were found, a bone biopsy was performed on the distal left tibial lesion, which showed no evidence of neoplastic infiltration or identifiable infectious agents, thus excluding malignancy and infectious aetiologies, respectively. As a result, a diagnosis of CRMO was established by exclusion. The patient underwent four months of non-steroidal anti-inflammatory treatment (naproxen), which provided pain relief. She is currently under follow-up care in the Paediatric Rheumatology unit. ***Conclusion:*** CRMO is a diagnosis of exclusion, relying on a combination of clinical, imaging and histopathological criteria for accurate identification. This clinical case exemplifies the typical CRMO patient, diagnosed in paediatric age and with multifocal bone involvement. FDG-PET/CT scan played an important role in identifying all bone lesions, not only raising suspicion for this pathology but also enabling a baseline assessment of the patient.

EP-1179

Splenic surprises: Unusual Breast Carcinoma Metastasis on ^{18}F-FDG PET/CT

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Aim/Introduction: Breast cancer is the most common malignant neoplasm in women resulting in high mortality and morbidity. FDG PET/CT imaging has emerged as a powerful tool in the staging and restaging of breast cancer, allowing for the detection of distant metastases. While lymph nodes, bones, lungs, and liver are the typical sites of spread for breast carcinoma, unusual metastases can also occur. The use of FDG PET/CT can help in identifying and characterizing these uncommon sites of metastasis thus accurately guiding the staging. Here we report a case of Carcinoma breast with spleen metastasis. ***Materials and Methods:*** A 54-year-old post-menopausal female presented with c/o lump in right breast since 5-6 months. O:E lump was 3 x 4 cm in right breast. Trucut biopsy was performed which was suggestive of invasive ductal carcinoma. No axillary lymph node was palpable. The clinical stage of the patient was IIA (cT2N0Mx). ***Results:*** Baseline FDG PET CT was done for staging. FDG PET/CT revealed a large well defined lobulated soft tissue density mass lesion with central area of necrosis within upper outer quadrant of right breast (measuring ~5.3 x 4.4 cm). It is involving underlying muscles and overlying skin. FDG avid perilesional satellite nodule is noted in upper outer quadrant of right breast (measuring ~2.0 x 1.7 cm), which was involving overlying skin causing its retraction. Also noted were, other FDG avid ill-defined enhancing soft tissue density lesion with central areas of necrosis is noted in upper central quadrant of right breast (measuring ~3.5 x 3.3 x 4.2 cm). It was closely abutting underlying pectoralis muscles and also involving nipple-areola-complex and overlying skin. Few satellite nodules were noted in lower quadrant of right breast. Thus, a multicenteric primary was present in right breast. FDG avid subcentimetric right cervical level IV, V, supraclavicular, infraclavicular, right-sided axillary lymph nodes with interpectoral and internal mammary lymph node were noted. FDG avid enlarged gastro-hepatic, coeliac, right retrocrural, paraaortic and aortocaval lymph nodes are noted. Also noted was FDG avid ill-defined hypodense lesion is noted in the superior pole of spleen (measuring ~2.0 x 2.1 cm). ***Conclusion:*** The role of FDG PET/CT in uncovering unexpected metastatic sites, such as the spleen in this case, highlights its importance as an indispensable tool in the comprehensive assessment of breast carcinoma, ultimately influencing patient management and outcomes.

EP-1180

$^{[18F]}$-FDG PET-CT Value in a Challenging Case of Pseudomyxoma Peritonei

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Aim/Introduction: Pseudomyxoma peritonei (PMP) is a rare, slowly growing neoplasm, characterized by the production of diffuse gelatinous ascites with mucinous implants on peritoneal surfaces. Typically, the development of PMP is associated with the rupture and intraperitoneal dissemination of various mucus producing neoplasms from the appendix, small and large bowel, stomach or ovary. Imaging studies includes contrast computed tomography (CT) scan, gadolinium enhanced magnetic resonance imaging (MRI) and fluorine 18- fluorodeoxyglucose ($^{[18F]}$-FDG) positron emission tomography (PET-CT). ***Materials and Methods:*** We present the case of a 73-year-old woman who underwent appendectomy, partial omentectomy and complete hysterectomy with bilateral adnexectomy for low grade metastatic appendiceal mucinous carcinoma in 2017. Chemotherapy was initiated postoperatively with good response. For almost three years the patient's evolution was stable with no signs of disease. Follow up imaging performed in 2020 included both CT and PET-CT scans. ***Results:*** In 05.2020 the CT scan revealed moderate ascites with median eventration and nonspecific hyperdensities within the peritoneum. The PET-CT exam was performed shortly after in 07.2020 and showed multiple confluent lesions with mixed densities located on both diaphragmatic domes, on the peritoneal surface of the liver, stomach, colon, intestinal loops and in the paracolic gutters and pelvis, presenting mostly peripheral minimal/moderate uptake of $^{[18F]}$-FDG. The voluminous median eventration contains the same type of lesions with moderate radiotracer uptake, SUVlbm up to 2.37, and massive peripheral calcifications. ***Conclusion:*** Diagnosing PMP early and accurately is challenging because of its rarity and characteristics. Even if PET-CT exam is not indicated for routine evaluation of this disease, by including it in the work-up of these patients, especially in subtypes with aggressive behaviour, it can help increase the precision of the diagnosis, staging and has the potential to be used in treatment response evaluation.

EP-1181

Keep in mind: ^{18}F-FDG PET CT in the Detection of Metachronous cancer, a case report.

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Aim/Introduction: Gastric cancer is the fifth most common and third leading cause of cancer death worldwide. Though survival from gastric cancer remains poor, an increase has been observed due to gradual improvements in diagnosis and treatment. The early diagnosis of gastric cancer has increased and the survival has been prolonged with gastrectomy and extended lymph node dissections. Gastric cancer patients are at risk for secondary primary malignancies. This long-term complication was first described by Warren and Gates in 1932. Synchronous malignancies are defined as occurring with 6 months of the primary diagnosis, whereas metachronous tumors occur more than 6 months after the initial event. The risk of secondary primary malignancies is dependent on factors including patient age, cancer stage at diagnosis, and treatment modality. Second primary cancers occurred in 5 per cent of patients with early gastric cancer, mostly within 10 years of the original surgical treatment. ***Materials and Methods:*** We present the case of an 59 year-old female patient with gastric adenocarcinoma. The patient underwent surgery and adjuvant chemotherapy. The patient was investigated through thoraco-abdominal imaging (CT and ultrasonography) following the routine examination. No evidence of metastatic disease was showed. A follow-up programme involving combinations of blood analysis, abdominal computed tomography, chest radiography, ultrasonography and endoscopy of the gastrointestinal tract was carried out every 3 months for the first year. ***Results:*** 18 months later the patient underwent follow up ^{18}F-FDG PET/CT, which revealed a solitary pulmonary nodule 15mm in diameter in the right upper lobe with increased of ^{18}F-FDG (SUVmax 15.57). A CT -guided biopsy of the pulmonary nodule was performed and histopathologic examination revealed a non small lung cancer adenocarcinoma and the patient underwent surgery. ***Conclusion:*** Colorectal cancer and lung cancer show the highest incidences of occurrence as second primary cancers. Therefore, careful preoperative and postoperative examinations for second primary cancer as well as for the extent of primary gastric cancer or the recurrence site are needed. ^{18}F-FDG PET/CT demonstrates high diagnostic accuracy for detecting synchronous and metachronous tumors. Postoperative follow-up with ^{18}F-FDG and close surveillance of patients with gastric cancer should focus on the early detection of recurrence and a second primary cancer.

EP-1182

Metastatic Parathyreoid Carcinoma And Evaluation By PET-CT $^{[18F]}$-FDG And SPECT-CT 99mTC-Sestamibi: A Case Report

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Aim/Introduction: Parathyroid carcinoma (PC) is a rare malignant neoplasm of the endocrine system, representing only 0.005% of all cancers. Predominantly, PC secretes parathyroid hormone, being the cause of approximately 1% of cases of primary hyperparathyroidism and may progress with lymphatic, hematogenous, or contiguous metastases to various organs. The present case report seeks to demonstrate the sensitivity of PET-CT $^{[18F]}$-FDG in the identification of active disease, as well as its extension, helping in the indication of a biopsy site and in the planning for therapeutic control of this condition. ***Materials and Methods:*** CASE REPORT: A 33-year-old female patient with a history of shoulder fracture due to falling from her own height, renal lithiasis, difficulty in locomotion and weight loss, diagnosed with primary hyperparathyroidism, underwent left lower parathyroidectomy with ipsilateral hemithyroidectomy and cervical lymphadenectomy in July/2022, obtaining as a result anatomopathological and immunohistochemical parathyroid carcinoma. In December/2022, the patient suffered fractures due to falling from her own height, progressing in June/2023 with dysphagia for solids and weight loss. The biochemical tests performed in March/2024 showed parathyroid hormone of 2753 pg/mL and serum calcium of 15.5 mg/dL. The PET-CT carried out in April/2024 showed two hypoattenuating solid nodules, one adjacent to the anterior face of the right lobe of the thyroid measuring 1.7 cm (SUVmax: 1.9) and another located in the left cervical paratracheal space without a plane of cleavage with the esophagus, measuring about 3.0 cm (SUVmax: 3.1), suspected of active neoplasm, in addition to diffuse bone textural alteration with areas of hyperuptake, probably related to hyperparathyroidism. ***Results:*** The parathyroid scintigraphy examination with 99mTC-SESTAMIBI performed in February/2024 showed a consistent pattern with hyperfunctioning parathyroids congruent with the nodules previously described in the PET-CT. A biopsy of an ulcerated lesion was performed in the proximal esophagus with an immunohistochemical profile being positive for CK AE1/AE3, pancitoq, Chromogranin A, Ki-67 and parathyroid hormone, in adition to negative for Caldesmon, CDX-2, Synaptophysin and S100, consistent with infiltrative carcinoma favoring the parathyroid gland as a probable primary site. The patient is scheduled for surgical resection of metastasis. ***Conclusion:*** Nuclear medicine contributed significantly to the diagnosis of metastasis and therapeutic planning of parathyroid carcinoma, which is a rare cancer with high morbidity. PET-CT, in addition to corroborating the findings of scintigraphy, showed an increase in glycolytic metabolism in the bone framework of this patient who has high serum levels of calcium and PTH.

EP-1183

Non Hodgkin lymphoma on ^{18}F-FDG-PET/CT in breast cancer follow up: an interesting finding

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Aim/Introduction: Site-specific second cancers have been extensively studied in breast cancer survivors over the past four decades. There is an elevated risk for malignancies of the contralateral breast, colon, pancreas, lung, oral cavity and pharynx, uterine corpus, soft tissue, melanoma, leukemia and non-Hodgkin lymphoma. Following chemotherapy or radiotherapy, patients with breast cancer are at greater risk of developing non Hodgkin lymphoma. Non-Hodgkin lymphoma is the most common hematologic malignancy worldwide. There is no established etiology for NHL as this disease does not constitute a single disorder but rather a group of disorders involving heterogeneous subtypes with variable clinical behaviors and treatment outcomes. ***Materials and Methods:*** We present a case of a 68-year-old patient with a right breast mastectomy in 2017. Pathology revealed infiltrating ductal carcinoma. She was treated with chemotherapy and radiotherapy. In 2023 on physical examination she presented palpable axillary and inguinal lymphnodes. She underwent a CT scan that identified multiple enlarged lymphnodes in the mediastinum, enlarged paraaortic lymhnodes in the abdomen, enlarged axillary, iliac and inguinal nodes. The clinical dilemma: metastatic disease or second malignancy. CT guided lymphnode biopsy from an inguinal lymphnode was performed but it revealed no diagnosis. ***Results:*** ^{18}F FDG PET/CT was performed in order to characterize the metabolic aspect of the lesions, to exclude

another primary tumor, and choose a proper biopsy place. ^{18}F-FDG PET/CT showed FDG avid lymphnodes in the mediastinum, in the abdomen, in the axillary and inguinal regions. CT guided biopsy of the most metabolic area according to the PET/CT findings was performed. Pathology findings revealed characteristic histological features of non Hodgkin follicular lymphoma and the patients started treatment. ***Conclusion:*** It is important for breast cancer survivors who have undergone chemotherapy and radiotherapy to be aware of the risk of second malignancy, like non Hodgkin lymphoma. ^{18}F-FDG PET can reveal the right area for biopsy. This case illustrates the superiority of FDG PET/CT over CT not only in the detection of a second malignancy but also in guiding the biopsy and leading to the correct diagnosis.

EP-1184

Graves' Disease with Negative TSH Receptor Antibodies and Positive Thyroid Peroxidase Antibodies: The Role of Thyroid Scintigraphy

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Aim/Introduction: Hyperthyroidism in Graves' disease is primarily driven by the generation of TSH-receptor stimulating autoantibodies. The thyroid receptor antibodies (TRAbs) are the pathological hallmark of GD and are present in nearly all patients with the disease. However, in some patients the measurement of TRAB titers may be in normal level therefore posing a problem of differential diagnosis with Hashimoto's thyroiditis. We report a case of Grave disease with positive anti-TPO antibodies, and negative TRAbs, where scintigraphy helped its discriminating from other autoimmune thyroiditis. ***Materials and Methods:*** A 31-year-old woman who presented clinical symptoms of hyperthyroidism. She had no personal or family history of thyroid disease. Clinically, she exhibited a palpable goiter. The biochemical assessment typically revealed low TSH levels and elevated thyroid hormones level. Additionally, anti-TPO antibodies and anti-thyroglobulin antibodies were high, but the measurement of TRAbs was negative.Thyroid ultrasound demonstrates an enlarged gland with heterogenous echogenicity without nodules. Color Doppler ultrasonography reveals heightened vascularization within the parenchyma. Thyroid scintigraphy was performed and the images were obtained after 20 minutes of intravenous injection of 185 MBq of 99mTc-pertechnetate. ***Results:*** The thyroid scintigraphy revealed an enlarged thyroid gland with regular contours and an intense homogeneous uptake. The diffuse increase in uptake was compatible with Grave's disease and has enabled us to exclude the diagnosis of Hashimoto thyroiditis, characterized by a decrease or absence of uptake of the radiotracer.Our findings align with the Doppler ultrasound results, indicating a peak systolic velocity in the inferior thyroid artery exceeding 60 cm/sec, whereas in Hashimoto thyroiditis, it typically falls below 40-50 cm/sec. Subsequently, the patient was referred to her endocrinologist for appropriate therapeutic management. ***Conclusion:*** The thyroid scintigraphy plays a critical role in confirming the diagnosis of GD , particularly in cases presenting with hyperthyroidism, positive anti-TPO antibodies, and negative TRAbs. Additionally, it serves as a valuable tool in distinguishing Graves' disease from Hashimoto's disease, facilitating accurate diagnosis and appropriate management strategies for patients with thyroid disorders.

EP-1185

68Ga-DOTATATE uptake in leiomyoma

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Aim/Introduction: This is a case report of a 54-year-old woman with a history of metastatic neuroendocrine tumor and long-acting octreotide therapy who underwent 68Ga-DOTATATE PET/CT scan for revaluation. ***Materials and Methods:*** 60 minutes after injecting 149 MBq of 68Ga-DOTATATE, PET/low dose CT scan from the top of the head to mid-thigh was performed. ***Results:*** The PET/CT scan showed multiple foci of radiopharmaceutical uptake in liver parenchyma and moderate DOTATATE uptake in a solid soft tissue mass with a diameter of 19.8 cm in uterus. DOTATATE uptake in liver was consistent with known metastases of neuroendocrine tumor. Due to the size of the soft tissue mass in uterus, surgery was scheduled and hysterectomy and bilateral adnexectomy were performed. The patohistological finding of uterine lesion was consistent with leiomyoma. ***Conclusion:*** 68Ga-DOTA-conjugated peptides has been used for staging and revaluation of neuroendocrine tumors via binding to somatostatin receptors that are overexpressed in this tumor type. Although 68Ga-DOTATATE PET/CT scans are highly accurate for neuroendocrine tumors imaging, DOTATATE uptake could also be seen in various non-neuroendocrine conditions, including thymoma, prostatitis, and vertebral haemangioma. And in case of DOTATATE uptake in uterus, diagnosis of leiomyoma should also be considered. ***References:*** Liu H, Zhang W, Chen Y. Incidental 68Ga-DOTATATE uptake in uterine leiomyoma. Endocrine. 2020;68(1):233-234. Hofman MS, Eddie Lau WF, Hicks RJ. Somatostatin receptor imaging with 68Ga DOTATATE PET/CT: clinical utility, normal patterns, pearls, and pitfalls in interpretation. Radiographics. 2015;35:500-16. Malan N, Vangu MDT. Normal variants, Pitfalls and Artifacts in Ga-68 DOTATATE PET/CT imaging.

EP-1186

Investigating the Timeline: Breast Implant-Associated Anaplastic Large Cell Lymphoma and Systemic Lupus - A Case Report

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Aim/Introduction: PET-CT with ^{18}F-fluorodeoxyglucose ($^{[18F]}$FDG) is a well-established method for staging and assessing therapy response in haemato-oncological diseases. This case report presents a distinctive type of non-Hodgkin's lymphoma known as breast implant associated with anaplastic large cell lymphoma (BIA-ALCL), in a patient with systemic lupus erythematosus (SLE). ***Materials and Methods:*** A 45-year-old woman has an established diagnosis of BIA-ALCL and SLE, presenting with inflammation, redness and purulent discharge at the incision scar. The diagnosis was immunohistochemically confirmed, showing negative anaplastic lymphoma kinase (ALK) and positive CD30 expression. The patient exhibited clinical and biological manifestations characteristic of SLE, including cutaneous eruptions and elevated biomarkers. Previous ultrasound and MRI imaging concluded with a BIRADS score of 4c. She underwent $^{[18F]}$FDG PET-CT for staging. ***Results:*** The PET-CT scan revealed high

[18F]FDG avid diffuse lesion in the right breast, particularly in the prepectoral area, with evidence of invasion into the thoracic wall and accumulation of periprosthetic fluid. A small glucose avid lesion was also noted on the outer edge of the left side of the breast. There were glucose avid lymph nodes in the retropectoral, axillary and internal mammary areas, bilaterally. Following bilateral breast capsulectomy and three cycles of chemotherapy with immunotherapy using brentuximab vedotin, the patient exhibited no abnormal metabolic activity in the breast or lymph nodes upon subsequent PET-CT imaging during follow-up. Biopsy findings after surgery indicated only inflammatory activity, with no evidence of disease extension from the primary site of origin. At follow up, the patient demonstrated negative SLE markers, with mild distal peripheral neuropathy emerging as the sole adverse effect attributed to immunotherapy. Some authors suggest that textured implants have a higher risk of developing BIA-ALCL with estimated incidence of 1 in 4000 cases. Immune involvement such as SLE can also occur as an independent factor that can manifest after breast augmentation, according to literature. In this patient, immune-related complications appear to have developed concurrently with BIA-ALCL. ***Conclusion:*** The use of [18F]FDG PET-CT in the staging of this rare disease is of great importance. In our patient, a multidisciplinary approach allowed a thorough assessment of disease progression and showed successful post-therapeutic outcome.

EP-1187

Hypermetabolic cranial button sequestra and peripheral cortical osteolytic lesions as pivotal FDG PET-CT super pattern to decipher skeletal syphilis

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Aim/Introduction: Syphilis is a sexually transmitted bacterial chronic infection caused by Treponema pallidum (TP). Syphilis has been described as the great imitator because of its protean clinical manifestations. Skeletal involvement is an unusual manifestation of late syphilis, heralded by bone pain. ***Materials and Methods:*** A 32-year-old man was hospitalized for a work-up of subacute multiple bone pain and headache. Livedoid erythema spreading over both arms was observed. Physical examination proved otherwise unremarkable. Cranio-encephalic MRI elicited multiple lesions located on skull outer table, left zygomatic and fronto-orbital bones, harbouring bone sequestra. Meningeal layers and brain were normal. Biological tests disclosed an elevated CRP (25 mg/L). Blood creatinine level, PTH, calcium, alkaline phosphatase were normal. SPEP depicted polyclonal gammopathy, immunofixation negative for monoclonal protein and no serum light chain excess identified. Battery of auto-immunity disorders and specific histiocytoses mutations revealed negative. ***Results:*** A diagnostic procedure launched FDG PET-CT and bone SPECT-CT imaging. Hybrid imaging evidenced multiple osteolytic lesions scattered over skull and 4 limbs. Skull exhibited several hypermetabolic button sequestra. Limbs lesions were small-sized, Lodwick II phenotype, involved cortical bone, and distributed bilaterally. Spino-pelvic bone and bone marrow were spared. Osteolytic lesions displayed moderately increased SUV (range: 3-6) contrasting with sharp increased bone turn over. PET delineated numerous intensively hypermetabolic (SUV range: 6-14) infra-centimetric lymph-nodes (neck, axillary, inguinal areas), and hypertrophied oropharyngeal lymphoid organs, satellites of bone lesions. No visceral target could be disclosed. A primary diagnostic filtering was operated from bone SPECT-CT and FDG PET-CT imaging patterns, yielding the diagnostic triad: Langerhans cell histiocytosis, lymphoma, syphilis. A further diagnostic filtering was provided by skin changes: livedoid erythema was reclassified syphilitic roseola. A Venereal Disease Research Laboratory test and TP hemagglutination assay were positive, substantiating diagnosis of syphilis. PET-targeted biopsies were undertaken, zeroing on left tonsil and a skull vertex lesion. Pathological examinations showed no morphological or immunohistochemical arguments for histiocytosis, lymphoma or solid tumour but staining confirmed the presence of spirochetes and PCR test for TP DNA was positive. The patient received 2 weeks of daily intramuscular benzathine penicillin, resulting in bone pain improvement and disappearance of skin stigmata. ***Conclusion:*** Multifocal skin and bone (SKIBO) disorders encompass a bewildering spectrum of differential diagnoses. However, FDG PET-CT and bone SPECT-CT, as panoramic hybrid imaging modalities, may prove a powerful tool to narrow the differential diagnosis gamut, providing that a multi-scale, integrative (PET + CT) anatomo-metabolic pattern is systematically searched for.

EP-1188

Cardio-renal syndrome in one image: a clinical case

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Aim/Introduction: Chronic kidney disease (CKD) represents a major risk factor for cardiovascular disease (CVD), increasing global morbidity and mortality. Patients with CKD, in relation to chronic uremic condition, exhibit an elevated cardiovascular risk displaying high blood pressure, heart failure, and even sudden cardiac death. The entity called cardio-renal syndrome (CRS) defines different clinical conditions in which heart and kidney dysfunctions bind. There are five stages of CRS: acute cardiorenal, chronic cardiorenal, acute nephrocardiac, chronic nephrocardiac and secondary to another predominant disease [1]. ***Materials and Methods:*** A patient from the Cardiology Department was refer to our laboratory to perform a 99mTc-DTPA radioisotope nephrography. After the 30 minutes dynamic acquisition, for the static images the gamma camera (dual headed Siemens) was center to view the kidney and the heart in the same image. Considering the high cardiac radiotracer fixation, a ratio between heart fixation and a mirrored reference region was perform. ***Results:*** We report the clinical case of a 73-year-old woman, with medical personal history of oscillating arterial hypertension grade III, insulin-requiring type 2 diabetes, grade III obesity and chronic kidney disease-G4. Renal parameters were abnormal: urea of 96 mg/dL, and serum creatinine 2.15 mg/dL. The dynamic nephrogram highlighted a small left kidney, with an altered curve, and decreased differential function (23.4%). The total glomerular filtration rate scintigraphically estimated was 15 mL/minute. We noticed that the ratio for the heart fixation / mirrored reference fixation of the radiotracer was 2.84. ***Conclusion:*** In literature it is

already stated that endothelial dysfunction in uremia can result in cell-to-cell junction loss and increased permeability, contributing to cardiovascular disease (CVD) development [2]. In our case, the uremic toxins correlated with chronic inflammation status induced and aggravated the cardiac pathology. Henceforth, we showed in one image the link between CKD and CVD. ***References:*** [1] Di Lullo L, Bellasi A, Barbera V, Russo D, Russo L, Di Iorio B, Cozzolino M, Ronco C. Pathophysiology of the cardio-renal syndromes types 1-5: An uptodate. Indian Heart J. 2017; 69(2):255-265.[2] Rayana A P Maciel, Regiane S Cunha, Valentina Busato, Célia R C Franco, Paulo C Gregório, Carla J R Dolenga, Lia S Nakao, Ziad A Massy, Agnès Boullier, Roberto Pecoits-Filho, Andréa E M Stinghen. Uremia Impacts VE-Cadherin and ZO-1 Expression in Human Endothelial Cell-to-Cell Junctions. Toxins (Basel).2018, 10(10), 404.

EP-1189

Polyostotic fibrous dysplasia: the role of bone scintigraphy in changing the diagnosis

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Aim/Introduction: Fibrous dysplasia (FD) is a rare benign, non-hereditary skeletal disorder, affecting children and young adults, due to a mosaic post-zygotic mutation of the GNAS gene, responsible for the proliferation of undifferentiated skeletal progenitor cells. It consists of replacing native tissue with a poorly mineralised fibro-osseous matrix, which tends to fracture and deform. The incidence is probably underestimated as it can present with a wide spectrum of clinical manifestations, ranging from asymptomatic monostotic to polyostotic forms and/or associated with extraosseous manifestations (café-au-lait skin macules and endocrinopathies constituting McCune-Albright syndrome). Although progression to osteosarcoma is extremely rare, it is more common in the polyostotic form. Diagnosis is radiological, but monostotic forms may require hystology. Treatment is surgical and involves excision of the lesions and correction of the deformities. However, it is often burdened by complications such as worsening of the pain syndrome, excessive resections, and unsuccessful reconstruction using bone grafts and implants. Therefore, systemic therapies are being investigated and tested such as small molecules, antibodies, and CRISPR-based gene editing technologies. ***Materials and Methods:*** We present the case of a 27-year-old female patient with a left radius fracture over an area of known FD. She had a history of only one other fracture, at the same site, at the age of 5 years, which allowed the diagnosis of monostotic FD. Radiographs showed the known area of FD and another similar area in the distal humerus. She also presented with hyperpigmented patches extending from the abdomen to the shoulder and the left side of the back, and café-au-lait spots in the gluteal region. Blood tests showed no evidence of altered phosphor-calcium metabolism or signs of endocrinopathies. She was referred to our nuclear medicine department for a bone scan to complete the diagnosis. ***Results:*** 99mTc-HDP whole-body bone scintigraphy showed multiple bone foci involving the mandible, scapula, left humerus and radius, left first metacarpal, all vertebral segments, multiple costal arches and the right femur. The SPECT/CT scan showed osteo-structural changes compatible with FD. The patient's diagnosis was changed to polyostotic FD and she was referred for follow-up due to an increased risk of malignant progression. ***Conclusion:*** Whole-body bone scintigraphy helped to refine the patient's diagnosis and corrected the relative risk of malignant progression. With new systemic therapies already being studied and tested, bone scintigraphy could be a valid tool for correctly diagnosing patients, given its wide availability and its relatively low cost.

EP-1190

Non-ossifying Fibroma Of Proximal Humerus, Case Report

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Aim/Introduction: Non-Ossifying Fibroma is a benign fibrogenic lesion that results from dysfunctional ossification. It commonly affects the metaphysis of long bones. Its incidence is about 30-40% in children. It is most frequently located in the distal femur and tibia and less commonly affects the upper extremities. ***Materials and Methods:*** A 18-year-old male patient complained of left arm pain and swelling following trauma. Plain radiographs showed a left proximal humeral shaft intra-medullary lytic lesion, lateral side cortical destruction, and a small extra-osseous component. There was no pathological fracture. This lesion had low signal intensity at T1WI, heterogeneous high signal intensity at T2WI, and STIR with heterogeneous post-contrast enhancement on MRI examination. ***Results:*** The patient was referred to our nuclear medicine unit and requested an F^{18}-FDG PET/CT examination to survey the whole body for any additional lesions.FDG PET/CT imaging revealed a proximal left humeral, well-defined intra-medullary bony lesion associated with an extra-osseous soft tissue sheet as well as a small area of cortical discontinuity at its anterolateral aspect. It displayed low-grade metabolic activity of SUV max 1.9 and measured about 3.5x2 cm. There were no other FDG-avid lesions at the rest of the entire body. The biopsy was taken and the diagnosis of non-ossifying fibroma was established. ***Conclusion:*** Non-ossifying fibromas usually appear in childhood and late adolescence. Histopathology is necessary to obtain an accurate diagnosis because, in certain cases, there may be differential diagnoses.

EP-1192

The first case of 99m Tc-FAPI Uptake in Optic Nerve sheath Meningioma

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Aim/Introduction: This case study presents the first demonstration of FAPI-ligand uptake in a patient with optic nerve sheath meningioma . The patient, a 23-year-old woman who had previously undergone surgery for refractory optic meningioma, was referred to our department for 177Lu-Dotatate therapy. After three cycles of 177Lu-Dotatate administration, her proptosis significantly decreased. Two months after her last therapeutic cycle, a 99mTc-FAPI scan was performed. Thescan revealed a mass with moderately increased uptake in the left retro-orbital region. This study is believed to be the first to demonstrate FAPI-ligand uptake in a patient with optic nerve sheath meningioma. ***Materials and Methods:*** The patient, a 23-year-old woman who had previously undergone surgery forrefractory optic meningioma, was referred to our department for 177Lu-Dotatate therapy. After three cycles of 177Lu-Dotatate administration, her proptosis significantly decreased. A recent MRI revealed a hypo signal mass in the retro orbital region with pressure effect on

the optic nerve. The third cycle of 177Lu-Dotatate scan showed intense increased uptake in the orbital region with a good target to background ratio. For more evaluation as an approved clinical trial study, a 99mTc-FAPI scan was performed after being consulted in a multidisciplinary team. ***Results:*** The 99mTc-FAPI revealed a large mass with moderately increased uptake in the left retro-orbital region. However, the target to background and intensity of the FAPI scan was lower than that of 177Lu-Dotatate. ***Conclusion:*** Nonetheless, FAPI avidity may offer hope for future treatment planning with 177Lu-FAPI in patients who are refractory to 177Lu-Dotatate treatment. Overall, this study highlights the potential use of FAPI-ligand uptake as a diagnostic and therapeutic tool for optic nerve sheath meningioma patients who have not responded well to traditional treatments. Further research is needed to explore this potential further and optimize treatment strategies using FAPI-ligands. This study is the first to demonstrate FAPI-ligand uptake in optic nervesheath meningioma. The uptake observed in the 99mTc-FAPI scan suggests that 177Lu-FAPI treatment may be beneficial for patients who do not respond well to 177Lu-DOTATATE treatment, but further studies are needed to confirm this potential benefit

EP-1193

Importance of dynamic myocardial perfusion SPECT in the assessment of patients with MINOCA

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Aim/Introduction: Currently a high percentage of patients with chest pain and detectable myocardial ischemia do not have obvious lesions in invasive coronary angiography, giving rise to two concepts regarding this pathology. MINOCA is a syndrome characterized by myocardial injury and normal coronary arteries or those with stenosis ≤50%, and INOCA is the presence of ischemia without non-obstructive coronary artery disease. An important cause in the development of this condition is microvascular involvement defined as microvascular dysfunction, that could be structural and/or functional, leading to decreased coronary flow reserve (CFR). Patients with this condition have a higher risk of developing major cardiac events and a higher mortality compared to normal population without ischemic heart disease. In recent years nuclear medicine techniques have been developed for the assessment of myocardial blood flow (MBF) and CFR, using PET and, more recently, dynamic SPECT techniques, using cardiodedicated CZT (cadmium-zinc-telluride) gammacameras, when PET is not available. ***Materials and Methods:*** We report the case of a 58-year-old woman (body mass index, 31 kg/m2) with hypertension, hyperlipidemia, and smoking. She developed symptoms of chest tightness and exertional dyspnea. The electrocardiogram (ECG) did not show changes, and normal echocardiogram and a coronary CT angiography without lesions were also performed. After 10 months the patient has recurrence of chest pain and dyspnea, this time with pathological ECG and elevated markers of myocardial damage, but without significant stenosis on invasive coronary angiography. Acetylcholine provocation test during procedure coronary angiography was also performed to rule-out epicardial vasospasm, with normal findings. Medical treatment was indicated, but the symptoms persisted, so molecular imaging tests were recommended to evaluate coronary microcirculation. ***Results:*** The findings of this study using stress/rest SPECT myocardial perfusion imaging (MPI) showed normal myocardial relative uptake in the left ventricle. The dynamic analysis found global deterioration in CFR and MBF (0.64 and 0.93 ml/g/min, respectively). These findings were below the cut-off value, and it allows the diagnosis of microvascular disease. Thus suggests a higher mortality compared to the rest of the population. ***Conclusion:*** The CZT gammacamera enables list-mode dynamic image acquisition for the assessment of MBF and CFR. Pathological values obtained through CZT SPECT, as in our patient, allow identification of patients with increased risk for developing major cardiovascular events. Correct diagnosis and early treatment of these patients reduces symptoms and prevents future cardiovascular events.

EP-1194

A case of leukocytoclastic vasculitis showing PSMA uptake mimicking metastasis in a prostate cancer patient with a history of brain metastasis

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Aim/Introduction: We will discuss the new lesion showing PSMA uptake , which mimics brain metastasis in the imaging performed after Lu-177 PSMA treatment, and which was diagnosed with leukocytoclastic vasculitis as a result of histopathological examination, in a prostate cancer patient who had a previous history of cranial radiotherapy due to multiple brain metastases. ***Materials and Methods:*** A 63-year-old patient diagnosed with prostate cancer (Gleason Score 4+5), having multiple brain, bone and lung metastases at the time of diagnosis, had underwent radiation therapy for these metastases two years ago. As disease progressed under Abiteron after androgen deprivation treatments and chemotherapy, he was referred for Lu-177 PSMA treatment. Then, Lu-177 PSMA post-treatment scans was evaluated together with other imaging and histopathological findings. ***Results:*** This patient, admitted to the hospital with complaints of disorientation and confusion, underwent a cranial MRI which showed a 33x22x16mm lesion in the corpus callosum centrally necrotic with peripheral contrast enhancement that was incompatible with previous metastatic regions, not showing diffusion restriction, and indistinguishable from metastasis. Stereotactic cranial biopsy findings were consistent with leukocytoclastic vasculitis, thought to be secondary to radiotherapy. The patient treated with steroids. After the fourth course of Lu-177 PSMA treatment, suspicious uptake was detected in the brain on the post-treatment whole-body scan. In the SPECT/CT, cranial slices showed PSMA uptake in the area corresponding to the lesion identified in the brain MRI images. Follow-up MRI and Ga-68 PSMA PET scans, performed to assess treatment response, showed regression of this lesion. ***Conclusion:*** Late complications of radiation therapy to the brain include vasculopathy in small and/or large arteries. Leukocytoclastic vasculitis in the central nervous system (CNS) is a very rare condition and has been described in systemic diseases such as hypersensitivity vasculitis, Behçet's disease, SLE and Mycoplasma pneumonia infection, which usually occurs with the accumulation of immune material deposits in small vessels. Cases with CNS involvement have been described together with systemic involvement, but isolated leukocytoclastic vasculitis, especially in the CNS, is published in only 2 cases. Without having

any additional findings suggesting systemic disease, this is the first case that has PSMA uptake small vessel inflammation, namely leukocytoclastic vasculitis. ***References:*** 1-Panchal NJ,Niku S,Imbesi SG. Lymphocytic vasculitis mimicking aggressive multifocal cerebral neoplasm:MR imaging and MR spectroscopic appearance. AJNR .2005Mar1;26(3):642-5.2-Bhesania S, Raol K, Medina C, Ilyas S, Bhesania J, Barmanwalla A. Leukocytoclastic vasculitis: depiction of the diagnostic dilemma. Cureus. 2021 Aug 26;13(8).

EP-1195

A Case of Metastatic Pulmonary Calcification detected on both ^{99m}Tc-FAPI SCAN and ^{99m}Tc-MDP Bone Scan

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Aim/Introduction: A 59-year-old woman with recent history of weakness, loss of appetite, and significant weight loss was referred for malignancy workup. On the first day, the patient underwent a 99mTc-MDP scan which revealed diffuse pulmonary uptake in both lungs. Two days later, 99mTc-FAPI scan was performed and showed diffuse pulmonary uptake in the planar and SPECT/CT images. The study present an interesting case demonstrating FAPI-ligand uptake in metastatic pulmonary calcification. ***Materials and Methods:*** A 59-year-old woman was admitted to the hospital due to poor oral intake, weakness, and significant weight loss. Laboratory studies at that time revealed the following (reference ranges provided parenthetically): calcium 17.1 mg/dL (8.6-10.3 mg/dL); phosphorus 4.4 mg/dL (2.6-4.5 mg/dL); creatinine 3.67 mg/dL (0.6-1.3 mg/dL); total 25-hydroxyvitamin D level 37.5 ng/mL (approx. 30 ng/mL); and parathyroid hormone 26 pg/mL (15-65 pg/mL). Upon arrival at the emergency department, the patient was quickly admitted to the intensive care unit for immediate and aggressive medical intervention due to the life- threatening hypercalcemia. The initial workup showed a speculated pulmonary nodule in the apex of right lung which was suspicious for primary lung cancer, which was subsequently confirmed by biopsy results. 99mTc-MDP bone scintigraphy was performed for metastasis work up. For more evaluation as an approved clinical trial study, a 99mTc-FAPI scan was performed after being consulted in a multidisciplinary team. ***Results:*** The whole body bone scan and SPECT/CT images demonstrated diffuse uptake in both lungs, with no significant lesion in underlying CT slices. The scan findings in the lungs were compatible with metastatic calcification. Also the 99mTc-FAPI whole body scan revealed increased radiotracer uptake in the same areas identified by the bone scan. Also the SPECT/CT images revealed a pulmonary nodule in the right lung with slightly higher uptake compared to the adjacent lung. ***Conclusion:*** This study demonstrated that 99mTc_FAPI scan, like 99mTc-MDP scan, have the potential to diagnose metastatic pulmonary calcification.

EP-1196

^{99m}Tc-FAPI uptake in a rare case of Metastatic urachal Carcinoma

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Aim/Introduction: A 37-year-old man presented with a mass in the right lower quadrant of the abdomen. Upon examination, it was determined that he had urachal cancer. Further evaluation using 99mTc-FAPI scan revealed activity in the malignant part of the urachal mass and in the metastases. Due to the presence of multiple metastases, the patient's surgery was cancelled. This case emphasizes the importance of utilizing 99mTc-FAPI for initial staging in patients diagnosed with urachal cancer. To our knowledge, this study represents the first investigation into the potential use of FAPI-ligands in treating urachal cancer. Additionally, incidental normal 68Ga-FAPI-46 uptake was observed in the urachal remnant.1 ***Materials and Methods:*** Here, we present the case of a 54-year-old man who was found to have an incidental mass in the right lower quadrant of the abdomen during a recent ultrasonography. Further examination through cystoscopy and biopsy confirmed the presence of well-differentiated, enteric type urachal adenocarcinoma . To assess the extent of the disease, an abdominal CT scan was performed. The spiral CT scan revealed a multi-locular cystic mass measuring 102*99*81 mm, located in the midline of the abdomen near the bladder, with no evidence of distant metastases. Based on these CT scan findings, the patient was admitted for partial cystectomy. Prior to surgery, for further assess the malignancy in a clinical trial study, after obtaining informed constent, 99mTc-FAPI scan was performed under the guidance of a multidisciplinary research center. ***Results:*** The 99mTc-FAPI scan revealed multiple areas of distant metastases in the skull, thoraco-lumbar spine, right scapula, ribs, and pelvic bone. Additionally, the whole body scan showed a photopenic region with a foci of intense uptake adjacent to the right side of the bladder, which were consistent with urachal cyst and a component of malignancy in the right posterior side of the bladder. In the SPECT/CT images, destruction of the left frontal bone and adjacent soft tissue component were observed. ***Conclusion:*** This case emphasizes the importance of utilizing FAPI ligand imaging for initial staging in patients diagnosed with urachal cancer and To our knowledge, this study represents the first investigation in evaluation this potentiality. ***References:*** 1. Maliha PG, Jafarvard M, Czernin J, et al. Incidental Focal 68Ga-FAPI-46 Uptake in a Urachal Remnant: A Potential Pitfall Mimicking a Malignant Peritoneal Lesion. Journal of Nuclear Medicine. 2023;64:992-992.

EP-1197

Unusual Location and Orientation of crossed fused Kidneys in a Patient with History of Repaired Congenital Diaphragmatic Hernia and Hypoplastic Lung: Importance of Tc-99m DMSA SPECT/CT and Correlation with Diuretic Renal Scan and VCUG

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Aim/Introduction: We presented a 2.5-year-old boy with medical history of the left pulmonary hypoplasia, repaired congenital diaphragmatic hernia and multiple episodes of pyelonephritis who was referred to our department for 99mTc-DMSA and 99mTc-EC renal scintigraphy. The scans revealed an unusual pattern of renal uptake with horizontally aligned kidneys located high on left lower thoracic region extended to the mid abdomen. SPECT/CT of the DMSA scan clearly showed the nature of the patient's unusual location of the kidneys which was due to crossed fused renal ectopia and elevated diaphragm. Diuretic renal scans showed no evidence of renal obstruction. Additionally, the VCUG scan indicated vesicoureteral reflux in both ureters. ***Materials and Methods:*** A 2.5-year-old boy with history of the left pulmonary hypoplasia, repaired congenital diaphragmatic hernia and multiple pyelonephritis episodes was referred to our nuclear medicine center due to fever and acute pyelonephritis for 99mTc-DMSA renal scintigraphy. also the patient underwent

99mTc-EC scan to asses the possibility of obstruction. ***Results:*** The planar 99mTc-DMSA images showed unusual shape and location of fused kidneys with horizontal orientation on the left side of the body. Two areas of decreased uptake was suspicious of being cortical defects. The patient underwent SPECT/CT imaging which revealed a single kidney with homogenous 99mTc-DMSA uptake on the left lower thoracic region extending to the mid abdomen. Areas of decreased activity were proven to be dilated pyelocalyceal systems. The kidney was abutting the left diaphragm which was elevated due to left lung hypoplasia. The 99mTc-EC scan was performed in posterior and anterior views, revealing the presence of fused kidneys with two ureters on the left side of the body and good response to lasix injection. Dynamic images showed two pyelocaliceal systems, and the time-activity curve (of the posterior view) indicating normal initial uptake without evidence of obstruction. Additionally, the VCUG scan showed vesicoureteral reflux in both ureters. ***Conclusion:*** Diuretic renal scan would also be useful in identifying renal outflow obstruction and estimating its impact on renal function. Our study showed the importance of SPECT/CT images in the correct diagnosis of renal anomalies and normal variations in atypical cases.

EP-1198

A Rare Case of Osteoid Osteoma of the Medial Cuneiform bone at tibialis anterior insertion confirmed by bone scan SPECT/CT

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Aim/Introduction: A 34-year-old man presented with progressive foot pain that was initially on the medial soft tissue but eventually localized to the medial side of midfoot. Despite undergoing various imaging tests and conservative treatments over two years, the patient remained undiagnosed. After six months, soft tissue and bone involvement were observed on the medial cuneiform. A needle biopsy was inconclusive. Since bone tumor is rare in the medial cuneiform the patient was referred to our department for 99mTc-MDP bone scan. The imaging and clinical findings suggested osteoid osteoma as the likely diagnosis, which was confirmed after surgical resection and pathological examination. ***Materials and Methods:*** A 34-year-old man presented with severe foot pain in the medial aspect of his foot for over 30 months, disrupting his sleep. Pain has been intermittent and in medial soft tissue for the first 6 month. Initial imaging studies were inconclusive, and needle biopsy after 24 months did not provide a specific diagnosis. Further evaluation (30 months later) revealed a calcified focus in the articular surface and tibialis anterior attachment site of medial cuneiform on the radiography and CT imaging and significant edema in the medial cuneiform on MRI images. However, these findings were not specific enough for a definitive diagnosis. Due to the persistent severe foot pain, the patient was referred to our department for a 99mTc-MDP scan. ***Results:*** The scan showed increased blood pool and tracer accumulation in the medial part of the mid foot, corresponding to the calcified focus in the medial cuneiform on the SPECT/CT images . Although osteoid osteoma is rare in the medial cuneiform, after evaluating all findings and the patient's symptoms, the first differential diagnosis to consider was osteoid osteoma. One centimeter nidus unattached to surrounding osteoporotic fragile cancellous bone was removed from attachment site of tibialis anterior tendon. Pathological evaluation confirmed the diagnosis of osteoid osteoma. Following surgery, the patient experienced resolution of pain and improved sleep quality. ***Conclusion:*** Our case shows the importance of bone scan and SPECT/CT in diagnosis of osteoid osteoma in unusual locations.

EP-1199

Congenital Hypothyroidism, Risk Factor For Autism Spectrum Disorder

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Aim/Introduction: Congenital hypothyroidism (CH) is characterized by hormone deficiency present at birth due to a defect in thyroid gland development.Ectopic thyroid tissue is an uncommon entity that may be found anywhere along the line of the obliterated thyroglossal duct, resulting from failure of the embryonic development and migration of the thyroid gland to its normal pre-laryngeal site. In most cases, patients develop subclinical hypothyroidism due to inadequate hormone production. Untreated, this condition puts them at risk of developing irreversible neurological deficits.A typical neuropathological finding caused by thyroid hormone insufficiency is a decrease in the parvalbumin of GABAergic neurons, condition that has been observed also in post-mortem brains of patients with autism spectrum disorder. Autism spectrum disorder (ASD) is a complex neurodevelopmental condition with both genetic and environmental influences. Thyroid hormones including T3 (triiodothyronine), thyroxine (T4), and thyroid stimulating hormone (TSH, produced in response to low T3 and T4), have been hypothesized to play an important role in ASD etiology given their critical role in brain development. ***Materials and Methods:*** We present a case of a 6-year-old male patient who was referred to our clinic after incidental finding of a mass located in the tongue root. ***Results:*** The patient did not describe any pressure symptoms. The physical examination revealed a swelling at the base of the tongue and did not identify any palpable thyroid gland in the pre-tracheal region. The cervical CT and US examinations showed the absence of the thyroid tissue in its normal location and found a mass in sublingual region. The thyroid scan with Tc-99m pertechnetate confirmed the presence of sublingual thyroid tissue. Hormonal profile diagnosed primary hypothyroidism and substitution treatment with levothyroxine was initiated and adjusted based on TSH levels. After a 6-year follow-up, the patient reported symptoms of insomnia, shyness, and introversion and after a psychiatric evaluation was diagnosed with autism spectrum disorder. ***Conclusion:*** The aim of this presentation is to present the case of a 6-year-old male patient and highlight the importance of thyroid dysfunction caused by ectopic thyroid gland in psychiatric disorders and the correlation between congenital hypothyroidism resulting from thyroid dysgenesis and autism spectrum disorder, both conditions being characterized by a decrease in parvalbumin expression.

EP-1200

Cancer Integrin Imaging with [^{68}Ga]Ga-Trivehexin PET/CT for a Patient with Breast Cancer and Neuroendocrine Neoplasm: A case both [^{18F}]FDG and [^{68}Ga]Ga-DOTATATE positive but [68Ga]Ga-Trivehexin PET for Integrin αvβ6 negative lesion

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Aim/Introduction: This study evaluates the diagnostic performance of [18F]FDG PET/CT and [68Ga]Ga-Trivehexin PET/CT in detecting and characterizing primary and secondary malignancies. We highlight the case of a 71-year-old woman with a diagnosis of right breast lobular carcinoma and a suspicious pancreatic lesion. ***Materials and Methods:*** The patient underwent an initial [18F]FDG PET/CT that identified a hypermetabolic mass in the retroareolar region of the right breast and a nodular lesion in the head-body of the pancreas. Given the potential for [18F]FDG PET/CT false positivity in pancreatic masses, a [68Ga]Ga-Trivehexin PET/CT was performed. Subsequently, the patient received a biopsy of the pancreatic mass, and further imaging with [68Ga]Ga DOTATATE PET/CT was conducted to assess somatostatin receptor expression. ***Results:*** The [18F]FDG PET/CT scan revealed a 3x2 cm hypermetabolic breast mass and a 23x22 mm pancreatic lesion. The latter did not show uptake in the [68Ga]Ga-Trivehexin PET/CT, suggesting a low likelihood of malignancy. However, the biopsy confirmed a Grade 2 neuroendocrine tumor (NET). The [68Ga]Ga DOTATATE PET/CT exhibited intense somatostatin receptor expression in both lesions, indicating a neuroendocrine characteristic. Also, a mild hypermetabolic lymphadenopathy was noted in the mediastinum, which was negative on both [68Ga]Ga-Trivehexin and [68Ga]Ga DOTATATE PET/CT scans. ***Conclusion:*** This case underscores the importance of utilizing multiple imaging modalities to improve diagnostic accuracy in oncology. The [68Ga]Ga-Trivehexin PET/CT showed potential in distinguishing false positives in pancreatic lesions seen on [18F] FDG PET/CT, though its role in neuroendocrine tumors remains unclear. Further studies are warranted to establish the definitive diagnostic value of [68Ga]Ga-Trivehexin PET/CT in various malignancies. This case also highlights the complex nature of integrin involvement in tumor angiogenesis and the potential of targeted PET radiopharmaceuticals in clinical applications.

EP-1201

Unexpected behaviour in 131-I retention rate in a patient with diffuse bone involvement from Differentiated Thyroid Cancer

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Aim/Introduction: Patients with bone metastases from Differentiated Thyroid Cancer (DTC) at diagnosis represent a therapeutic challenge. After thyroidectomy, radioiodine (RAI) is the treatment of choice. We report a case of diffuse "bulky" bone involvement from DTC showing a peculiar 131-I whole-body (WB) time/activity curve (TaC) at post-RAI dosimetry. ***Materials and Methods:*** A 82-years-old female with history of thyroid goitre with 4cm left nodule underwent lumbar and pelvic MRI due to acute hip pain, showing a large mass involving left pelvic bone and soft tissues and multiple spine metastases. Bone biopsy was consistent with metastasis from follicular thyroid carcinoma. ^{18}F-FDG PET/CT showed two hypermetabolic areas in left thyroid lobe and multiple hypermetabolic bone metastases. Total thyroidectomy with central lymphadenectomy was performed. Final histology demonstrated a follicular carcinoma of the left lobe with vascular invasion (pT2). One month later, RAI treatment was performed under levothyroxine withdrawal [TSH 2,93mUI/ml, fT4 4,4pg/ml, Thyroglobulin 61208,38ng/ml]. Pre-treatment dosimetry was performed with serial blood and external WB counts, assessing Maximum Tolerated Dose (MTD) to bone marrow and theoretical 131-I dismissal rate. Post-treatment dosimetry was performed by the same method. ***Results:*** On the basis of theoretical 131-I dismissal rate, the patient received 1850MBq of 131-I; post-RAI WB scan showed multiple 131-I-avid areas in the thyroid bed, in right laterocervical region and in multiple bone metastases, including left sphenoid and left pelvic bone. Post-RAI dosimetry showed a peculiar 131-I whole-body TaC characterized by an upward trend followed by a stable plateau, with a consequent stable 131-I retention rate. Six months later, II RAI treatment was performed under levothyroxine withdrawal [TSH 3,17mUI/ml, fT4 6,6pg/ml, Thyroglobulin 12050ng/ml]. Considering pre-RAI dosimetry, the patient received 2220MBq of 131-I. Post-RAI dosimetry confirmed the peculiar trend in 131-I whole-body TaC. At last follow-up in April 2024, the patient showed partial disease response in both functional [TSH 2,23 mUI/ml, Thyroglobulin 7196 ng/ml] and instrumental evaluation (^{18}F-FDG PET/CT). ***Conclusion:*** This case, showing an unexpected 131I TaC after 131-I treatment, emphasizes the role of dosimetry in patients with diffuse "bulky" bone metastases from DTC. Pre-RAI dosimetry is helpful to choose the most appropriate 131-I activity to be administered on the basis of bone marrow limit and theoretical 131-I dismissal rate. Post-TRM dosimetry is fundamental to assess 131-I TaC. On the hypothetical bases, the peculiar trend of 131-I TaC in this metastatic patient could be associated to an incremental 131-I efficacy even for administered activities below 3700MBq.

EP-1202

Lung ventilation and perfusion scintigraphy pattern in Swyer-James-MacLeod syndrome

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Aim/Introduction: Swyer-James-MacLeod syndrome (SJMS) is a rare lung disorder which occurs as a result of childhood bronchiolitis obliterans, with an estimated prevalence of 0.01%. It is characterized by unilateral hyperlucency of a part of or the entire lung, with diminished arterial blood flow. Although most cases are diagnosed during childhood in the context of frequent respiratory infections, some patients remain asymptomatic until adulthood. Occasionally it is an incidental imaging finding. We report a case of a young adult patient who underwent lung ventilation and perfusion scintigraphy for suspected SJMS. ***Materials and Methods:*** We report a case of a 26-year-old woman who presented to our outpatient clinic with a suspected mixed connective tissue disease. In this context, a thoracic CT scan was performed, which revealed decreased size of the middle and lower lobes of the right lung, as well as lobar hyperlucency, air trapping, hypoplasia of the pulmonary vascular bed and bronchiectatic changes in this region. Therefore, SJMS was suspected and the patient underwent lung ventilation and perfusion SPECT/CT. ***Results:*** Lung ventilation and perfusion SPECT/CT showed markedly decreased perfusion in the middle and lower lobes of the right lung, with a matched heterogeneous ventilation defect. The low-dose CT scan demonstrated similar findings as the previous thoracic CT, namely increased lucency of the affected lobes. These findings were consistent with SJMS. ***Conclusion:*** Lung ventilation and perfusion scintigraphy is a useful noninvasive procedure for the differential diagnosis of hyperlucent lung on conventional imaging, while being also helpful in assessing the extent of the disease. SPECT/CT provides

both anatomic and functional information, improving diagnostic precision. Despite being a rare condition, it is essential for nuclear medicine physicians to be familiar with its scintigraphic pattern, as it may be an incidental finding in the investigation of other diseases, namely pulmonary thromboembolism. ***References:*** Mehra S, Basnayake T, Falhammar H, Heraganahally S, Tripathi S. Swyer-James-MacLeod Syndrome-A Rare Diagnosis Presented Through Two Adult Patients. Respirol Case Rep. 2017;5(5):e00245.

EP-1203

Free $TcO4^-$ in ^{99m}Tc-PSMA Scan A Case Report and Review of an Old Pitfall in the New Era of Modern Imaging

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Aim/Introduction: In a recent 99mTc-HYNIC-PSMA study conducted at our department, we examined 2 patients with prostate cancer referred for initial staging on the same day. The whole-body scans revealed radiotracer uptake in the gastric mucosa and thyroid glands, alluding to high levels of free TcO4– in the injected vial. The scans were repeated after confirming acceptable radiopharmaceutical purity of 97% (normal range, 95%-100%). Interestingly, 1 patient had liver metastases at presentation, which remained non-PSMA-avid after repeating the scan. We have reviewed this pitfall, which has been reported with many radiotracers, yet not reported with PSMA tracers. ***Materials and Methods:*** On the same day, 2 patients with a previous history of prostate cancer underwent 99mTc-HYNIC-PSMA imaging for staging purposes in our department ***Results:*** Both scans showed foci of uptake in the gastric mucosa and thyroid glands compatible with the presence of free TcO4– in the kit. In 1 patient, some of the metastatic lesions were also visualized. The scans were repeated after checking the quality control of the kits. One patient had a non-PSMA-avid liver lesion as well as widespread PSMA-avid bone and a few PSMA-avid pelvic lymph node metastases. Comparing the baseline scan with the repeated scan revealed additional lesions in the ribs, humerus, and thoracic spine. The other patient had no extraprostatic PSMA-avid abnormality. ***Conclusion:*** To the best of our knowledge, no study has reported such a pitfall. The presence of free TcO4– in 99mTc-PSMA imaging may lead to false-negative results, which might be of clinical importance to candidate patients for radioligand therapy.1 ***References:*** 1. Sartor O, De Bono J, Chi KN, et al. Lutetium-177-PSMA-617 for metastatic castration-resistant prostate cancer. N Engl J Med. 2021;385:1091-1103.

EP-1204

Redistribution of Brain Metabolism from the Neocortex to Evolutionary Ancient Brain Structures in a Patient with Hodgkin's Lymphoma

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Aim/Introduction: In a recent study, we highlighted a distinctive pattern of brain metabolic redistribution from the neocortex to evolutionarily ancient brain structures during the acute phase of COVID-19 respiratory syndrome (1). Here, we present a case of a patient with extensive lesions caused by Hodgkin's lymphoma, whose PET/CT revealed alterations in FDG distribution in the brain, characterized by decreased uptake in the neocortex and a relative increase in the basal ganglia, resembling findings observed in acute COVID-19 (1). ***Materials and Methods:*** A 57-year-old female patient with a medical history of hypertension and hypothyroidism presented with weight loss and generalized lymphadenopathy. Biopsy confirmed nodular sclerosis classical Hodgkin's lymphoma. A $^{[18F]}$FDG PET/CT was requested for disease staging. ***Results:*** $^{[18F]}$FDG PET/CT revealed significant hypermetabolism in lymphadenopathy below and above the diaphragm, spleen, and bone marrow, consistent with lymphoma infiltration. Additionally, reduced radiotracer uptake was noted in the cerebral neocortex, with relatively increased uptake in the basal ganglia. Semiquantitative analysis using dedicated software showed marked uptake reduction in the frontal, parietal, and temporal lobes (-9.4 SD to -14.3 SD) and preserved uptake in the striatum (1.1 SD). Before chemotherapy initiation, the patient experienced weakness, multiple episodes of diarrhea, and decreased level of consciousness, ultimately developing hemophagocytic syndrome, septic shock, and succumbing 19 days post-PET/CT. ***Conclusion:*** Aggressive lymphomas often exhibit intense FDG uptake and high tumor burden, which can elevate blood lactate levels, potentially serving as an alternative energy substrate for the brain and reducing FDG uptake (2). This phenomenon is akin to observations in individuals engaged in intense exercise, where decreased FDG uptake may result from potential lactate utilization by the brain (3). The relatively preserved FDG uptake in the basal ganglia could be interpreted as a physiological protective response to reduced glucose availability for the brain. Given the brain's inability to store metabolic products for later use, metabolic redistribution during competition with neoplastic cells for available energy substrates may serve to preserve essential brain functions.We conclude that patients with Hodgkin's lymphoma and high tumor burden may exhibit not only a global reduction in cerebral glucose uptake but also a redistribution of glucose consumption from the neocortex to older brain structures essential for survival. ***References:*** (1) Souza, SPM et al. EJNMMI Res 2024.12;14(1):28.(2) Yi HK, Yoo J, et al. Sci Rep 2022. 25;12(1):12639.(3) Hanaoka K, et al. Ann Nucl Med 2010. 24(10):707-11.

EP-1205

Improvement in microvascularisation evaluated with 99mTc-MIBI Tissue Perfusion scan in Diabetic Patient after Tarsal Tunnel Decompression surgery

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Aim/Introduction: Tissue perfusion is a diagnostic functional nuclear medicine method that can evaluate the foot perfusion in diabetic patients, delineating foot angiosomes of increase and decreased perfusion. Diabetic neuropathy leads to microvascular complication that presents with loss of foot sensation further complicated by the development of diabetic ulcer that affects the quality of life. We hypothesized that decompressing the tibial nerve for diabetic neuropathy patients would increase blood flow, decrease time for ulcer healing and increase sensibility to plantar area. ***Materials and Methods:*** We present a case of a 62-year-

old woman who had a non-healing diabetic neuropathic ulcer on her right foot for an average of 12 months. She had diabetes diagnosed 36 months ago, with good glycemic control and positive Tinel sign at the tarsal tunnel. We assessed blood flow by Doppler ultrasonography of posterior tibial artery at ankle. "DellonTarsal Tunel Decompression" was performed in four medial ankle tunnels. Three months post - operation, tissue perfusion was compared between operated foot and non-operated foot,using dual phase (rest and stress) 99mTc-MIBI scintigraphicmethod. Stress method was performed after 60 flexion/extension of the feet. ***Results:*** Three-month post operation tissue perfusion analysis revealed lower vascularization in the left foot in both studies, as well as lower perfusion on the late static images with total counts of the feet: L(rest) - 14169, R (rest) - 17237, L(stress) -45858, R (stress) - 55314. The perfusion reserve was preserved and symmetrical in both feet L - 223%, R - 220%. Doppler ultrasonography demonstrated enhanced blood flow within posterior tibial artery where flow rate increased from 1.60 cm^3/sec to 2.15 cm^3/sec after six months follow up visit period. No wound infections or new ulcers were noted post-operatively. ***Conclusion:*** Dellon decompression of tarsal tunnel improves sensibility and blood flow as well as enhances tissue perfusion, which plays a vital role in promoting wound healing in the plantar area of diabetic foot patients. This case underscores the significant impact of optimized tissue perfusion on enhancing sensibility and accelerating ulcer healing in diabetic neuropathy.

EP-1206

Cardiac aspergillosis: a case report.

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Aim/Introduction: Aspergillosis is a fungal infection caused by the fungus Aspergillus. In immunosuppressed individuals can cause severe infection, usually affecting the lungs, although it can also spread to other parts of the body. Confirmatory diagnosis requires histological study. The diagnosis of suspicion and follow-up of patients is performed by imaging tests. ***Materials and Methods:*** 46-year-old male from Pakistan, monitored at our centre for diagnosis of pulmonary aspergillosis, who was lost to follow-up due to change of address. He reconsulted two years later due to a worsening of his general condition, for which reason an [18F] FDG-PET/CT was requested to assess his current condition. The examination revealed several pulmonary, cutaneous and bone hypermetabolic lesions, compatible with invasive aspergillosis. It is worth mentioning an area with high hypermetabolism at the level of the interventricular septum that seems to infiltrate the posteroinferior wall of the right atrium and could be attributed to vasculitis vs. primary tumour or, with lower degree of suspicion due to its low prevalence, to cardiac involvement by aspergillosis. For a better characterization of the cardiac lesion, an [18F]FDG-PET/MRI was requested, which confirmed presence of edema in the mid-basal interventricular septum with a notable hypermetabolism extending towards the right atrium. ***Results:*** Figure 1: MIP shows several focal deposits of the radiopharmaceutical, of remarkable intensity, located at the cranial calotte, lung parenchyma and right femur.PET, CT and fusion images, in axial plane, showing cutaneous lesions.PET, CT and fusion images, in axial plane, showing the pulmonary lesions.PET, CT and fusion images, in axial plane, at the right femoral head, showing the hypermetabolic lesion. Figure 2: PET, CT and fusion images showing hypermetabolism in the interventricular septum, which appears to extend into the right atrium. Figure 3: PET/MRI images (PSIR, CINE, STIR) showing hypermetabolism at the interventricular septum, which behaves like the rest of the lesions, leading to a diagnosis of cardiac aspergillosis. The patient was treated with oral posaconazole and anidulafungin. A control [18F]FDG-PET/CT study was performed 3 months later with improvement of the lesions. Figure 4: PET, CT and fusion images showing a morphometabolic decrease in lung lesions and also an the cardiac level, which supports the diagnosis of underlying aspergillosis. ***Conclusion:*** [18F]FDG-PET/CT is a good tool for diagnosis, response assessment and follow-up for patients with invasive aspergillosis. [18F]FDG-PET/MRI allows better tissue characterization of the disease at the cardiac level, with a higher sensitivity and specificity compared to PET/CT.

EP-1207

Infectious thrombosis in femoropopliteal bypass: a case report.

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Aim/Introduction: Lower limb occlusive disease can be asymptomatic or manifest in three ways depending on the severity: intermittent claudication, pain at rest or tissue necrosis. The latter two evolve into major amputation if measures are not taken in time, so these patients may benefit from surgical treatment by performing a bypass. The femoropopliteal bypass is performed in those patients with involvement of this territory in order to alleviate the symptoms and improve their quality of life. The main complications are thrombosis, infection or formation of a prosthetic pseudoaneurysm due to degeneration. The aim of this work is to recognize the features visualized on [18F]FDG-PET/CT, in a patient with bypass infection. ***Materials and Methods:*** 85-year-old woman with a history of peripheral vasculopathy and infragenicular amputation of the left lower extremity more than 15 years ago. In January 2024 she was admitted for severe ischemia of the right lower limb requiring femoropopliteal bypass with saphenous vein. Subsequent admission in March 2024 for thrombosis of the bypass. An unsuccessful mechanical thrombectomy was attempted, so a PTFE (poly-tetra-harin-ethylene) vascular prosthesis was placed. In April 2024 she consulted our center for symptoms of less than 24 hours of evolution in the form of disorientation, drowsiness and fever up to 38.5º. Physical examination revealed a 2cm dehiscence at the right supragenicular level with slight exudate discharge, with no signs of acute infection (cellulitis, erythema). Several complementary tests were performed, showing elevated acute phase reactants and growth of methicillin-sensitive S. aureus in blood cultures. Given the findings, she was admitted to the Infectious Diseases Department and [18F]FDG-PET/CT was requested to confirm the infectious focus and assess the extent of it. ***Results:*** Figure 1: MIP shows a remarkable homogeneous hyperenhancement in the proximal third of the right lower extremity. PET, CT and fusion images, in axial plane, showing contiguity solution with fistulous tract and air bubbles at the inner distal third of the right thigh, extending towards the bypass, which shows an increase of the glycemic metabolism along its entire femoral tract, in relation to an associated thrombosis. PET, CT and fusion images, in the coronal plane. Likewise, several fractures are also observed in the

right costal grid related to traumatic antecedent. ***Conclusion:*** [18F]FDG-PET/CT allows us to obtain a global vision, being able to locate the infectious focus, assess its local extension as well as the presence of septic emboli in the rest of the organism.

EP-1208

^{18}F-FDG-PET/CT in the end-stage of ADPKD and MCTD

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Aim/Introduction: 18F-FDG-PET/CT is a diagnostic tool for infection localization and clinical management in fever of unknown origin FUO [1] with limitation to kidney/urinary-tract infections. It's also useful for metabolic assessment of muscle connective tissue disease MCTD [2]. A case which summarizes all these pathologic conditions. ***Materials and Methods:*** We present the comparison between the images of a 55y female patient affected by autosomal dominant polycystic kidney disease ADPKD in 4years dialysis, hepatic-renal involvement and MCTD with sick-syndrome, photosensitivity, Raynaud-phenomenon. In June2012 she underwent ^{18}F-FDG PET/CT for MCTD, in April2024 for persistent FUO. ***Results:*** Peritoneal infection due to peritoneal dialysis lead to chronic entericCD+colitis E.Coli-VanA-related, and chronic diarrhea. Also gastric uremic disease with multiple erosions was seen during endoscopy. Other complications were systemic hypertension, iatrogenic osteoporosis (L1-L2, left ischial bone, costs fractures). ^{18}F-FDG findings were: respect the WB-PET-CT of 2012, the WB-PET/CT of 2024 showed: 1)severe numeric increment and enlargement of cysts in the liver, currently disseminated and associated to a mean reduction of metabolic activity (hepatic mean SUV 1,57 vs 2,34) in all segments, 2)severe numeric increment and enlargement of cysts into the kidneys with current huge extension to the pelvis 3)in the right kidney presence of inhomogeneous intense glucose hypermetabolism (max SUV 16.3) in the anterior kidney profile around cysts, and probable compressive phenomenon of renal pelvis, deformed and dislocated. 4)not significant intestinal FDG-hypermetabolism, moderate gastric activity 5)appearance of evident ascitic effusion, in pelvis and flanks 6)appearance of evident bilateral pleural effusion 7)appearance of upper paratracheal cystic alterations into the thyroid parenchima 8)diffuse reduction of metabolic activity of left ventricular myocardium 9)diffuse metabolic and volumetric reduction of all muscles mostly for lower limbs 10) focal intense bone hyperactivity in the 6th-right cost and in the left ischial insertion 11)diffuse calcific depots on the principal vessels 12)high normal brain activity. ***Conclusion:*** We consider ^{18}F-FDG-PET/CT of paramount importance in the assessment of organs involvement, functional evaluation and space-consuming impact in this life-threatening inherited human systemic disorder. In the most common hereditary kidney disease, ^{18}F-FDG PET/CT allows a correct localization of the infection-site being the renal kidneys not-functioning in dialytic phase. FDG-PET/CT demonstrated useful for the management of very complex cases, with unexpected rapid evolution and timing of possible surgical solutions in infected kidney cysts. ***References:*** [1]Kouijzer IJE et al. Semin Nucl Med. 2018 Mar;48(2):100-107. doi: 10.1053/j.semnuclmed.2017.11.004. Epub 2017 Dec 8. PMID: 29452615.[2] Okabe Tet al. Clin Nucl Med. 2011 May;36(5):350-4. doi: 10.1097/RLU.0b013e318212c858. PMID: 21467850.

EP-1209

PET-CT ^{18}F FDG in the Management of Splenic Red Pulp Small B-Cell Lymphoma: A Clinical Case Report

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Aim/Introduction: Splenic diffuse red pulp small B-cell lymphoma (SDRPL) is a rare disease, representing <1% of all non-Hodgkin lymphomas. The most common clinical manifestations include splenomegaly, lymphocytosis, and hemocytopenia. A diagnosis of SDRPL can be challenging, as it shares multiple clinical and laboratory features with splenic marginal zone lymphoma, hair cell leukemia, and HCL variant. Obtaining splenic tissue remains the gold standard for diagnosis. In the cases where splenic tissue is not available, diagnosis can be established by a review of peripheral blood and bone marrow studies. SDRPL is characterized by a diffuse involvement of the splenic red pulp by monomorphous small-to-medium sized mature B lymphocytes effacing the white pulp. ^{18}F FDG PET-CT characteristically shows splenomegaly with a mild and diffuse increase in metabolic activity and mild hypermetabolism in the bone marrow, according to what has been described in the literature so far. ***Materials and Methods:*** A 64-year-old male patient was referred for a hematology study due to moderate leukothrombopenia that had been going on for years, with no other clinical or analytical findings. During the physical examination, splenomegaly was detected and the patient was referred for an ultrasound and CT study that confirmed splenomegaly of 21cm, with no other findings.Immunophenotype in peripheral blood, bone marrow biopsy and ^{18}F-FDG PET-CT are requested. ***Results:*** The immunophenotype in peripheral blood shows a result compatible with type B non-Hodgkin lymphoma suggestive of SDRPL. The bone marrow biopsy shows a result of interstitial lymphocytosis of small lymphocytes of phenotype B that suggests infiltration by a lymphoproliferative process of small lymphocytes.The ^{18}F-FDG PET-CT shows splenomegaly of 21.5cm with metabolic activity slightly higher than that of the liver (SUVmax=5.22), without evidence of focal lesions, diffuse hypermetabolism of the bone marrow, and multiple supradiaphragmatic and infradiaphragmatic nodes, all of them with an SUVmax lower than the hepatic one and less than 1cm in diameter. ***Conclusion:*** Splenic small cell lymphoma B of the red pulp is a rare type of primary splenic lymphoma, and although the diagnosis is based on splenic and bone marrow biopsies and immunophenotype. Recognizing the characteristic involvement of this pathology in ^{18}F-FDG PET-CT is important to assess the extension and support the diagnosis in cases of doubt.

EP-1210

PET-CT ^{18}F FDG evaluation of Paraneoplastic Skin Manifestations in Hodgkin Lymphoma: A Case Report and Review

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Aim/Introduction: Hodgkin's lymphoma is a monoclonal lymphoid neoplasm that is mainly characterized by multinucleated Reed-Sternberg cells on a background of non-neoplastic inflammatory cells. The incidence rate of Hodgkin's lymphoma is 2.5 new cases per 100,000 people per year. Paraneoplastic syndromes are conditions that are related to malignancy; however, they are not a result of tumor invasion. These paraneoplastic syndromes can occur virtually at any point

in the disease course, and their various forms are not well studied. Paraneoplastic skin conditions like diffuse hyperpigmentation, erythema nodosum, and acquired ichthyosis have been described in the literature. The main pathophysiology is hypothesized to be T cell dysregulation and increased Th2 cytokine profiles conducive to atopy.In this case, we analyze a case of Hodgkin lymphoma with paraneoplastic skin involvement. ***Materials and Methods:*** A 61-year-old woman presented with generalized pruritus, skin lesions and lymphadenopathy, and after a lymphadenopathy biopsy, she was referred to hematology with initial suspicion of peripheral T lymphoma NOS, which was later confirmed as Hodgkin Lymphoma upon completion of the immunophenotype analysis. ***Results:*** The ^{18}F-FDG PET-CT at diagnosis showed hypermetabolic supra- and infradiaphragmatic lymphadenopathy and multiple suspicious hypermetabolic skin lesions on the limbs and trunk.Given the suspicion of skin involvement, a biopsy of one of the skin lesions was performed, which showed a result of superficial perivascular lymphocytic dermatitis. Suggesting probable paraneoplastic etiology of the lesions. The patient was treated with an ABVD (adriamycin, bleomycin, vinblastine, dacarbazine) regimen. The interim ^{18}F-FDG PET-CT 3 months after starting treatment showed complete response to treatment and resolution of the skin lesions, which were metabolically undetectable.In line with what was published in the literature, the skin lesions resolved after a favorable response to treatment. ***Conclusion:*** The presence of hypermetabolic skin lesions in a ^{18}F-FDG PET-CT atf Hodgkin lymphoma should initially make us think, due to its greater frequency, of paraneoplastic etiology. However, a biopsy must be obtained to confirm the diagnosis, and rule out malignant skin infiltration, which, although less common, is also possible.

EP-1211

Disseminated localizations of plasmoblastic lymphoma in an AIDS presenter patient

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Aim/Introduction: HIV-associated lymphoma was first classified as an AIDS-defining disease by the American Center for Disease Control and Prevention (CDC) in 1985. Non-Hodgkin's lymphomas (NHLs) are the most frequent malignancies in AIDS patients; ^{18F}-FDG PET/CT could help to reveal their localizations. ***Materials and Methods:*** We present a case report of an AIDS patient with a voluminous vulvar lesion that underwent PET/CT examination with an evidence of diffuse metastatic localizations of disease. A biopsy of the vulvar lesion revealed a rare form of NHL, the plasmoblastic lymphoma (PBL). ***Results:*** A patient with deteriorating clinical conditions presented to the Emergency Department of our hospital. Blood tests revealed increased values of LDH, ferritin and beta2-microglobulin with initial pancytopenia and positivity of anti-HIV1-2 antibodies at HIV test; in this setting, a high quantitative HIV RNA and a low CD4+ lymphocyte count were highlighted. A mass in the vaginal canal with extension to the uterine cervix and pathological lymph nodes in the left inguinal area were found at CT images. Additional ^{18F}-FDG PET/CT findings were a diffuse bone marrow uptake, further lymphadenopathies in left laterocervical area and in the mediastinum, as well as nodulations/inhomogeneities of the subcutaneous adipose tissue in the right gluteal region. Two tracer uptake foci were also observed in the head and body of the pancreas. Consistent with the presence of carcinomatous lymphangitis were the multiple areas of uptake on parenchymal bilateral pulmonary lesions. Bone marrow and pelvic lesion biopsies were suggestive of plasmoblastic lymphoma (PBL). ***Conclusion:*** ^{18F}-FDG PET/CT proved to be an important diagnostic tool in localizing nodal and extranodal sites of AIDS-related disease. This could impact on management of AIDS presenter patients with poor-prognosis lymphoma. ***References:*** -Liu Q, Yang T, Chen X, Liu Y. Clinical value of 18F-FDG PET/CT in the management of HIV-associated lymphoma. Front Oncol. 2023 Jan 26;13:1117064. doi: 10.3389/fonc.2023.1117064. PMID: 36776334; PMCID: PMC9909962.

EP-1212

Pulmonary Necrotic Inflammation Mimics Lung Cancer on [68Ga]Ga-FAPI-46 PET/CT and ^{18F}F-FDG PET/CT

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Aim/Introduction: A 73y.o. male patient underwent a thoracic diagnostic-CT to investigate the presence of a lung lesion after the onset of haemoptysis. CT-scan detected a voluminous, solid and inhomogeneous lung lesion in the left superior lobe near to pleura, with hypodense and colliquative areas, irregular and spiculated margins. Some enlarged mediastinal lymph nodes were described. ***Materials and Methods:*** The patient was referred to our Centre for a standard ^{18F}F-FDG PET/CT to evaluate the lung lesion in the left superior lobe and, in the suspect of lung cancer, enrolled to perform an additional [68Ga]Ga-FAPI-46 PET/CT(2days later) within an ongoing prospective monocentric investigational trial(EudraCT number:2021-006570-23). PET scans were acquired 60 minutes after the radiopharmaceutical injection, with a field-of-view from the vertex to the proximal thighs. ***Results:*** ^{18F}F-FDG PET/CT detected intense and inhomogeneous uptake(SUVmax=14.8) in the known lung lesion in the left superior lobe, with some central areas of absent uptake due to possible necrotic phenomena; a moderate uptake was detected in subaortic (#5, SUVmax=4.3), left hilar (#10; SUVmax=7.8) and left interlobar peribronchial (#11, SUVmax=7.8) lymph-nodes(T2N2M0). [68Ga]Ga-FAPI-46 PET/CT detected an intense and inhomogeneous uptake in the lung lesion (SUVmax=21.3) and focal uptake only in left interlobar peribronchial lymphnodal region (#11, SUVmax=9.3) (T2N1M0). Endobronchial ultrasound-guided biopsies resulted inconclusive in lung and exlcluded malignancy in #4L (TXN0M0). Subsequent surgery (left superior lobectomy) demonstrated necrotic inflammation with hilar abscess and contiguous areas of pneumonia. Inflamed lymph nodes were detected in #5, #7, #9, #10, #11. Immunochemistry was also performed with FAPI staining: immunoreactivity in fibroblasts and plasma cells was detected. ***Conclusion:*** As previously reported, the novel promising tracer FAPI can show diffuse/multifocal uptake in pneumonia and chronic inflammations[1-3], thus mimicking lung cancer, similarly to the false positives often observed with standard ^{18F}F-FDG PET/CT. Interestingly, in this case [68Ga]Ga-FAPI-46 PET/CT detected less lymph nodal involvement than

[18F]F-FDG PET/CT, raising some concern whether it was a tumour downstaging compared to FDG or an impressive pitfall to be encountered within the non-oncological FAPI uptake. A deeper analysis of the [68Ga]Ga-FAPI-46 PET/CT uptake(also collecting and comparing semiquantitative parameters) with respect to the definitive histological diagnosis is awaited in the ongoing trials, in order to better understand the tracer behaviour. ***References:*** [1]Tang W,Wu J,Yang S,Wang Q,Chen Y.Organizing Pneumonia With Intense 68Ga-FAPI Uptake Mimicking Lung Cancer on 68Ga-FAPI PET/CT.ClinNuclMed. 2022;47(3):223-225.doi:10.1097/RLU.0000000000003855[2]Hotta M, Rieger AC, Jafarvand MG,et al.Non-oncologic incidental uptake on FAPI PET/CTimaging. BrJRadiol.2023;96(1142):20220463.doi:10.1259/bjr.20220463[3] Aydin Y, Arslan R, Filik M.Pulmonary actinomycosis mimicks lung cancer. RevSocBrasMedTrop. 2022;55:e0195.

EP-1213

A case of occult invasive urothelial carcinoma with bone metastasis on ^{18}F-FDG PET/CT

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Aim/Introduction: We present ^{18}F-FDG-PET/CT images of a case with occult metastatic invasive urothelial carcinoma diagnosed by bone biopsy. ***Materials and Methods:*** The patient was administered 0.15 mCi/kg FDG intravenously. PET/CT imaging was obtained from whole body at 60th minute after the injection. ***Results:*** A 67-year-old man with no known chronic disease presented with a 3-month history of left hip pain. Lumbar MRI revealed osteolytic lesions with periosteal reaction and heterogeneous contrast enhancement in lumbar vertebrae, sacrum, and left pelvic bone, accompanied by edema in surrounding soft tissues. It has been stated that it may be compatible with metastasis, osteomyelitis, fibrous dysplasia or metabolic bone diseases. Subsequent FDG-PET/CT imaging revealed extensive hypermetabolic sclerotic bone lesions in sacrum, left pelvic bones, and proximal left femur. Additionally, multiple hypermetabolic bone lesions were detected in parietal bone, sternum, L3-L4-L5 vertebrae, right iliac and right femur accompanied by sclerosis in some of them. A focal FDG uptake was detected in prostate gland. Prostate needle biopsy revealed high-grade prostatic intraepithelial neoplasia and chronic prostatitis, but no invasive tumour was detected. A subsequent sacral osteocut biopsy revealed invasive urothelial carcinoma metastasis, with positive immunohistochemical staining for PanCK, CK7, GATA3, and Uroplakin-3. PET images were re-evaluated retrospectively after the pathology report, no pathological involvement was detected in the urinary system that could be distinguished from urinary FDG activity. MRI urography study also didn't reveal any finding in the urogenital system that could indicate a primary tumour. Follow-up bladder washing cytology was also negative for malignancy. Cisplatin, gemcitabine and zoledronic acid treatment was started by medical oncology with the diagnosis of metastatic urothelial carcinoma. ***Conclusion:*** Urothelial carcinomas are malignant tumors arising from transitional cells throughout the urinary system, most commonly in bladder. Distant metastasis is rare at the time of diagnosis (approximately 5%). Distant metastases are frequently to the liver, lung and bones. Occult metastatic urothelial carcinoma is very rare, with only a few case reports in the literature. In our case, only multiple bone metastases were present at the time of diagnosis, mainly in pelvis, left femur and lumbar vertebrae. It is known that the most common bone metastasis localizations of urothelial carcinomas are pelvic and vertebral bones. Therefore, the possibility of urothelial carcinoma metastasis should be considered in cases of unknown primary bone metastases, particularly in these locations. ***References:*** 1.Bu K,et al. An occult urothelial carcinoma with wide multiorgan metastases and its genetic alteration profiling. Medicine. 2019;98.

EP-1214

FDG PET/ CT in the evaluation of therapy response assessment of hepatic alveolar hydatid disease (Echinococcus multilocularis) in non- endemic areas- case report of two treated patient

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Aim/Introduction: Alveolar or multilocular echinococcosis is an infection with the larval form of the tapeworm Echinococcus multilocularis. In comparison to cystic echinococcosis (CE) this form of infection is rarebit more severe and both infections most commonly affect the liver. Recent epidemiological studies show that it is becoming a growing public health issue, and it has a progressive spread to other non- endemic regions. AE if left untreated can be fatal, once diagnosed the treatment is difficult and therapy response assessment is also not easy. It also gas a long asymptomatic incubation period, approximately from 5 to 15 years and the development and progression of a primary liver AE is very slow. Because of its non- specific clinical symptoms and imaging characteristics the diagnosis and the evaluation of response to treatment can be sometimes challenging. In the follow- up and therapy response assessment PET/ CT has been suggested as a very useful imaging modality. ***Materials and Methods:*** The FDG PET/ CT was done by using standard protocols, with normal glycaemia and after 4- 6 hours of fasting. In these patients delayed images of the abdomen were also obtained 3 hours after injection. Two patients were classified according to the PNM system (P- parasitic mass; N- neighbouring organ involvement; M- metastatic disease) and FDG PET/ CT was performed after therapy with radical surgery and after adjuvant therapy with albendazole. ***Results:*** PET/ CT in one patient did not show increased liver uptake in the region of treatment and in the other patient it showed only discreet rim uptake in the region of the liver lesion. On delayed images both patients did not have an increase of FDG uptake. These findings were interpreted as good response to therapy with stable disease or even resolution. ***Conclusion:*** Therapy response assessment is very challenging for morphological imaging modalities like computed tomography (CT) and magnetic resonance imaging (MRI) and therefore FDG PET/ CT has been proposed as a tool for follow- up of treated patients. Reduced or negative perilesional FDG uptake following treatment can be taken as a marker of stable disease with good response to therapy or resolution even in the presence of morphological lesions.

EP-1215

Case Report: ^{18}F-FDG PET/CT For Fuo Contributes To Uncover Atypical Presentations Of Rare Whipple Disease Infection

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Aim/Introduction: We present the case of a 60-year-old man admitted to the hospital presenting with high fever of unknown origin (FUO), strong headache, face erythematous-desquamative cutaneous lesions, long history of abdominal pain and diffuse myalgia. He was also previously treated with immunosuppressants and currently managed with corticosteroids for a seronegative rheumatic disease. Given the immunocompromised state, an infective aetiology was suspected. ***Materials and Methods:*** The patient was referred, as part of standard clinical practice, to perform a routine 18F-FDG-PET/CT, to identify potential causes of FUO. The patient signed written informed consents for data treatment and images' use for scientific purpose and publication. ***Results:*** The FDG-PET/CT scan revealed diffuse bone marrow uptake, without focal areas, involving the whole axial skeleton and the proximal part of humeri and femora bilaterally (SUVmax in the femur=5.6) which could indicate functional bone marrow activation in response to ongoing infection. Interestingly, multifocal uptake was observed in all muscular soft tissue (SUVmax=5) included in the standard field-of-view. Considering PET resolution limitations and physiological unspecific-functional bowel uptake, no significant focal uptake was depicted at the gastrointestinal level. Whipple disease (WD) is a very rare, systemic disease, caused by a gram-positive bacillus bacterium Tropheryma whipplei that primarily targets the intestinal epithelium but can affect various organs, generally presenting at the onset with polyarthritis (approximately 60% of cases), often misdiagnosed as rheumatic disease. Exceptionally it can cause inflammation of muscles and soft tissues: cases of bilateral extraocular myositis, of WD mimicking an autoinflammatory disease with myositis and soft tissue inflammation, of dermato-polymyositis-like presentation have been reported.To the best of our knowledge, this is the first instance where FDG-PET/CT has revealed multifocal muscular uptake in WD. At first non -pathological muscles' hyper-contraction due to elevated fever with shaking chills during 18F-FDG uptake time (also requiring paracetamol administration) was an option, but still in differential diagnosis with haematological, rheumatological and infectious aetiologies. Finally, when a small bowel (duodenum) biopsy pathologically confirmed the clinical suspect of WD, infectious muscular involvement remained the only most reliable hypothesis, prompting the initiation of specific antibiotic therapy (ceftriaxone, trimetroprim + sulfametoxazole). ***Conclusion:*** These unusual imaging findings highlight the crucial application of FDG-PET/CT in the flow-chart of FUO, being able to uncover also atypical manifestations and to expand our understanding of rare diseases. However, WD diagnosis remains challenging due to its rarity, clinical manifestations heterogeneity and slow progressive course mimicking autoinflammatory/autoimmune/malignant diseases, thus requiring multidisciplinary approach.

EP-1216

Bone scan in Camurati-Engelman disease: a case report

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Aim/Introduction: Camurati-Engelmann disease (CED) is a rare disorder characterized by progressive cranial hyperostosis and diaphyseal sclerosis of the long bones. Chronic intracranial hypertension gradually occurs due to progressive cranial vault hyperostosis. (1) ***Materials and Methods:*** A 35-year-old patient complained about pain in right leg since August '22 so he performed some exams, in which, a rx which described a thickening in right shinbone and in the radius and ulna. The orthopaedic surgeon suspected a CED and suggested to perform a bone scan to analyse the metabolic state of the bone. ***Results:*** The bone scan described uptake of radiotracer in left shinbone, at the ulna, at the femur and at the bone skull. Genetic analysis is in progress. ***Conclusion:*** Bone scintigraphy can be an useful tool in the diagnosis and assessing the severity of suspected Camurati-Engelmann disease. ***References:*** (1) 10.1007/s00223-019-00532-1

EP-1217

An Alternative Therapeutic Approach to Neuroendocrine Prostate Cancer

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Aim/Introduction: Androgen deprivation therapy (ADT) has become the standard treatment for patients with prostate cancer, owing to the unique role of the androgen in the growth and progression in prostate cancer (PC). Tumors receiving ADT eventually progress to an androgen-resistant state, known as CRPC (castration resistant PC) or more lethal NEPC (neuroendocrine PC). So, NEPC is an aggressive variant of prostate cancer, usually diagnosed at an advanced stage and shows great increase in incidence due to the rapid development of drug resistance, making the discovery of new therapeutic approaches of paramount importance. Here, we discuss a case of utilization of 177Lu-DOTATATE in the treatment of a patient with NEPC. ***Materials and Methods:*** A 71-year-old male, with a previous diagnosis of prostate cancer in another institution, started follow-up in our center, where a prostate biopsy was performed, that led to the diagnosis of prostate adenocarcinoma, Gleason 9 (5+4), with neuroendocrine diferentiation (small cell neuroendocrine carcinoma). ***Results:*** After undergoing an initial course of two months of chemotherapy (cisplatin + etoposide), a PET/CT 68Ga-DOTANOC was requested, showing bone lesions with mild radiopharmaceutical uptake. The cromogranin A level was 1238 ng/mL and the PSA level 10.67 ng/mL. With these results, the patient was proposed to be treated with 177Lu-DOTATATE, undergoing a total of three cycles (from october/2018 to february/2019), showing a good biochemical (the cromogranin A levels dropped from 1238ng/mL pre-treatment to 205.8 ng/mL after the third cycle) and clinical response (no new lesions detected during the treatment). The patient continued then follow-up, with hormonotherapy and chemotherapy until he passed away, in september/2023. ***Conclusion:*** Neuroendocrine prostate cancer (NEPC) is a highly aggressive subtype of prostate cancer (PC) that commonly emerges through a transdifferentiation process from prostate adenocarcinoma and evades conventional therapies. This case shows that 177Lu-DOTATATE may be an important alternative for the treatment of NEPC.

EP-1218

Very rare case of solitary fibrous tumour of the pleura with intermediate/hight risk of malignancy discovered incidentally on bone scintigraphy

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Aim/Introduction: Solitary fibrous tumour of the pleura (SFTP) is a rare neoplasm originated from the mesenchymal layer of the pleura, but occasionally found in other sites. Historically considered benign with slow tumour growth, recent literature has shown that such tumours often exhibit unpreadictable histologic behaviours, make it a challenge for pathologists to differentiate between benign and malignant form. Patients are usually asymptomatic, manifesting atypical symptoms upt to 40%, and only at advanced stage presenting with mechanical chest compression. In rare cases, non-diabetic patients may develop hypoglycaemia due to SFTP secreting insulin-like growth factor 2 (IGF-2). Treatment is surgical, but because of the late diagnosis, it is hampered by the effects of large pleuropulmonary resections in often elderly patients with comorbidities. We present the case of a patient with chronic left lower limb pain, who was diagnosed and treated for SFTP based on bone scan results, before compression symptoms developed. ***Materials and Methods:*** A 78-year-old female patient presented with severe left low-back pain unresponsive to conventional antalgic therapies. To rule out metastases and lytic bone lesions, she was referred for further evaluation with a CT scan of the pelvis and left femur, which showed only calcific enthesopathy of the great trochanter, followed by bone scintigraphy. ***Results:*** A 99mTc-HDP bone scintigraphy was performed and showed, in addition to signs of polydistrict arthrosis, a large oval area of relative tracer uptake in the right mid-thoracic region of probable lung relevance. Consequently, the patient underwent a CT scan of the thorax, which showed a large solid neoformation, starting from the visceral pleura, at the middle lobe. Subsequent ^{18}F-FDG PET/CT scan revealed low uptake of the lesion (SUVmax=2). A transtoracic biopsy revealed spindle-cell mesenchymal tissue with morphological and immunophenotypic features consistent with SFTP, areas of ischaemic necrosis and uncertain biological malignancy potential (intermediate/high risk). Therefore, the patient underwent surgical excision of the tumour with atypical resection of middle lobe lung parenchyma by thoracotomy without post-operative sequelae. Few other cases of SFTP uptake on bone scintigraphy have been reported. ***Conclusion:*** In this case, bone scintigraphy allowed the early diagnosis of a potentially malignant SFTP in an asymptomatic patient, providing us with another example of non-bone disease detectable with 99mTc-HDP.

EP-1219

Rebound Thymic Hyperplasia Following Corticotherapy: A Case Report Demonstrated on 2-[18F] FDG-PET/CT

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Aim/Introduction: Thymic Rebound Hyperplasia (TRH) is a recognised phenomenon characterised by the proliferation of thymic tissue following periods of stress, such as thermal burns or cardiac surgery, post-chemotherapy or, less frequently, after discontinuation of oral corticosteroid treatment (CST). These latter cases have been particularly described in children who received CST for lymphoma. Currently, PET/CT with 2-[18F]FDG (2-[18F]FDG PET/CT) plays an important role in staging malignancies as well as in detecting tumour recurrence. However, interpreting lesions encountered in the anterior mediastinum during malignancy follow-up can be challenging. We aimed to review the role 2-[18F]FDG PET/CT had in identifying a case of RTH following the resolution of hypercortisolism after adrenalectomy for an adrenocortical tumour. ***Materials and Methods:*** We report the case of a 39-year-old man with a history of nephrolithiasis and recently diagnosed arterial hypertension, who presented to the emergency department of our institution with symptoms consistent with renal colic. Initial evaluation with abdominal computed tomography excluded ureteral obstruction but revealed a suspicious 5 cm nodule in the left adrenal gland. He was referred to an Endocrinology evaluation. Blood work revealed ACTH-independent hypercortisolism and abdominal magnetic resonance imaging suggested diagnosis of an atypical adenoma versus a collision tumour. Given the suspicion of malignancy, 2-[18F] FDG PET/CT was requested and demonstrated moderate focal hypermetabolism in the adrenal lesion with no other suspicious foci. The patient underwent laparoscopic left adrenalectomy without complications. Postoperatively, CST was started, initially administered as hydrocortisone via intravenous infusion, and changed after 2 days to an oral physiologic replacement dose, with sequential slow tapering. ***Results:*** The histopathological analysis identified an adrenal cortex neoplasm of uncertain malignant potential. Blood pressure and cortisol values normalised post-operatively and antihypertensive medication was suspended. Six months post-surgery, re-evaluation with 2-[18F]FDG PET/CT revealed resolution of adrenal hypermetabolism and the appearance of diffuse and intense radiopharmaceutical uptake in an enlarged thymus, which was previously absent. This pattern was consistent with reactivity to CST, namely TRH. Currently, the patient remains asymptomatic on clinical and imaging follow-up. ***Conclusion:*** Our case highlights the importance of including TRH in the differential diagnosis of mediastinal lesions following corticotherapy. The interpretation of 2-[18F]FDG PET/CT findings in this context needs careful consideration of clinical history and imaging characteristics to avoid misdiagnosis. 2-[18F]FDG PET/CT is, therefore, a valuable emerging tool in these situations, facilitating optimal patient care by avoiding futile aggressive management strategies and allowing conservative approaches for follow-up.

EP-1220

Radioguided Occult Lesion Localization (ROLL) to perform pre-surgery marking of non-palpable thigh melanoma metastasis of multi-recurrent scalp melanoma: a case report

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Aim/Introduction: Our aim is to describe our pilot experience of ROLL (Radioguided Occult Lesion Localization) technique with 99mTC-MAA to perform pre-surgical precision marking of non-palpable retro popliteal melanoma metastasis, already described by ^{18}F-FDG PET/CT, in 80 year-old male patient ***Materials and Methods:*** The ROLL is performed under local and intramuscolar anesthesia. Once the lesion is located by ultrasound-guided technique, it is accessed with a needle 18G, it is estimated that the administered dose is 25 MBq. Once the radiopharmaceutical is administered, it is confrmed by local deposit with a posterior static

acquisition and SPECT/CT view performed by GE 670 gamma-camera ***Results:*** The methodical shows a focal and limited localization of the radiopharmaceutical, without local spilling, above the right retro popliteal fossa to omolateral distal femoral diaphysis between the short and long heads of the biceps femoris muscle, in correspondence to the already know finding described by ^{18}F-FDG PET/CT. The metastasis was subsequently localized by the surgeons deep in the posterior muscle planes adherent to nerve structures and was removed without complications ***Conclusion:*** the methodical, in particulare the SPECT/CT view, obtained a pre-surgical high marking accuracy with an improvement in space localization, and it seems to be a simple, safe and reproducible technique.

EP-1221

Wash-out index used in 99mTc-MIBI scintigraphy in differentiating benign from malignant thyroid nodules

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Aim/Introduction: Nuclear medicine scintigraphic methods are useful diagnostic tools in evaluating thyroid nodules. In ultrasonographically suspected thyroid nodules as well as indeterminate fine needle aspiration biopsy findings, thyroid scintigraphy with 99mTc-MIBI has been used in nuclear medicine centers to differentiate benign from malignant thyroid nodules. ***Materials and Methods:*** We evaluated 32 nodules, from 30 euthyroid patients, both gender. All patients presented with suspected thyroid nodules upon ultrasound examination, primarily categorized as indeterminate nodules (Bethesda III and Bethesda IV) on fine needle aspiration biopsy, with only five falling under the Bethesda II classification. A thyroid scan lasting 10 minutes was conducted using a dual phase approach, with images at 10 minutes and 1 hour after iv administration of 370 MBq 99mTc-MIBI. Total and average counts were obtained from mirrored regions of interest (ROIs), accounting for background levels. The washout index (WOI) for each nodule was calculated using the formula (LR/ER*100-100). ***Results:*** Thyroid nodules were described mostly as hypoechoic-non-chomogenous by structure, mainly cold on pertechnetate scan, while five were isoechoic and three were hyperechoic. Their size varied from 9mm to 40mm. 16 thyroid nodules were located in the right thyroid lobe, while the rest were in the left thyroid lobe. In the benign group we revealed 9-Follicular adenoma, 2 - Tumor of unknown malignant potential and 3 - Struma nodosa, 2 - Thyroiditis Hashimoto. In the malignant group we post surgically received 10-Papillary thyroid carcinoma (3 being Microcarcinoma papillare), 3 - Papillary thyroid carcinoma with follicular variant, 2 - Follicular carcinoma, 1 - Hurthle carcinoma.The WOI values displayed distinct ranges specific for malignant and benign nodules respectively, with the following specifications: (54.6±10.9) and (43.5±7.1), accompanied by standard deviations of 12.9 for malignant and 8.6 for benign samples. Analysis using the Mann- Whitney U test two-tailed comparisons has revealed a statistically significant difference between the observed samples at a significant value $p<0.05$. ***Conclusion:*** The computation of WOI derived from 99mTc-MIBI thyroid scintigraphy proves to be a valuable diagnostic tool, in delineating benign from malignant thyroid nodules for proper future thyroid patient managment.

EP-1222

Not Everything Is As It Seems - a Case Report of a Rare Thyroid Cancer

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Aim/Introduction: Papillary thyroid cancer (PTC) and medullary thyroid cancer (MTC) originate from different cells and show no shared genetic origin. There are only several cases describing a tumor containing both MTC and PTC features - condition known as mixed medullary and follicular cell-derived thyroid carcinoma (MMFTC), which occurs in <1% of all malignant thyroid tumors. ***Materials and Methods:*** A 54-year-old female patient with Graves' disease and bilateral thyroid-associated ophthalmopathy was treated by thiamazole for 7 years before undergoing definitive treatment by total thyroidectomy. The histopathology report showed PTC of the left thyroid lobe, 9 mm in diameter, with metastases to the central lymph nodes of the neck. The patient was referred to our clinic for adjuvant radioactive iodine therapy. ***Results:*** On neck ultrasound exam, a nodule was found in the thyroid gland bed, as well as suspicious metastatic lymph nodes in the central and lateral neck regions. Fine-needle aspiration of the suspicious lymph nodes uncovered metastases of the medullary and papillary carcinoma, with high levels of calcitonin (5000 ng/L) and thyroglobulin (Tg) (>3550 ug/L) in the aspirate. Serum thyroid-stimulating-hormone (TSH) levels were normal, while serum Tg level was mildly increased (2,35 ug/L) and declining since surgery date (14 days post-operatively Tg was 71,75 ug/L; 5 weeks post-operatively Tg was 3,01 ug/L), with undetectable anti-thyroglobulin antibodies. Serum calcitonin levels were checked and were very elevated (801 ng/L), as well as carcinoembryonic antigen levels (31 ug/L). Histopathological revision of the original material was indicated. Immunohistochemical analysis showed a part of tumoral cells in the thyroid gland, as well as the majority of tumoral cells in the extirpated central neck area lymph nodes were positive for calcitonin stains and negative for thyroglobulin. Therefore, the tumor was re-characterized as MMFTC. The patient underwent dissection of the central and lateral neck regions. Histopathological analysis revealed metastatic lymph nodes occupied by tumoral cells of MMFTC. The patient is expected to receive ablative radioiodine treatment with pretreatment by recombinant human-TSH, and pulse corticosteroid therapy. ***Conclusion:*** Patterns of MMFTC should be recognized because of their significance in the correct diagnosis, due to significantly worse prognostic and treatment implications in such patients. ***References:*** Wang Y, Yin D, Ren G, Wang Z, Kong F. Mixed medullaryfollicular thyroid carcinoma: A case report and literature review. Oncol Lett. 2023 Aug 18;26(4):429. doi: 10.3892/ol.2023.14015.

EP-1223

PET/CT findings of primary cutaneous malignant rhabdoid melanoma of the shoulder: a case report

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Aim/Introduction: Cutaneous melanoma is a tumor that develops from melanocytes in the skin. It is a rare neoplasia accounting for less than 5% of all skin cancers, but has the poorest prognosis. The four most frequently encountered histological

subtypes are superficial, nodular, malignant lentiginous and acrolentiginous malignant melanoma. Rhabdoid melanoma is an extremely rare subtype of cutaneous melanoma. In this poster, we embark on an exploration of the role of ^{18}F-FDG PET in the evaluation of this tumor. ***Materials and Methods:*** We report the case of a 35-year-old patient who presented in January 2023 with an abscessed cutaneous mass of the right scapular region. This mass was laid flat and then reappeared twice after 3 and 6 months in the same region as a hemorrhagic pigmented budding lesion excised each time.Pathological examination concluded that the lesion was a melanoma with rhabdoid differentiation.The rest of the clinical examination revealed no palpable axillary or cervical adenopathy, particularly on the right.Imaging examinations, notably cervical ultrasound and cervico-thoraco-abdomino-pelvic CT scan, were without abnormalities.He was referred for an ^{18}FDG PET-CT scan to complete the extension work-up.The patient underwent whole-body acquisitions after injection of 230MBq of ^{18}FDG. ***Results:*** The ^{18}FDG PET scan showed : A hypermetabolic centromedullary lesion of the right lower femur suggestive of secondary lesion.Hypermetabolic submandibular and upper left jugulocarotid lymph nodes associated with homolateral dental focus suggesting an inflammatory originHomogeneous osteomedullary hypermetabolism.The centromedullary lesion of Diffuse, globally homogeneous hypermetabolism of the right scapular region probably due to a reactive origin(recent surgery). The right femur was checked by MRI, which showed clear signs of malignancy and the patient underwent local radiotherapy at a dose of 45Gywith good evolution. ***Conclusion:*** Rhabdoid melanoma is a very rare histological subtype of cutaneous melanoma, with a very poor prognosis. With its high sensitivity for melanoma metastases, particularly bone metastases, ^{18}FDG PET is proving to be a powerful imaging tool for the extension assessment of these aggressive tumors ***References:*** Till Heusner a , Philipp Gölitz a , Monia Hamami b , Wilfried Eberhardt c , Stefan Esser d , Michael Forstinga et al."One-stop-shop" staging: Should we prefer FDG-PET/CT or MRI for the detection of bone metastases?.European Journal of Radiology 78 (2011) 430-435

EP-1224

Multiple enchondromatosis in Ollier's disease. Can bone scintigraphy be useful in detection of malignant progression?

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Aim/Introduction: Ollier syndrome is a rare genetic condition characterized by numerous enchondromas within the long bones, especially at the epiphyses and metaphyses. The enchondromas can vary in size and cause bone deformities, growth retardation and limitations in joint mobility. Up to 50% of patients with Ollier syndrome develop a malignancy over time. In this context, active surveillance is useful for early diagnosis. ***Materials and Methods:*** A 47-year-old woman with congenital hypoplasia of the left appendicular skeleton and diagnosis of Ollier disease has been complaining for months of knee pain that worsenes at rest and flexion and decreases during deambulation. An initial X-ray of the left knee showed osteolytic area predominantly in the proximal epiphyseal region of the tibia. Subsequent TC and MRI demonstrated polylobular neoformative process in the region previously described on RX deserving of bioptic investigation. The diagnosis at biopsy was atypical cartilage tumour. Bone scintigraphy was performed to studied other bone district. ***Results:*** A two phase SPECT-TC bone scintigraphy with 99mTc-HDP was performed. It showed an intense uptake in the early blood pool phase and a very intense focal uptake at the left tibial lesion with central reduction of uptake in relation to the presence of the malignant lesion described at previous imaging studies. The degree of uptake was visually different from that showed in other multiple bone segments, particularly at the level of the left iliac wing, right head and proximal third of femur, scapula, proximal left humerus, left second and third ribs, proximal third of right fibula and distal third of right tibia consistent with cartilage malformations at increased phospho-calcium turnover. The patient underwent surgical excision of the lesion. Eight months after surgery, a subsequent MRI showed local recurrence so a resection of the proximal tibia with bone graft and joint arthroplasty was performed. ***Conclusion:*** Bone scintigraphy proves useful in detecting multiple bone localisation in genetic syndromes such as Ollier syndrome. Moreover, in this case, the simultaneous presence of the benign lesion and the malignant one allows a direct visual comparison between the degree of uptake of the two types of lesions. Bone scintigraphy is useful in determining the true extent of bone changes in patients with predisposing genetic conditions. Additionally it may allow suspicion of malignant progression based on uptake intensity, but more studied are needed.

EP-1225

Unexpected focuses of metastasis in a patient with thyroid and breast cancer: what is the source of the metastasis?

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Aim/Introduction: Thyroid cancer is an endocrine malignancy whose incidence has been increasing in recent years. It is often associated with breast cancer. Although it's a cancer with a good prognosis, the stage of diagnosis is important in determining the survival. The aim of this case report is to emphasize rare metastatic sites in a patient with thyroid cancer and concomitant breast cancer who was not staged at the time of diagnosis and was not followed up subsequently. ***Materials and Methods:*** case datas were evaluated ***Results:*** A 65-year-old female patient diagnosed with thyroid follicular carcinoma underwent right thyroid lobectomy in 2004, but was not followed up postoperatively. The patient received chemoradiotherapy after breast mastectomy in 2020. In 2021, F^{18} FDG PET/CT study showed diffuse metastatic nodular lesions in both lungs and metastatic lytic expansive lesions in the skeletal system. The pathological results of tru-cut biopsy obtained from lung and bone tissue was found to be compatible with thyroid carcinoma metastasis. The patient underwent a complementary left lobectomy operation. The patient, who had not received radioactive iodine therapy (RAI) before, received 200 mCi and 230 mCi RAI in 2022 and 2023 due to elevated Tg during follow-up. Control PET/CT study revealed multiple nodular lesions in both lungs, lytic sclerotic lesions in the bones, hypermetabolic nodules on the anterior abdominal wall at the level of the suprapubic region and under the skin at the level of the posterior right scapula. Incisional biopsy was performed on the lesion defined at the suprapubic region. The biopsy result

was reported as compatible with thyroid carcinoma metastasis. Simultaneous contrast-enhanced abdominal MRI study showed prominent contrast enhancing mass lesions in both kidneys after IV contrast and was accepted as thyroid carcinoma metastasis with the decision of the radiology council. ***Conclusion:*** In recent years, many studies have suggested possible bidirectional relationship between breast cancer and thyroid cancer. In the literature, renal and skin metastases are reported to be very rare in follicular thyroid cancer. In our patient, who was also diagnosed with breast cancer, metastatic lesions observed in the lung, kidney, bone and skin were found to be of thyroid origin by biopsy. In the postablative scanning study, the lesions detected on PET-CT and MRI images were found to be densely iodinated. Correctly identifying the source of metastases in patients with both types of cancer is crucial for treatment and prognosis.

EP-1226

Old but still gold: Nuclear Medicine technique still the best way to non-invasively detect thoracic splenosis.

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Aim/Introduction: Thoracic splenosis (TS) is a rare condition characterized by the autotransplantation of splenic tissue into the chest cavity, typically following splenic trauma or surgery.A 39-year-old Caucasian man presented to the emergency department of our center for an acute exacerbation of its known chronic neck pain and an outpatient standard chest X-ray showing a suspicious left upper mediastinal enlargement with dimensions 27x18mm. ***Materials and Methods:*** Patient's medical history included smoke (10 cigarettes per day) and a past splenectomy and left nephrectomy consecutive to a severe gun accident. The patient still had retained bullets and could not have taken a magnetic resonance (MR) for his neck pain.In the ER a chest contrast enhanced CT confirmed the presence of a solid, expansive mass in the left hemithorax, located in the costovertebral angle of the second rib, pertaining to the pleura, with regular outlines and axial diameters of approximately 32x6mm, which infiltrates the extra-pleural adipose tissue, located in the upper posterior left mediastinum. The mass, probably of pleural or ganglionic origin, which showed contrast enhancement, could not be better classified. An inhomogeneous neoformation of the left adrenal gland was reported. In the suspect of neoplasia, either originating from pleura or from the nervous ganglia a 2-fluorine-18-deoxyglucose positron emission tomography/computed tomography (FDG PET) was required, which showed no pathologic uptake.In the context of a multidisciplinary board, the medical history and all the available imaging were reviewed, and a suspect of splenic residue was detected. After case revision and according to patient's medical history, a diagnosis of thoracic splenosis (TS) was suspected. The planning for a biopsy of the left mediastinal mass was, therefore, suspended. A spleen scintigraphy with [99mTc]Tc-nanocolloid was proposed to confirm the suspected diagnosis of TS. Scintigraphy was performed with antero-posterior planar images acquisition of the thorax and upper abdominal region after around 30 minutes from the injection of 170 MBq of [99mTc]Tc-nanocolloid in the right arm. ***Results:*** The images demonstrated uptake corresponding to the known thoracic mass,confirming the diagnosis of TS. Based on the scintigraphy results, a biopsy of the mass was avoided. This approach prevented unnecessary aggressive procedures and allowed the patient to focus on managing his neck pain. ***Conclusion:*** This case highlights the importance of considering "old" techniques in the constantly evolving field of Nuclear Medicine, reminding us that spleen scintigraphy with [99mTc]Tc-nanocolloid offers a valuable tool for confirming the diagnosis of TS and avoiding unnecessary biopsies.

EP-1227

Histopathological proven papillary thyroid cancer in Marine-Lenhart syndrome, A therapeutic dilemma.

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Aim/Introduction: A variant of Graves' disease where there are coexistent autonomous thyroid nodules is referred to as Marine-Lenhart syndrome. The most definitive management is radionuclide therapy and thyroidectomy ***Materials and Methods:*** This study involved a 23-year-old female with a slow growing anterior neck mass for 4 years. The diagnosis was made on the basis of thyrotoxicosis, elevated thyroid stimulating hormone receptor antibody I, scintigraphy and ultrasound (U/S). ***Results:*** On U/S, both lobes appeared enlarged L>R. The left lobe had heterogeneous echotexture with increased flow and a solid heterogeneous mass. On scintigraphy the left lobe appeared heterogeneous with an area of photopenia seen in the inferior pole. Technitium 99m Methylene di iso betyl iso nitrile (MIBI) did not show any avidity in the left lobe. Fine needle aspiration biopsy confirmed papillary thyroid cancer (PTC) and a total thyroidectomy was done. Iodien123 scan diagnostic scan done under TSH of >100 after 6 weeks revealed residual tissue in the neck, lytic skull lesion and cervical lymph node. Iodine 131 therapy was given. The patient was lost to follow up and treatment response scan was not done. The patient had stopped Eltroxin and was admitted in a psychiatric hospital for psychosis . On recovery TG was 0,3 and T4 of 18.6 . A year later, the patient fell pregnant, and treatment had to be halted until 5/12 post-partum. Breast feeding was stopped prior iodine 123 scan. The maximally TSH stimulated scan showed intense uptake in the breast bilaterally and a new iodine 123 avid lesion in the right distal femur. All other previous lesions were not visualized. A multi-disciplinary team comprising of orthopedic and NM team reached a consensus to perform a magnetic resonance study (MRI) which confirmed a small eccentric sub periosteal lesion in the right femoral medial metaphysis. The orthopedic team was reluctant to operate on the basis of possible complications including future revision and infection. Two more doses of iodine 131 therapy were given with an accumulative dose of 346 mCi. The scan done 6 months after the last dose showed no residual disease. ***Conclusion:*** The co-existence of Graves' disease with a cold nodule warrants further investigation that will help to exclude malignancy. In a patient with marine Lenhardt syndrome and proven PTC, Iodine 131 is a reliable therapeutic option even in complicated cases aiding in rendering the patient disease free and likely improve the quality of life.

EP-1228

A patient with heart transplantation and Quilty lesion at endomyocardial biopsy: ^{18}F-FDG PET/CT findings

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Aim/Introduction: Heart transplantation represents the best therapeutic opportunity in terms of survival benefit for patients with end-stage heart failure. Acute rejection represents the main complication to this procedure. Early diagnosis and grading of acute rejection are of pivotal importance in the clinical management of heart recipients. In this setting, percutaneous endomyocardial biopsy (EMBs) remains the standard method for surveillance of allograft rejection after heart transplant.Beyond acute rejection, the presence of nodular endocardial inflammatory infiltrates represents another possible histologic finding observed in EMBs. This finding, known as Quilty lesion, seems to be an indicator of previous acute cellular rejection probably correlated with cardiac allograft vasculopathy. In this case report we show a Quilty lesion detected by ^{18}F-FDG PET/CT. ***Materials and Methods:*** CASE REPORT: a 48-year-old man underwent orthotopic cardiac transplantation for obstructive hypertrophic cardiomyopathy. This patient developed two episodes of acute rejection respectively after 54 and 82 days from transplantation and was admitted to our hospital for follow up investigations.A new endomyocardial biopsy was performed one year after transplantation and showed a lymphocytic infiltrate suggestive for Quilty lesion although a low-grade lymphoproliferative disorder could not be ruled out with certainty. For this reason, it was decided to submit the patient to a 18F-FDG PET/CT scan after 12 hour fasting and under high-fat, low-carbohydrate diet for at least 24 hours before the scan, in order to assess the possible presence of cardiac myocardial inflammatory infiltrate even excluding a lymphoproliferative disorder. ***Results:*** 18F-FDG PET/CT showed an intense focal myocardial uptake of the tracer at the left ventricular walls, particularly at the apex with extension to the distal portion of the septal, anterior and inferior walls and at the basal portion of the lateral wall. No other pathological extra-myocardial site of significant uptake were found. ***Conclusion:*** This case report underlines the utility of ^{18}F-FDG-PET in the identification of myocardial inflammatory burden in cardiac transplanted patients. The presence of an intense cardiac uptake was consistent with the presence of inflammatory infiltrate demonstrated by the biopsy support the hypothesis of Quilty lesion.The non-invasive nature of ^{18}F-FDG-PET together with its capability to detect inflammatory infiltrate, could be potentially helpful in clinical management of cardiac transplant patients. ***References:*** Cho, Haeyon et al. "Quilty Lesions in the Endomyocardial Biopsies after Heart Transplantation." Journal of Pathology and Translational Medicine Awad, Morcos A et al. "Current status and outcomes in heart transplantation: a narrative review."

EP-1229

Safety of elevated pulmonary doses from [^{177}Lu]Lu-PSMA-617 and ^{90}Y-radioembolization therapies

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Aim/Introduction: Treatment with [177Lu]Lu-PSMA-617 is generally considered safe from the point of view of lung radiation exposure, however elevated lung absorbed dose may result from some benign but chronic lung diseases. Although external beam radiotherapy-derived lung dose limits are available, the extrapolation to multi-cycle therapy with 177Lu-based agents may not accurately predict dose-effects. Similarly, lung shunting and dosimetry is crucial in the planning of liver-directed transarterial radioembolization (TARE) using Yttrium-90 labeled microspheres. Here we present a case with concern of higher lung exposure who underwent [177Lu]Lu-PSMA-617 therapy with dosimetry. Additionally, we report a case of a patient who underwent sequential TARE procedures resulting in cumulative lung dose in excess of the commonly accepted 50 Gy limit. ***Materials and Methods:*** Two cases were retrospectively reviewed, one patient undergoing therapy with [177Lu]Lu-PSMA-617 and one patient undergoing therapy with TARE - in both cases the patients received much greater than typical cumulative lung doses for their respective therapeutic agents. ***Results:*** Case 1: A 65-year-old male with metastatic castration resistant prostate cancer underwent [68Ga]Ga-PSMA-11 PET/CT scan prior to [177Lu]Lu-PSMA-617 therapy. He had a history of occupational lung disease and the imaging revealed diffusely increased PSMA uptake in both the lungs. He underwent 4 cycles of [177Lu]Lu-PSMA-617 therapy (7.4 GBq) with post-therapy dosimetry for cycles 1 - 3. Dosimetry following cycles 1, 2, and 3 revealed lung doses of 7.45 Gy, 4.18 Gy, and 3.4 Gy, respectively, for an estimated cumulative lung dose of ~18 Gy. No adverse pulmonary effects were observed. Case 2: A 71-year-old male with renal cell carcinoma metastatic to the liver underwent seven sequential liver directed therapies. The estimated lung doses (and lung shunt fractions) of 6.93 Gy (13%), 7.95 Gy (10.6%), 9.33 Gy (10.8%), 3.73 Gy (2.3%), 2.75 Gy (3.5%), 30.1 Gy (21%), and 13.8 Gy (18%) for the treatments 1,2,3,4,5,6 and 7, respectively, administered over 4 years. The estimated cumulative lung dose of ~75 Gy. No significant pulmonary adverse effects were observed. ***Conclusion:*** These cases demonstrate the value of routine dosimetry in optimizing systemic and liver directed radionuclide therapies. Although lung exposure from systemic 177Lu-based radiopharmaceutical therapies is typically quite low, benign lung conditions can result in significantly elevated pulmonary absorbed dose. For TARE, although some limits are used, additional data and reports are needed to confirm and refine our understanding of lung dose-effect relationships following radionuclide-based therapies. Additional cases of elevated lung exposure will be presented.

EP-1230

Radioguided Surgery in the Treatment of Lymphedema Secondary to Oncologic Lymphadenectomy.

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Aim/Introduction: Radioguided surgery is a set of techniques developed between nuclear medicine and surgical services. Our work involves the use of lymphoscintigraphy (LG) to evaluate and locate the lymphatic drainage systems of the limbs. ***Materials and Methods:*** Vascularized lymph node transplantation (VLNT) is a promising technique for treating lymphedema. However, one of the main challenges of this procedure is selecting the right donor site for transplantation. The inguinal region is the most used location because it contains lymph nodes that drain from the lower limb and superficial abdominal region, which are optimal for the procedure. However, there is a risk of accidentally removing lymph nodes belonging to the lower limb, which can lead to iatrogenic lymphedema. To prevent this complication, nuclear medicine techniques such as standard lower limb LG are used. During surgery, an intraoperative gamma-detecting probe is used to locate the lymph nodes originating from the superficial abdominal system, while avoiding those originating from the limb. This allows the surgeon to selectively choose only those

lymph nodes that are ideal for the procedure when creating the flap. ***Results:*** Fig1. 47-year-old woman with invasive ductal breast carcinoma, treated with mastectomy, axillary lymphadenectomy, and adjuvant chemo-radiotherapy, developed secondary lymphedema. LG is performed according to standard protocol. Intraoperatively, lymph nodes draining the lower limb in the inguinal region (green arrow) are identified using a gamma-detecting probe (white arrow), to avoid their inclusion in the flap for VLNT, aiming to reduce iatrogenic lymphedema. Fig2. 45-year-old woman with invasive ductal breast carcinoma received the same treatment and developed secondary lymphedema. LG is performed according to standard protocol. In the operating room, after identifying the lymph nodes draining the lower limb in the inguinal region (green arrow), verification is conducted to ensure they are not present in the flap chosen for VLNT (blue arrow) using the gamma-detecting probe (white arrow), aiming to reduce the risk of iatrogenic lymphedema in the donor limb. After 16 weeks of follow-up, the patients have not exhibited any symptoms in the donor limbs, fulfilling the purpose of the procedure, making this technique safer, and reducing adverse effects. ***Conclusion:*** The use of nuclear medicine techniques in innovative surgical procedures and the treatment of highly morbid and difficult-to-control pathologies has the potential to make techniques safer and more efficient. Although more cases are needed to fully incorporate nuclear medicine into the VLNT protocol, the initial cases have shown promising results.

EP-1231

SUVmax in ^{18}F FDG-PET/CT in managment of the relapsed vasculitis : an example of tailored therapy.

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Aim/Introduction: We tested the semiquantitative Standartized Uptake Value as index of disease metabolic hyperactivity during the pathway of a large vessel vasculitis to check if the variations of this index would be useful to asses therapy response, follow up, suspicion of relapse, confirmation of relapse and after fist line response to therapy. ***Materials and Methods:*** We compared the values of SUVmax in most relevant vessel districts in the acute phase, after therapy, first and second follow up and after first line CCS therapy in subsequent ^{18}F FDG-PET/CT whole body scan. An expert nuclear medicine on reumatologic/inflammatory disease revised all the wb-scans for a final opinion. ***Results:*** See Table 1.After high doses of corticosteroid we documented a reduction in SUVmax values measured at staging with normalization of flogosis indexes; an initial increment one year later and the confirmed suspicion or relapse some months later. The first line CCS therapy was attemped as first choice avoiding cyclophosphamide, more toxic and difficult to manage.The SUVmax vlues measured in all district allow to consider not so severe the pathologic hypermetabolism, and a few month later the final FDG-PET/CT confirmed a stability/reduction of SUVmax value after the first choice therapy. ***Conclusion:*** SUVmax is a useful tool to manage the disease trough the metabolic activity and help the immunologist to choice the first line more tolerable therapy and avoid toxicity of cyclosfamide. ***References:*** [1] Slart RHJA; Writing group; Reviewer group; Members of EANM Cardiovascular; Members of EANM Infection & Inflammation; Members of Committees, SNMMI Cardiovascular; Members of Council, PET Interest Group; Members of ASNC; EANM Committee Coordinator. FDG-PET/CT(A) imaging in large vessel vasculitis and polymyalgia rheumatica: joint procedural recommendation of the EANM, SNMMI, and the PET Interest Group (PIG), and endorsed by the ASNC. Eur J Nucl Med Mol Imaging. 2018 Jul;45(7):1250-1269. doi: 10.1007/s00259-018-3973-8. Epub 2018 Apr 11. PMID: 29637252; PMCID: PMC5954002.

EP-1232

Redistribution of Brain Metabolism during Autoimmune Encephalitis: Hypermetabolic Thalami: an amazing finding.

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Aim/Introduction: Immunotherapy with chimeric antigen receptor T-cell (CAR-T) therapy is one of the most important advances in the treatment of cancer and, particularly, hematologic malignancies. In lymphoma, CAR-T cells targeting CD19 have been widely developed. CAR-T cell therapy is associated with high rates of unique toxicities, namely cytokine release syndrome and neurotoxicity. Neurotoxicity is recognized as a frequent and major complication in patients receiving CAR T cell therapy. There is a rather narrow time window associated with the occurrence of CAR T cell-related neurotoxicity, starting around day 3 after T cell infusion and lasting until about 2 weeks later but a delayed onset of neurological complications is also possible. ***Materials and Methods:*** We present a case of a 68-year-old male patient with Diffuse Large B cell Lymphoma who received CAR T cell therapy. 6 months later the patient presented with impaired consciousness, confusion and delirium. As with complications due to other immunotherapeutic approaches, other causes that could explain the neurological condition should be ruled out with an appropriate diagnostic work-up. MRI of the brain showed unspecific T2/FLAIR hyperintensities in various regions but no generalized edema. CSF cultures and polymerase chain reaction assays for the detection of neurotrophic viruses (herpes simplex virus 1 and 2, human herpes virus 6 and 7, Epstein Barr virus, cytomegalovirus, enterovirus, parvovirus B19, adenovirus, and severe acute respiratory syndrome coronavirus-2) were negative. The patient underwent an ^{18}F-FDG PET/CT to exclude replase of lymphoma and involvement of central nervous system and treatment with steroids started. ***Results:*** ^{18}F-FDG PET/CT scan revealed an impressive predominance of thalamic hypermetabolism and hypometabolism in the other regions of the brain. During autoimmune insults to the brain, the metabolic redistribution suggested by our finding may contribute to preserving essential brain functions. None pathological finding was revealed from the whole body scanning and no evidence of lymphoma replapse was observed. ***Conclusion:*** ^{18}F-FDG PET/CT could be useful in the detection of neoplasia as the cause of encephalitis but surprisingly could be useful for detecting initial brain metabolic alterations in encephalitis in comparison to normal MRI, with brain region hypo/hypermetabolism.

EP-1233

Undifferentiated Pleomorphic Sarcoma : Does ^{18}FDG PET-CT scan surpass MRI ?

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Aim/Introduction: Undifferentiated Pleomorphic Sarcoma (UPS), formerly known as malignant fibrous histiocytoma (MFH), represents an heterogenous and challenging entity within the soft tissue sarcomas. Its aggressive behavior and variable clinical

presentation, poses significant diagnostic and therapeutic dilemmas for clinician.In recent years, positron emission tomography with ^{18}F-fluorodeoxyglucose (^{18}F-FDG PET) has emerged as a valuable tool in the evaluation of UPS, offering insights into its metabolic activity and aiding in disease staging, response assessment, and treatment planning. In this poster, we aim to discuss the role of ^{18}F-FDG PET in UPS, shedding light on its contributions to staging, therapeutic decision-making and its constraints. ***Materials and Methods:*** We report the case of a 57-year-old patient who presented with muscle pain and swelling of the right thigh. After radiological exploration, the mass was biopsied. The histopathological examination favored an undifferentiated pleomorphic inflammatory sarcoma. The patient then underwent resection of the right anterior quadriceps muscle. The patient received four cycles of chemotherapy. A follow-up MRI showed the persistence of a tissue nodule in the resection compartment. The patient was then referred to our department for an ^{18}FDG PET-CT scan examination for evaluation and consideration of radiotherapy. Then after six months, he was referred to us again for evaluation. ***Results:*** The initial examination showed two intensely hypermetabolic tissue lesions on the anterior aspect of the right thigh. The first lesion, located near the femoral neck, exhibited heterogeneous solid-cystic characteristics (SUVmax=10.8). The second, a nodular lesion adjacent to the lateral vastus muscle, correlated with the MRI findings (SUVmax=7.5). Biopsy results from both nodules confirmed metastasis from the pleomorphic sarcoma, prompting local radiotherapy treatment. The patient returned for a post-therapeutic evaluation, revealing complete morpho-metabolic regression of the previously observed tissue lesions. However, a new hypermetabolic focus (SUVmax=6.9) emerged adjacent to the lateral vastus muscle at the mid-third of the right femoral diaphysis.Additionally, a deep mixed lesion within the right femoral muscle exhibited weakly hypermetabolic activity (SUVmax=3). Due to the intra- and interlesional heterogeneity typical of soft tissue sarcomas, a definitive malignant origin could not be conclusively determined. An MRI of the thigh performed favored a malignant origin instead. ***Conclusion:*** ^{18}F-FDG PET represents a powerful tool in the armamentarium against UPS, offering clinicians valuable insights into tumor biology and aiding in personalized treatment approaches on the condition that variations in the metabolism of soft tissue tumors, which may elude diagnosis, are taken into account.

EP-1234

Myelodysplastic syndrome presenting with bone marrow uptake on 68Ga-PSMA PET/CT

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Aim/Introduction: Prostate-specific membrane antigen (PSMA) ligand uptake on positron emission tomography/computed tomography (PET/CT) can be found in non-prostate diseases, which is challenging and must be recognized to avoid misdiagnosis. As PSMA-avid hematological disorders are scarcely mentioned in the literature, we present the case of a patient with prostate cancer with 68Ga-PSMA bone marrow uptake attributable to a myelodysplastic syndrome. ***Materials and Methods:*** A 68-year-old man with prostate cancer, Gleason score 6 (3+3), initial prostate-specific antigen (PSA) 10ng/ml, cT1cN0M0, was referred to our institute for brachytherapy treatment. His previous medical history was irrelevant, normal preoperative blood count and no hematological/urological complaints. He remained under surveillance for 3 years, at which time biochemical recurrence was assumed (PSA: 6,750ng/ml) and 68Ga-PSMA-PET/CT was requested. ***Results:*** 68Ga-PSMA-PET/CT showed intense radiotracer uptake in the left seminal vesicle (SUVmax = 16,52) and in a right external iliac lymph node (SUVmax = 8,85), suggesting locoregional recurrence. Furthermore, diffuse and heterogeneous radiotracer bone uptake, with focal uptake in some costal arches and sternum (SUVmax = 4,31), were reported as undetermined etiology findings, but raising the hypothesis of some underlying hematological disorder. Most of the bone marrow uptake seen on 68Ga-PSMA-PET did not show corresponding lytic or sclerotic lesions on contrast-enhanced CT performed two months later. Further analytical investigation revealed anemia, leukopenia and thrombocytopenia and the patient reported asthenia. Hormonal therapy with goserelin was started. The patient underwent additional investigation, including myelogram and bone marrow biopsy from the iliac crest that revealed hypercellular bone marrow, with signs of trilinear dysplasia, compatible with involvement by myelodysplastic syndrome. The patient started erythropoietin and at this time (after starting goserelin and before starting erythropoietin), PSA value was 1,390ng/ml. During the 6 months of treatment with erythropoietin, the patient received 6 red blood cell transfusions with worsening fatigue. Erythropoietin was discontinued due to lack of response and chemotherapy with azacitidine was started. No new red blood cell transfusions had been needed since. Currently, 1 year after 68Ga-PSMA-PET/CT hypothesized a hematological disorder, and 9 months after the confirmed diagnosis of myelodysplastic syndrome, the patient remains on treatment with azacitidine (3rd cycle) and reported a clear improvement in his quality of life. ***Conclusion:*** The present case highlights that alternative diagnoses other than prostate cancer, including hematological diseases, should be considered in the presence of diffuse bone/bone marrow 68Ga-PSMA uptake.

EP-1235

Abnormal 99mTc-DMSA uptake in the lung, the spleen and the liver:report of four cases

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Aim/Introduction: One of the most common problems associated with radiopharmaceuticals is abnormal unexpected biodistribution, which can have a significant clinical impact when interpreting scintigraphic images. We present four cases of extra-renal uptake of 99mTc-DSMA in the spleen, lung and liver, focusing on the possible molecular mechanisms involved. ***Materials and Methods:*** Case report: 99mTc-DMSA renal scintigraphy was performed on 30/01/2024 in six patients with recurrent urinary tract infections and/or vesico-ureteral reflux. The scintigraphic examinations of four of the six patients were found to be uninterpretable due to abnormal extra-renal radiotracer fixation. All patients received the same preparation, and were injected at the same time. ***Results:*** In the first two patients, normal fixation was found, exclusively renal with kidneys in place, evenly contoured, with no detectable cortical defects. In the third patient, five hours after injection of 2mCi of 99mTc-DMSA, scintigraphy showed homogeneous renal fixation with distribution in both lung fields. The fourth patient was a 7-month-old child who received 1.4mCi of 99mTc-DMSA. Scintigraphic images obtained after 5h post-injection showed abnormal radiotracer uptake in the spleen, liver and lung, with more intense uptake in the spleen. The last two

patients received 1.5mCi and 1.6mCi of 99mTc-DMSA respectively, and presented a similar appearance, with intense uptake in the lungs and to a lesser degree in the kidneys and liver. ***Conclusion:*** Despite our well-established knowledge of the biodistribution of the various radiopharmaceuticals, we are sometimes confronted with unsuitable and unforeseen fixations that can compromise the interpretation of the examination, hence the importance of checking the chain of preparation and injection of the radiopharmaceutical to identify its origin in time. ***References:*** Abnormal focal 99mTc-DMSA uptake in the lung — report of two casesElahe Pirayesh1, Mahasti Amoui1, Ali Asghar Halimi Asl2, Majid Assadi3Altered Biodistribution of Radiopharmaceuticals: Role of Radiochemical/Pharmaceutical Purity, Physiological, and Pharmacologic FactorsShankar Vallabhajosula, PhD, Ronan P. Killeen, MD, and Joseph R. Osborne, MD, PhD.

EP-68

e-Poster Area

E: Other Studies -> E2 Covid Studies

EP-1236

Impact of delaying radioiodine in high-risk thyroid cancer patients: a retrospective analysis in Mexican population after COVID-19 due to hospital saturation

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Aim/Introduction: The optimal time for initiating radioactive iodine (RAI) therapy for differentiated thyroid cancer (DTC) patients is controversial. we investigate the relationship between the timing of initiating RAI and the clinical response based on dynamic stratification risk in high-risk DTC patients in the Mexican population after COVID-19 due to hospital saturation. ***Materials and Methods:*** We evaluated 71 patients with high-risk DTC who received a dose of RAI to 150 - 200 mCi and were retrospectively reviewed. the patients were divided into 2 groups agreeable initial therapy (between total thyroidectomy and initial RAI), called time interval therapy (TIT): Group A: TIT < 3 months (n=34), and Group B: TI ≥ 3 months (n=37). Six and twelve months after RAI, we followed up on these patients and evaluated the therapy response with neck ultrasound, whole-body scan SPECT/CT, and measures of thyroglobulin and antibodies anti-thyroglobulin. According to the therapy stratification system, the therapy responses to RAI were assessed as either excellent response (ER), biochemical incomplete response (BIR), indeterminate response (IR), or structural incomplete response (SIR) at every follow-up. We conducted a univariate and multivariate analysis to determine different factors associated with different responses. A $p < 0.05$ was considered to be statistically significant. ***Results:*** the overall response to RAI was statistically significantly different between 2 groups during dynamic follow-up, Group A had significantly lower SIR rates (33.4 vs 65.8 and 48.7 vs 70.2, all P<0.05, respectively) and higher ER rates (35.7 vs 16.9 and 40.6 vs 19.6, all P<0.05, respectively) than group B during dynamic follow-ups. By univariate and multivariate analyses, prolonged TIT (HR: 7.44, 95%CI: 2.891-17.621, P=0.001), soft tissue invasion (HR: 6.88, 95%CI: 1.902-29.454, P=0.004), metastatic disease (HR: 7.79, 95%CI: 2.805-24.886, P=0.002) were manifested to be independent risk factors for IR, SIR and BIR. The highest levels of thyroglobulin before starting treatment were also an independent risk factor for BIR (p=0.045). Doses of 200 mCi were not significant in both groups (p=0.28) but had an increase more adverse events. Only patients with micronodular lung metastatic disease had a decreased number of lung lesions with higher doses ***Conclusion:*** Starting treatment with RAI early is associated with greater biochemical response, except in patients with the initial highest levels of thyroglobulin. ER is higher in patients who start treatment early. Delayed initial RAI (≥3 months after thyroidectomy) is associated with poor response.

EP-1237

Brain Glucose Metabolism is altered in COVID-19 disease: An activation likelihood estimation Meta-analysis

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Aim/Introduction: COVID-19 disease, which is caused by infection of the SARS-CoV-2 virus has brought massive changes to modern society and lifestyle. Thus, by comparing brain glucose metabolism of patients with COVID-19 disease with healthy controls, we can identify the brain regions affected by COVID-19 disease. ***Materials and Methods:*** We performed a systematic search of MEDLINE/EMBASE for English-language publications using the keywords of "positron emission tomography", "single-photon emission computed tomography", and "COVID-19". The inclusion criteria were original research articles that reported the changes in brain glucose metabolism after COVID-19 disease. For each experiment, the modeled activation map is calculated by finding the maximum across each focus's Gaussian. For each voxel, the ALE value is calculated from the union of the modeled activation map. ALE values were combined across studies and tested against a null hypothesis of random distribution of ALE values, which are higher than could be expected by chance. A threshold of FWE 0.05 for both cluster-level forming thresholds and 0.05 for cluster-level inference was applied to the resulting ALE map. ***Results:*** Eight papers were deemed suitable for inclusion in the study. Two studies reported increased brain glucose metabolism from 19 COVID-19 disease patients after comparison with 58 controls. A significant increase in brain glucose metabolism was observed in the left anterior cingulate gyrus, right thalamus, brainstem. Studies of hypometabolism in COVID-19 disease were categorized into subgroups according to 1) the patient's age, and 2) the time interval between COVID-19 disease and PET scanning. In children with COVID-19 disease, we observed the decreased glucose metabolism in 5 regions including cerebellum, left amygdala/hippocampus, left anterior cingulate gyrus, right amygdala. In adult with COVID-19 disease, we found one hypometabolic cluster: right temporal lobe. We divided the studies into 2 groups according to the time interval between COVID-19 disease and PET scanning. In acute phase of COVID-19 disease, hypometabolism was observed in right temporal lobe and brainstem. In chronic phase, hypometabolism was observed in 7 clusters: left posterior cingulate gyrus, left precuneus, right cerebellum, right insula, right anterior cingulate gyrus, left occipital lobe, left globus pallidus. ***Conclusion:*** COVID-19 disease alters brain glucose metabolism. COVID-19 disease generally manifests on 18F-FDG PET as areas of decreased brain glucose metabolism, however, there can be areas of increased brain glucose metabolism. This decrease of brain glucose metabolism was dependent on the patients' age, and the time interval between COVID-19 disease and PET scanning.

EP-1238

Characterization of a Group of COVID-19 Patients Who Underwent V/Q Scintigraphy.

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Aim/Introduction: The study focuses on assessing COVID-19 patients to detect pulmonary thromboembolism (PE) using ventilation/perfusion (V/Q) scintigraphy. Given the potential for severe pulmonary complications like PE, precise diagnostic tools are essential. While pulmonary angiography via computed tomography (CT angiography) is common, it has limitations. Thus, V/Q scintigraphy is proposed as a non-invasive and safe alternative. ***Materials and Methods:*** Retrospective study analysed 25 confirmed COVID-19 patients who underwent V/Q scintigraphy between March 2020 and May 2023 at a centre in Santiago, Chile. Demographic and clinical data, including age, gender, comorbidities, and additional test results, were collected. ***Results:*** Results indicated that most patients were elderly with comorbidities like hypertension and type 2 diabetes. The majority had received at least one dose of the COVID-19 vaccine. Analysis of V/Q scintigraphy revealed PE in 48% of patients, with most showing a single defect in the study. ***Conclusion:*** In conclusion, V/Q scintigraphy appears valuable in detecting PE in COVID-19 patients, especially those with comorbidities. However, larger prospective studies are necessary to confirm these findings and better understand its role in various disease stages. ***References:*** Konstantinides SV, Meyer G, Becattini C, et al. "2019 ESC Guidelines for the diagnosis and management of acute pulmonary embolism developed in collaboration with the European Respiratory Society (ERS)." European Heart Journal. 2020;41(4):543-603.Arya R. Venous thromboembolism prevention. London: Department of Health, 2009.Agarwal PP, Wolfson AR, Matsumura M, et al. "Utility of cardiac computed tomography scanning in the evaluation of acute pulmonary embolism." Journal of the American College of Cardiology. 2007;49(19):207-216.Bajc, M., Schümichen, C., Grüning, T., Lindqvist, A., Le Roux, P. Y., Alatri, A., ... & Jonson, B. (2019). EANM guideline for ventilation/perfusion single-photon emission computed tomography (SPECT) for diagnosis of pulmonary embolism and beyond. European journal of nuclear medicine and molecular imaging, 46, 2429-2451.

EP-1239

Spontaneous Remission of Advanced Follicular Lymphoma Following SARSCOV-2 Infection: A Case Report

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Aim/Introduction: Follicular lymphoma is the second most common subtype of lymphoma worldwide and the most common of the indolent lymphomas. Patients usually present with asymptomatic lymphadenopathy and advanced disease. Patients with asymptomatic and low burden disease are managed in a watch and wait approach and patients with high tumor and/or symptomatic disease are treated with immuno-chemotherapy. There are few case reports about lymphoma remissions after bacterial or virus infections, including recently the SARSCOV-2 infection, suggesting that the infection can trigger the immune system against the tumor cell.Here, we show the case of a patient with advanced follicular lymphoma that presented spontaneously remission after a SARSCOV-2 infection. ***Materials and Methods:*** We present a 53 year old male patient diagnosed with follicular lymphoma, E-IV FLIPI-2 (intermediate risk), in 2019. He achieved a complete response after treatment with R-CHOP + Rituximab maintenance regimen. Subsequently, ^{18}F-FDG PET-CT showed a relapse in September 2023.He was admitted to the hospital with severe bilateral pneumonia due to SARSCOV-2 in December 2023, and was only treated with antibiotic and corticosteroid treatment. Since the SARSCOV-2 infection prevented from considering the possibility of starting lymphoma treatment. ***Results:*** Once the patient is discharged after partially recovering from his pneumonia. ^{18}F-FDG PET-CT was performed in March 2024, to reevaluate the lymphoma due to suspected evolution in the absence of treatment, showing a marked decrease in metabolic activity and size of all lesions. Since the patient did not receive treatment, the study suggests partial response due to immune response induced by SARCOVS-2 infection. ***Conclusion:*** The response/remission of lymphomas induced by SARSCOV-2 infection, although it is rare, some cases have been described. We consider it important to exhaustively assess the patient's clinical history and be aware of this possibility, in order to carry out a correct evaluation of the patient.

EP-69

e-Poster Area

E: Other Studies -> E3 Other Study (including Training, Projects)

EP-1240

Estimation of the carbon footprint of a french nuclear medicine department

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Aim/Introduction: In France, the Health sector accounts for about 8% of the national greenhouse gas (GHG) emissions. We estimated the carbon footprint of our nuclear medicine department with the help of Aktio, a specialized consulting firm. ***Materials and Methods:*** The estimate of GHG emissions comprises direct and indirect emissions. Direct emissions are due to fuels consumption (by the hospital and by hospital's vehicles), refrigerant leaks and impact of buildings on biomass (land use change). Indirect emissions include upstream and downstream emissions. Upstream emissions are linked to electricity and heating consumption, transport of merchandises, transport of patients and employees, business travels, purchases, and fixed assets. Downstream emissions are due to usage and disposal of manufactured products created by the hospital. Different GHGs (CO2, CH4, N2O, fluorinated gases...) each have a different global warming potential. To aggregate all GHG emissions, the results were expressed in carbon dioxide equivalent (CO2e). For this purpose, we used Aktio tools, and emissions factors from the french database Base Empreinte. We also used a few emission factors from the US Environmental Protection Agency. ***Results:*** in 2022, 13 303 diagnostic and therapeutic procedures were performed in our department, for an estimated carbon footprint reaching 772 tons of CO2 equivalent. This value corresponds to the mean annual carbon footprint of 78 french citizens, or to 27 kgCO2eq per patient visit in our department. Transport of people accounts for 66.4% of total emissions: 60.3% due to patients

travelling to and from the hospital, 4.6% to professionals travelling from home to work and 1.5% to medical missions outside the hospital or attendance to scientific conferences. Of note, 96% and 99% of patients and employees transport relies on combustion-powered vehicles, respectively. Transport of merchandises only accounts for 0.4% of total emissions. Purchases are responsible for 13.6% of total emissions: 11.8% due to radiotracers supply and the rest due to ink, paper, disposable examination sheets and small office supplies. Imaging devices (2 PET/CT, 2 SPECT/CT and 1 cardiac imaging dedicated CZT camera) account for 5.5% of emissions. Real estate, IT infrastructure and furniture account for 2.1%, 1.5% and 0.1%, respectively. Energy consumption accounts for 6.9% of total emissions: 4% for electricity and 2.7% for heating by heat network. ***Conclusion:*** Our emissions are mainly due to indirect emissions, which is a common result in tertiary sector. This estimate is the first step to understanding and controlling our emissions as much as possible.

EP-1241

The use and effect of listening to music to reduce anxiety in patients during PET/CT imaging protocol

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Aim/Introduction: Most of the patients who come for PET/CT scans are oncology patients and feel a certain level of anxiety. However, it is observed that the anxiety level of patients additionally increases during the PET/CT preparation phase. This study aimed to observe the anxiety levels of patients during the technical preparation phase during the PET-CT scan and to investigate whether listening to meditative music, which is officially reported to be calm and relaxing, affects reducing the patient's anxiety. ***Materials and Methods:*** To perform $^{[18F]}$FDG-PET/CT scanning, 28 patients (14 experimental and 14 control groups) aged 30-81 years (mean 60 ±15 SDTS), who were referred for scanning from the oncology clinic, were included in the study. The number of men and women in each group was selected equally. The study, which was conducted with informed consent, was conducted using the short version of the Spielberger State and Trait Anxiety Inventory (STAI-S). The pre-procedure survey focused on demographic information, oncological status, and pre- and post-procedure subjective perception of anxiety and STAI testing. During the PET-CT technical preparation phase, the experimental group was given headphones and information to listen to quiet music during the post-injection waiting period of approximately 45-60 minutes, and they were asked to fill out the questions in the survey form before and after the music. ***Results:*** Significant differences were found between the intervention group and controls in terms of the effect of music listening on the anxiety score on the short version of the Spielberger State-Trait Anxiety Inventory (STAI-S) in patients. The patient group listening to music presented lower mean scores on the STAI state anxiety scale post-intervention and showed statistically significant differences with the control group ($P<0.005$). ***Conclusion:*** Our study shows statistically that relaxing meditative music can be used as a complementary method for psychological relaxation and anxiolytic mechanisms in patients during the technical preparation phase before PET-CT studies. In this context and in light of our results, the details of the patient preparation phase, which is one of the issues where quality standards in nuclear medicine units can be increased, and the importance of the support of the technical team with whom we work one-on-one on technical details in the field, were also emphasized.

EP-1242

Adverse Drug Reactions in Radiopharmaceutical Therapy for Bone Metastases: A Comprehensive Review of ^{89}Sr, ^{153}Sm, and ^{186}Re Safety Reports from 1991 to 2022

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Aim/Introduction: Bone metastases are one of the most frequent complications of advanced cancers and a therapeutic option is the use of radiopharmaceuticals, which can cause adverse drug reactions (ADRs). Despite its use on a smaller scale, compared to other drugs, radiopharmaceuticals can cause ADRs and it is extremely important to update knowledge about these, in order to allow their detection, understanding, evaluation and prevention. This study aimed to analyse the individual case safety reports (ICSRs) of suspected ADRs related to the active substances 89Sr, 153Sm and 186Re (all with β– decay), obtained through spontaneous reporting, and recorded in the EudraVigilance, VigiAccess, Spanish Pharmacovigilance System (FEDRA) and Portuguese National Pharmacovigilance System databases between 1991 and 2022. ***Materials and Methods:*** This observational and cross-sectional study analysed the ICSRs of suspected ADRs to the radiopharmaceuticals 89Sr, 153Sm and 186Re . Data collected was analysed according study variable: number of cases reported per year; identification of the medicine associated with ADRs; identification of the origin of the notification; demographic characterization of the population affected by ADRs and characterization of the type of ADRs reported. ADRs were manually coded by System Organ Classes (SOC) according to the MedDRA 25.1 dictionary. ***Results:*** Most reports pertained to male individuals (66,5% in EudraVigilance, 73,5% in VigiAccess and 77,8% in FEDRA) between 18 and 85 years of age. Health professionals were the primary source of these reports (88.6% in EudraVigilance and 100.0% in FEDRA). The largest number of ADRs reported belong to the SOC "diseases of the blood and lymphatic system" (26.1% of ADRs in EudraVigilance; 20% of ADRs in VigiAccess and 28.6% of ADRs in FEDRA). EudraVigilance is the database that provides more information, with 94,5% of ADRs being considered serious and 26,1% of cases declared fatal. ***Conclusion:*** The fact that only 975 ADRs were reported over 31 years in the analysed databases may be due to underreporting and as such, it is extremely important that healthcare professionals and patients themselves are more alert and more involved in pharmacovigilance of radiopharmaceuticals. The limited data of adverse events makes it challenging to detect rare or unexpected reactions, as large datasets are often needed to identify signals for uncommon ADRs.

EP-1243

Remote reporting in Nuclear Medicine: no more a vision of the future

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Aim/Introduction: With the great digital development in Nuclear Medicine during the last decades and worldwide internet connections, remote reporting is not a mirage and is more and more feasible. Many organizational, technical, and legal issues have limited, up to now, the spread of the application of remote reporting systems. The COVID-19 pandemic, however, has pushed the broader introduction of telemedicine and "remote/flexible working" maintaining the health care assistance levels as before, firstly accelerating the spread of remote work technology. Secure access to workstations from home and optimal portable devices dedicated to remote reporting can now assure the quality of the process and potentially lead to an increase in productivity and efficiency (e.g. opportunity to report in a controlled environment with no distractions), with more flexibility and autonomy for the workers (e.g. reduced travel time and costs). In this prospective study we aim to promote remote reporting as a stable and effective organizational work model in Nuclear Medicine. ***Materials and Methods:*** Since November 2023, one day a week has been allocated for each doctor to work from home. The hospital, through the data center, has provided a laptop with secure access to its network and reporting systems. Data were obtained from the radiological information system (RIS) database at our institution, which recorded the reporting activities. The number of personal daily PET scans reported has been counted and compared to the previous 6 months as a reference. The Psychological General Well-Being Index has been recorded at the beginning, at 3 months and it will be verified at 6 months to assess the impact of this new working model on workers life. ***Results:*** Each doctor has reported more than the previous reference period, with a mean increase of 43% on the number of reports (10,3 [9-15] vs 7,2 [6-12]; p< 0.05). Moreover, the time between the PET scan and delivery of the report to the patient was shortened by at least one day, with a notable impact on clinical management of patients. The first psychological assessment has demonstrated a clear benefit in term of quality of life, above all for what concerns the commute to work. ***Conclusion:*** These preliminary results demonstrated that remote reporting in Nuclear Medicine can be adopted as a organizational model that is possible, effective and beneficial to the worker's well-being. In future, this efficient model can potentially solves the expected problem of Nuclear doctors shortages, too.

EP-1244

Application of Audience Response System in Radiology Residents' Lecture Sessions with the Examination Score Outcome in Nuclear Medicine Theory

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Aim/Introduction: Audience response systems are technologies promised to enhance learner engagement and knowledge retention. Although audience response systems are extensively studied in undergraduate medical education, their utility in postgraduate residency training remains relatively unexplored. Therefore, we introduced Kahoot, an audience response system, in nuclear medicine theory lecture sessions for radiology residents before assessing their perceptions and exam performance. ***Materials and Methods:*** This retrospective study involved two classes of first-year radiology residents in a teaching hospital. There were 26 residents who participated in the audience response system class. We collected anonymous questionnaires from those residents to evaluate their perceptions, and we compared their examination scores to the other class, which consisted of 24 residents, without audience response system. ***Results:*** Twenty-four residents from the audience response system classes (92.3%) responded to the questionnaires. The percentages of respondents who preferred lectures with audience response systems, lectures with minimal in-class interactions, and lectures with direct face-to-face questioning were 75.0%, 29.4%, and 11.1% respectively. The level of mental stress caused by audience response system was significantly less than that caused by direct questioning (36.4% vs 6.67%, $p < 0.001$). All residents in the audience response system class and the class without it took the examinations that had the total score of 60. The scores of the audience response system class (Median = 44, IQR = 5.75) and the class without audience response system (Median = 40, IQR = 6) were not significantly different ($p = 0.880$). ***Conclusion:*** The majority of radiology residents prefer audience response systems due to their significantly lower stress levels compared to direct questioning during lecture sessions. Although audience response system might not lead to significantly higher scores in examination, the use of audience response system may be encouraged in place of direct questioning to promote in-class participation without exacerbating stress levels among the residents.

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EP-1245

Facile radiolabeling optimization of a new piroxicam analogue using Design Expert® Software

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Aim/Introduction: cyclooxygenase (COX) is a key enzyme in the process of prostaglandins (PGs) synthesis. The products of this enzyme could play a major role as the mediators of the inflammatory response, cancer and some neurodegenerative diseases. The pharmacologic effects of nonsteroidal anti-inflammatory drugs (NSAIDs) are attributed to inhibition of COX-1 and COX-2 enzymes. COX-2 is one the most important targets overexpressed in the inflammation and tumor sites (1-2).

So, efficiently radiolabeled COX-2 inhibitors can precisely detect these lesions. Providing high quality radiopharmaceuticals with fewer experiments can be achieved by optimized radiolabeling process. The present study aimed to utilize the polynomial analysis for optimization of radiolabeling process of piroxicam analogue with 99mTc as a new tracer targeting COX-2. ***Materials and Methods:*** Such various parameters affecting the radiolabeling reaction as the amount of ligand -piroxicam analogue- (100-1000 µg), SnCl2 (10-100 µg), co-ligands (50-300 µg), vitamin C (50-600 µg), radioactivity (370-1850 MBq), pH (7-11) and incubation time (15-45 min) were studied. According to the proposed design, 46 experimental runs of radiolabeling reaction were performed. The mathematical model was statistically analyzed for providing tracer with radiochemical purity (RCP) > 95%. ***Results:*** Our results revealed that quadratic model was the best fit to explain the influence of variables (p-value = 0.0011; F-value = 5.13; R2 = 0.9191; non-significant Lack of Fit). The maximum RCP (95.5%) was found in kit formulation containing 100 µg ligand, 36.82 µg SnCl2, 54 µg co-ligand, 480 µg vitamin C which was labeled using 1850 MBq of radioactivity after 40 min of incubation at pH 11. ***Conclusion:*** 99mTc-piroxicam analogue as a promising agent for detection of inflammation and tumor sites was successfully developed by response surface methodology. Using this method, personnel radiation exposure during radiopharmaceutical preparation can be reduced. ***References:*** 1. Fu, J.Y., et al., The induction and suppression of prostaglandin H2 synthase (cyclooxygenase) in human monocytes. Journal of Biological Chemistry, 1990. 265(28): p. 16737-40. 2. Williams, C.S. and R.N. DuBois, Prostaglandin endoperoxide synthase: why two isoforms? American Journal of Physiology, 1996. 270(3 Pt 1): p. G393-400.

EP-1246

In Vivo Behavior Study of Chemical in Household Products in Rats using Preclinical Techniques in Nuclear Medicine: $^{[Cu-64]}$Cu-DOTA-Branched polyethylenimine ($^{[Cu-64]}$Cu-DOTA-BPEI)

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Aim/Introduction: Polyethyleneimine (PEI) is widely used as an ingredient in household chemical products, such as laundry detergents, pet deodorizers, dishwasher detergents, and fabric refreshers, because it can be deodorized by absorbing anionic odorants. These products are mainly sold in pump sprays that can potentially enter the body through the air when used. In this study, we radiolabeled the main ingredients, BPEI, with Cu-64 in household products, and investigated in vivo behavior of $^{[Cu-64]}$Cu-DOTA-BPEI via intratracheal (i.t.) instillation in rodents. ***Materials and Methods:*** The precursor (DOTA-BPEI) and $^{[Cu-64]}$Cu-DOTA-BPEI were synthesized using a previously reported method. [1] To evaluate in vivo biodistribution, $^{[Cu-64]}$Cu-DOTA-BPEI was instilled into rats via i.t.. Rats were sacrificed at 5 min and 3, 6, 24, 48, and 72 h post-instillation, the organs were removed, weighed, and counted the radioactivity. In the microPET/CT study, [Cu-64]Cu-DOTA-BPEI was instilled using the same administration method, and PET/CT images were acquired at 5 min and 24, 48, 72, and 96 h post-instillation of $^{[Cu-64]}$Cu-DOTA-BPEI. The acquired PET images were reconstructed using a 3D-OSEM algorithm. In the excretion study, urine and feces were collected from 1 to 7 d in metabolic cages after instillation of $^{[Cu-64]}$Cu-DOTA-BPEI to rats via i.t., and radioactivity was counted. ***Results:*** The in vivo biodistribution of [Cu-64]Cu-DOTA-BPEI via i.t. instillation showed dominant uptake in the lung after 5 min (45.65%ID/g) and retained a high uptake of $^{[Cu-64]}$Cu-DOTA-BPEI in rats at 72 h (38.69%ID/g) post-instillation. Uptake of $^{[Cu-64]}$Cu-DOTA-BPEI in other organs was not observed except in the trachea, which is the instillation route, and all were less than 1% ID/g up to 72 h. Consistent with the in vivo biodistribution results, PET/CT images showed no uptake of $^{[Cu-64]}$Cu-DOTA-BPEI in other organs, and a high uptake of $^{[Cu-64]}$Cu-DOTA-BPEI was observed in the lungs from the initial time point to 96 h post-instillation. In the excretion study, the cumulative excretion rate of the instilled $^{[Cu-64]}$Cu-DOTA-BPEI dose in rats was 2.37% in urine and 13.07% in feces up to 144 h, with a total excretion of 15.44%. ***Conclusion:*** These results elucidated the in vivo fate of $^{[Cu-64]}$Cu-DOTA-BPEI in rats via respiratory administration. This study can be useful in preparing basic information for investigating the risks of chemicals in household products in various living subjects using radioisotopes and nuclear medicine techniques. ***References:*** 1. Poster-275, 25th International Symposium on Radiopharmaceutical Sciences, Honolulu, Hawaii, USA, May 22-26, 2023.

EP-1247

In Vivo Biodistribution and Mass Balance Studies of [C-14]C12-Benzylalkyldimethylammonium chloride ([C-14]C12-BKC) in rats via intranasal administration

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Aim/Introduction: Benzylalkyldimethylammonium chloride (BKC) is a cationic surfactant widely used as a disinfectant because of its microbial effect. [1] It is important to evaluate their distribution and elimination in the body via respiratory exposure because most household chemical products that contain BKCs are sold in spray pumps. In this study, we radiolabeled BKC with C-14, and conducted an in vivo biodistribution and excretion study to evaluate the behavior of BKC following intranasal (i.n.) administration in rats. ***Materials and Methods:*** [C-14] C12-BKC was synthesized using a previously reported method. [1] To evaluate the in vivo biodistribution, [C-14]C12-BKC was administered to rats i.n.. Rats were sacrificed at 5 min and 3, 6, 24, 48, 72, and 144 h post-instillation, the organs of interest were collected, weighed, and radioactivity was measured by LSC. In the excretion study, urine and feces were collected from days 1 to 7 in metabolic cages after i.n. administration of [C-14] C12-BKC to rats, and radioactivity was measured. ***Results:*** In vivo biodistribution data showed high uptake (3.63-9.53%ID/g) of [C-14]C12-BKC in the trachea, stomach, small intestine, and large intestine at the initial time points, 5 min and 3 h, with the highest uptake (4.66%ID) in the large intestine at 48 h post-administration. In contrast, other organs showed [C-14]C12-BKC uptake of 2%ID/g at all time points, but the heart, pancreas, and adrenal gland showed uptake accumulation up to 48 h post-administration. In the excretion study, the cumulative excretion rate of the administered [C-14]C12-BKC dose in rats was 13.6% in urine and 86.5% in feces for up to 168 h, with a total excretion and recovery rate of 100.1%. ***Conclusion:*** This study provided a basis for toxicity assessment by determining BKC accumulation in rats. These results elucidated the in vivo fate of [C-14]C12-BKC in rats via respiratory administration and were consistent with previously reported QWBA analysis results [2], confirming the need for toxicity assessment, particularly for the heart, paracentesis, and adrenal

gland. ***References:*** 1. Nadagouda et al., Med. Chem. Res. 31 (10), 1663-1678 2. Park et al., Chemosphere 338 (2023) 139460.

EP-1248

Novel Radiolabeling Strategy for Al[F18]FAPI-74 complex using Water-in-oil Microemulsions

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Aim/Introduction: Al[F18]F radiolabeling method is a metal-based radiochemistry that has recently been widely used in radiopharmaceutical development [1]. However, Al[F18]F required high temperatures (100-120 °C) and appropriate pH for chelation. Additionally, most biologically active vectors pose challenges for labeling due to their complex structures, low solubility in water, and sensitivity to temperature and pH. To overcome these challenges, radiometal chelate labeling using microemulsions has been reported [2]. In this study, the synthesis of Al[F18]FAPI-74 required high temperatures, so we investigated the possibility of synthesizing it under mild conditions using microemulsion. ***Materials and Methods:*** Automated radiosynthesis of Al[F18]FAPI-74 was performed using a TRACERlab FXFN module and purified by C18 Seppak cartridge. [F18]F- was eluted from QMA with 0.5 M NaOAc was converted to Al[F18]F by reaction with 10 µL of 10 mM AlCl3 at r.t. for 5 min. Al[F18]F was coordinated to NOTA-FAPI-74 precursor in the 0.5 M NaOAc buffer (pH 4.0) and DMSO (100 oC, 20 min), The crude mixture was purified using C18 Seppak cartridge. Final Al[F-18]FAPI-74 was eluted with EtOH and diluted with 0.1 M NaCl solution. For the Al[F18]FAPI-74 synthesis using microemulsion method, Al[F18]F was synthesized by the same method as above, and the coordination reaction was followed by water-in-oil microemulsion method to synthesize Al[F18]FAPI-74. Microemulsion was generated with isooctane containing 1 wt% Span 80. Al[F18]F was coordinated with NOTA-FAPI-74 precursor in a microemulsion with sonication for 30 min at r.t. and vortexing every 10 min. At the end of reaction, TFA was added to break microemulsion and the mixture was centrifuged at 3000 rpm for 1 min. The aqueous layer was extracted and the radiolabeling yield was confirmed using HPLC. ***Results:*** Radiochemical synthesis of Al[F18]FAPI-74 using an automated production module was obtained in 15-22% radiochemical yield, while the synthesis using microemulsion method was confirmed in 20-35% radiochemical yield. Total synthesis time was 50 and 60 min, respectively, with the microemulsion method taking longer. HPLC analysis confirmed that the retention time of Al[F18]FAPI-74 by both methods was the same (10-11 min). ***Conclusion:*** [F18]FAPI-74 was synthesized using a water-in-oil microemulsion in high radiochemical yield. This result demonstrated that using microemulsion has potential to be used as reaction media for the synthesis of radioligand. ***References:*** 1. McBride et al., J. Nucl. Med. 2009 (6), 991-999 2. Simm et al., Chem. Eur. J. 2012 (18) 6746-6749

EP-1249

First experiences with scanning patients with a long axial field of view PET/CT scanner

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Aim/Introduction: The Royal Free Hospital, London, had the first long axial field of view (LAFOV) PET/CT in the UK. This acquisition system allowed shorter acquisition times, lower administered activities and, at the same time, allowed an increased scanning capacity. Patient workflow previously set-up for conventional PET/CT scanners had to be reviewed to take advantage of this new acquisition system. The goal of this project is to evaluate the impact of this acquisition system on staff satisfaction, patient experience and scan workflow effectiveness. Also, since scanning capacity has increased, staff radiation exposure was also assessed prior and post the use of this new acquisition system. ***Materials and Methods:*** The LAFOV PET/CT scanner had implications at different levels within our department: at booking level, patient preparation, space available, shift patterns, reconstruction times and also how training is provided. To assess staff satisfaction, an anonymous questionnaire was handed to technologist to assess this. Patients were asked about their experience through their scan. Workflow effectiveness was assessed by comparing the time different scan stages took place by analysing respective time stamps (recorded by radiology information system), before and after the use of the LAFOV PET/CT. Radiation exposure of staff members, recorded by electronic personal dosimeters, was also compared. ***Results:*** After two months of utilising a LAFOV PET/CT scanner, the feedback obtained from PET technologists has been quite positive. However, there were some concerns with the increased turnover of scans. Feedback from patients was also quite positive, mainly because of reduced acquisition time. With regards to workflow, time between patient attendance to injection time hasn't shown any significant difference, nor the difference between planned and actual scan acquisition start. Staff radiation exposure has been greatly reduced even considering there had been a significant number of manual radiotracer administration. Another comment made by technologist is regarding the availability of radiotracer to inject, especially when dealing with limited amounts such as 68Ga-DOTATATE and 68Ga-PSMA due to production limitations. ***Conclusion:*** The use of a LAFOV PET/CT scanner has been quite positive experience in our department, not only from staff perspective, but also form patients' one. Thus, it had a significant impact in our current scanning capacity. ***References:*** Long-axial field-of-view PET/CT: perspectives and review of a revolutionary development in nuclear medicine based on clinical experience in over 7000 patients; I Alberts et all; Cancer Imaging, 23 Article number:28 (2023).

EP-1250

Study protocol: A randomized phase 2 trial of FLEXible and extended dosing of ^{177}Lu-PSMA-617 Molecular Radioligand Therapy in mCRPC (FLEX-MRT)

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Aim/Introduction: The European Medicines Agency (EMA) approved 177Lu-PSMA-617 radioligand therapy (RLT) for patients with metastatic castration-resistant prostate cancer (mCRPC) with a fixed dosing schedule of 7.4 GBq administered once every

6 weeks for up to a total of 6 doses. However, a patient-tailored more flexible and extended dosing schedule may increase treatment efficacy of 177Lu-PSMA RLT. ***Materials and Methods:*** We here present the study protocol of the randomized FLEX-MRT trial. ***Results:*** In this investigator-initiated prospective phase 2, open-label, randomized, controlled, parallel group, single-center trial, we aim to assess the efficacy of a response-based flexible dosing schedule of 177Lu-PSMA-617 RLT administered up to 12 treatment cycles in men with mCRPC. Progressive mCRPC patients post-ARSI, post taxane-based chemotherapy are eligible by PSMA PET VISION trial criteria. Exclusion criteria include prior RLT and less than 6 weeks since the last myelosuppressive therapy. We hypothesized 2-year survival rates of 55% in the investigational group and 30% in the control group. A two-sided log rank test with an overall sample size of 90 subjects (45 per group) achieves 80.3% power at a 0.050 significance level to detect a hazard ratio of 0.4966. Randomization will allocate patients in a 1:1 ratio: The investigational arm is treated with up to 12 cycles including potential "treatment holidays" depending on the treatment response; the control arm receives 6 cycles administered in six-week intervals. Imaging response to RLT is assessed using 177Lu-PSMA-617 SPECT/CT 24h after each cycle and PSMA PET/CT every 3 months during treatment holidays, respectively. RLT will be re-started after a treatment holiday in the investigational arm, if the patient experiences ≥25% PSA progression and an imaging progression according to the RECIP criteria. The primary endpoint is the 2-year survival rate calculated from the date of the first treatment cycle. Secondary endpoints include safety by CTCAE and dosimetry, and determination of overall and progression-free survival (evidence of progression as defined by either radiographic, PSA, or clinical progression, or death from any cause). The FLEX-MRT trial has been approved by the FDA (IND #168362) and the UCLA IRB (#23-000931) and it is registered on ClinicalTrials.gov (NCT06216249). Start of enrollment is in May 2024. The study will last for 48 months of which subject accrual (entry) occurs in the first 12 months. ***Conclusion:*** The randomized FLEX-MRT trial aims to generate evidence for the efficacy of a response-based extended dosing schedule of 177Lu-PSMA RLT in patients with advanced mCRPC.

EP-1251

Customer satisfaction surveys for Nuclear Medicine department, measured through patients and referring clinicians' surveys

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Aim/Introduction: The purpose of this survey is to identify improvement areas within the care process in line with ISO 9001:2015 standard. ***Materials and Methods:*** Patients have been approached by the technical team who requested their collaboration and provided a free of charge telephone number for further questions or concerns. Interviews were carried out by telephone questionnaire handled by the CATI program (Computer Assisted Telephone Interview). Average interview time was 454 seconds. 89 patients were contacted, 50 sample holders and 39 substitute. 50 patients responded, 28 sample holder an 22 substitutes. Physicians survey was conducted through a cover letter and a Google Form questionnaire, sent by corporate mail to head of department and clinical director who distributed the questionnaire to the physicians. The survey was sent in March 2023, containing 7 questions (score 1 to 5 and NR/DK). 31 responded, we do not know the number of surveys sent. ***Results:*** Average score of Patients was 8.74 and the majority of the patients replied that they would recommend the department 9.00 (1 to 10 scale). Highest value indicator was "Active listening and empathy" (9.59), "technical proficiency of staff" (9.43), "quality of care" (9.28), "cleanliness" (9.04) and "privacy during examination" (9.04). Lowest value indicators were "waiting list" (7.40) and "confidentiality" (6.90). Results of Referring Clinicians were substantially high, with only one indicator being below reference, namely "participation in hospital committees" (41.9%). All other indicators with a high satisfaction value: "reporting time" (80.6%), "report & study quality" (93.5%), "waiting time scheduling" (80.6%), "reports of unexpected finding" (74.2), "clear communication / courtesy" (90.3%) and "global satisfaction" (96.8%). As improvement measurement, we incorporated automated appointment scheduling and registration processes (SIGUE program) and increased the participation in hospital committees from 5 to 11. ***Conclusion:*** The data from this study highlights areas for improvement such as patients' privacy and additional participation in hospital committees. Deployment of additional surveys in nuclear medicine departments could serve to establish best practice and improve the overall service level to patients and professionals

EP-1252

Cost-Effectiveness of PET/CT in Head-Neck Cancer & comparisons with CT-MRI

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Aim/Introduction: To evaluate the cost-effectiveness of Positron Emission Tomography/Computed Tomography (PET/CT) in the initial N-staging of Head-Neck Cancer (H-NCa) and compare it with CT and Magnetic Resonance Imaging (MRI) within the Greek National Healthcare System. ***Materials and Methods:*** A cohort of 100 clinically N0 H-NCa patients was evaluated for a 10 years' time horizon. Initially, a decision tree model was constructed including 3 different imaging strategies for H-NCa staging, namely a) Whole-Body Fluoro-deoxy-Glucose (FDG)-PET/CT, b) CT of the neck, chest, and abdomen ("CT") and c) MRI of the neck plus CT of the chest-abdomen ("MRI"). Afterwards, a Markov Model was applied simulating transition in different disease states such as recurrence and death. Input parameters (disease prevalence, diagnostic accuracy estimates and transition probabilities) were based on recent literature and costs were adjusted to the Greek Healthcare System. Total Life-Years (LYs) were defined as Health Outcome. ***Results:*** Total costs per patient were 144.822€ for PET/CT yielding 4,095 LYs. For MRI the costs were 144.904€ with yield of 4,094 LYs and for CT 144.586€ with 4,094 LYs respectively. PET/CT marginally dominated MRI while the Incremental Cost Effectiveness Ratio (ICER) of PET/CT vs. CT was estimated at 179.562€ for 1 LY gained. ***Conclusion:*** All 3 imaging strategies had comparable health outcomes and costs. PET/CT is an appropriate and preferred imaging modality as it has high diagnostic accuracy in initial N-staging of H-NCa.

EP-1253

Harnessing Accelerator Mass Spectrometer (AMS) and C-14 micro-tracing for the long-term in vivo behavior evaluation of polystyrene (PS) microplastics via inhalation exposure

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Aim/Introduction: Recently, it has been reported that microplastics are not only the cause of environmental pollution, but also enter the human body through various pathways, affecting human health, and microplastics are most frequently introduced through the respiratory tract [1]. In this study, to evaluate the long-term in vivo behavior of microplastics, PS was radiolabeled with C-14 (half life: 5730 y), and in vivo biodistribution and excretion studies were conducted in rats after inhalation exposure of [C-14]PS-Bn using an accelerator mass spectrometer (AMS) capable of measuring trace amounts of radiocarbon. ***Materials and Methods:*** [C-14]PS-Bn was synthesized from PS and [C-14]benzyl bromide in the presence of K2CO3 in DMF/H2O. SD rats were exposed to [C-14]PS-NH-Bn for 4 h using nose-only inhalation exposure equipment. The organs were collected at 5 min, 3, 24, 48, and 72 h, and 1, 2, 3, and 4 weeks after exposure to [C-14]PS-NH-Bn, carbonized, and the fraction of modern carbon (fMC) was measured using AMS. In the mass balance study, after inhalation exposure of rats to [C-14] PS-NH-Bn, urine and feces were collected for 4 weeks in metabolic cages and carbonized, and fMC was measured by AMS as described above. ***Results:*** [C-14]PS-NH-Bn (average size: 254 nm) was successfully radiolabeled with C-14 in 12% radiochemical yield. The calculated inhalation exposure doses were 7.94-11.05 mBq/rat, considering the respiratory rate and weight of the rats. In vivo behavioral results showed a decreasing pattern over time, with less than 5% ID/g in the blood, kidney, large intestine, small intestine, liver, stomach, and trachea up to 1 w post-exposure, after which it was not detected. In contrast, the lungs showed high uptake, ranging from 21.70 - 9.32%ID/g from the initial time to 4 w. An excretion study showed that 50% of [C-14]PS-NH-Bn was excreted in urine within 1 d and in small amounts in feces up to 11 d after exposure. ***Conclusion:*** This study overcame by AMS and C-14 microtracing techniques the limitations of the in vivo behavior evaluation of microplastics using short half-life radiotracer. These methods are applicable to various environmental toxicants and are expected to be useful tools to provide basic data for toxicity assessments of accumulation organs in the human body. ***References:*** [1] Environmental Science & Technology 53, 12(2019): 7071

EP-1254

Assessment of Economic Implications of CXCR4-Directed Molecular Imaging in Marginal Zone Lymphomas: A Cost-Consequence Analysis

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Aim/Introduction: Marginal Zone Lymphomas (MZLs) represent approximately 7% of all non-Hodgkin lymphomas and are, therefore, the second most common form of indolent lymphoma. Current diagnostic guidelines recommend a thorough diagnostic assessment. Recent studies have highlighted the overexpression of C-X-C motif chemokine receptor 4 (CXCR4) in MZL, making it a potential target for imaging and therapy. The novel positron emission tomography (PET) tracer [68Ga]Ga-Pentixafor has shown promising diagnostic performance in initial staging and therapeutic monitoring in MZL. This health economic analysis evaluates the cost-of-illness and cost-consequence of [68Ga]Ga-Pentixafor PET/ computed tomography (CT) scans in managing hospitalized patients diagnosed with MZL ***Materials and Methods:*** Patients diagnosed with MZL from 2016 to 2024 at University Hospital of Würzburg were divided into two groups. From 2016 to 2020, one group was diagnosed and staged according to the applicable guideline procedures, while the other group, from 2020 to 2024, received additional [68Ga]Ga-Pentixafor PET/CT. A cost-consequence analysis assesses the impact of this intervention on subsequent therapies and associated costs, with reference to the up- and downstaging distribution and management changes observed by Duell et al. (2023). ***Results:*** We anticipate examining a cohort of 400 patients diagnosed with MZL over the study period. Drawing from the evidence of Duell et al. (2023), we expect to observe distinct distributions of up- and downstaging among the patient cohort, indicating potential variations in treatment responses and subsequent therapies. As a result, we expect a difference in patient-related and health economic parameters between these two groups. ***Conclusion:*** By comparing patient cohorts and evaluating treatment responses, as well as subsequent costs, we seek to provide insights into the value proposition of adopting innovative imaging techniques into the diagnostic and therapeutic algorithms for MZL. The potential resource-savings and improvements in patient outcomes associated with [68Ga]Ga-Pentixafor PET/CT imaging could have significant implications for healthcare resource allocation decisions and patient care delivery. ***References:*** Duell, J., Buck, A. K., Hartrampf, P. E., Schlötelburg, W., Schneid, S., Weich, A., ... & Werner, R. A. (2023). Chemokine Receptor PET/CT Provides Relevant Staging and Management Changes in Marginal Zone Lymphoma. Journal of Nuclear Medicine, 64(12), 1889-1894.

EP-1255

Improving reporting quality in PET/CT Imaging of Lymphomas: the influence of Lugano classification

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Aim/Introduction: Fluorodeoxyglucose positron emission tomography/computed tomography (FDG PET/CT) has become vital in oncologic imaging, aiding in disease detection, staging, and treatment response assessment [1]. However, subjective interpretation can lead to variability in reporting and clinical decisions. Deauville scoring system was introduced in 2009 to standardize the interpretation of FDG PET/CT scans, providing a quantitative measure of tracer uptake in lesions relative to background activity. In 2014, the Lugano classification criteria [2] further enhanced reporting. This abstract explores the significance of Lugano classification reporting compared to traditional reporting in FDG PET/CT imaging. ***Materials and Methods:*** We conducted a retrospective overview in our hospital of FDG PET/CT reports in lymphoma patients who underwent treatment, including interim and end-of-treatment scans, in the years 2020 and 2023. Traditional reporting involved subjective visual assessment, while Lugano classification provided standardized numerical scoring. ***Results:*** Deauville scoring has transformed interpretation, minimizing interobserver variability and enhancing reproducibility. Studies demonstrate its superiority

over traditional assessment, with higher scores correlating with poorer outcomes [3]. However, retrospective analysis of PET/CT reports in lymphoma patients in year 2020 and 2023 showed that the percentage of Deauville reporting did not increase, remaining stable at 61% in 2020 (total 146 reports) and 59% in 2023 (total 149 reports). A significant portion of reports still lacked Deauville scores, indicating the need for further dissemination and education among clinicians. ***Conclusion:*** The implementation of Lugano classification has significantly improved the utility of FDG PET/CT in lymphomas. Standardized, quantitative assessment enhances interobserver agreement and offers valuable prognostic insights. Despite advancements, the retrospective comparison highlights the ongoing need to popularize Deauville scoring across specialties. Embracing standardized reporting practices holds promise for advancing precision oncology and personalized medicine. Continued efforts in education and practice integration are essential to maximize the benefits of Lugano classification. ***References:*** 1) D'souza MM, Jaimini A, Bansal A, Tripathi M, Sharma R, Mondal A, Tripathi RP. FDG-PET/CT in lymphoma. doi: 10.4103/0971-3026.125626. 2) Van Heertum RL, Scarimbolo R, Wolodzko JG, Klencke B, Messmann R, Tunc F, Sokol L, Agarwal R, Strafaci JA, O'Neal M. Lugano 2014 criteria for assessing FDG-PET/CT in lymphoma: an operational approach for clinical trials. doi: 10.2147/DDDT.S136988. 3) Fallanca F, Alongi P, Incerti E, Gianolli L, Picchio M, Kayani I, Bomanji J. Diagnostic accuracy of FDG PET/CT for clinical evaluation at the end of treatment of HL and NHL: a comparison of the Deauville Criteria (DC) and the International Harmonization Project Criteria (IHPC). doi: 10.1007/s00259-016-3390-9.

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Long-Term Follow-Up Results and Factors Affecting Survival In Oncocytic Thyroid Cancer

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Aim/Introduction: Oncocytic (Hurthle cell) carcinoma of thyroid, constitutes 3-4% of all thyroid cancers and it was classified as oncocytic thyroid carcinoma (OTC) in the 2017 WHO classification, separated from the thyroid follicular cancer subtype. Our study aimed to classify the pathological and clinical features of patients diagnosed with OTC and to determine long-term follow-up results and prognostic factors affecting survival. ***Materials and Methods:*** 56 patients with a diagnosis of OTC were included in the study. Demographic data, pathological features, biochemical data, radioactive iodine (RAI) doses, disease status during follow-up and follow-up periods of the patients were recorded. ***Results:*** 56 patients with OTC pathology were included in our study. Bilateral total thyroidectomy (BTT) was performed in all patients. All patients received RAI treatment at least once. At diagnosis, local lymph node metastasis was detected in 4 (7.1%) patients and distant metastasis was detected in 2 patients. Recurrence was observed in 11 of the patients with excellent response or indeterminate response. The mean time to recurrence was 5.3 ± 3.39 years and the median follow-up time after recurrence was 8.4 years (95% CI 7.27-9.63). Distant metastases were observed in a total of 10 patients during diagnosis and follow-up, and their localizations were lung, bone and liver, in order of frequency. In the latest status in follow-up; mortality was observed in 5 patients (9%), all of whom were distant metastatic. The median follow-up period in the entire patient group was 14.4 years (95% CI 12.9-15.9); RFS (recurrence-free survival) was found to be 86% at 5 years, 78% at 10 years and 75% at 20 years. Tumor size >4cm (p=0.006) and ETE+ (p<0.01) were found to be statistically significant in affecting RFS (Figure 1). According to the treatment response after BTT + RAI; The 5-year RFS of those with a excellent response was 90%, and the RFS of those with an indeterminate response was 66%. In the entire patient group, OS (overall survival) was found to be 98% at 5 years, 94% at 10 years and 89% at 20 years. Age at diagnosis >45 (p=0.005), tumor size >4cm (p=0.006), and ETE+ (p=0.005) were found to be statistically significant in affecting OS. ***Conclusion:*** Although oncocytic thyroid cancer is known to have a poor prognosis among differentiated thyroid cancers; In the light of our clinic's data, it has been concluded that long survival times can be achieved with the correct treatment and personalized dynamic approach.

EP-1257

Environmental sustainability in Radionuclide Therapy

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Aim/Introduction: The World Health Organisation has stated that climate change is the single biggest health threat facing humanity[1].The UK National Health Service (NHS) has committed to reaching net zero by 2045[2] requiring input and adaptation of all healthcare services.There is limited data regarding the environmental footprint of radionuclide therapies.This work aims to estimate the environmental impact of common starting points for sustainability projects including patient transport,paper usage and consumable disposal in radionuclide therapies. ***Materials and Methods:*** The environmental impact of patient transport was estimated from the average patient travel distance to a large London NHS Trust and published conversion factors for different modes of transport[3].An estimate of the environmental impact of paper used for patient communications and record keeping was calculated from the average A4 sides produced for as range of first cycle treatments across three nuclear medicine institutions and published conversion factors[3].The environmental impact of consumable disposal was estimated from the consumable weight,packaging weight and observed disposal route for a range of therapies together with disposal emissions factors[4]. ***Results:*** The emissions equivalent for 30.3km average travel distance depended on mode of transport and were 0.8kgCO2e by underground train, 1.1kgCO2e by train, 2.4kgCO2e by bus and 5.1kgCO2e by car. The average sides of A4 produced for a first cycle treatment was 19-29 across the therapies in this study. The emissions equivalent were 0.10kgCO2e for I-131 sodium iodide, 0.10kgCO2e for Lu-177 oxodotredotide, 0.12kgCO2e for Ra-223 dichloride and 0.13kgCO2e for Lu-177 PSMA therapies. The weight of consumables varied from 0.04-1.3kg per therapy cycle (excluding the radiopharmaceutical and associated packaging).The emissions from consumable disposal were estimated as 0.01kgCO2e for I-131 sodium iodide, 0.62kgCO2e for Ra-223 dichloride, 0.79kgCO2e for Lu-177 oxodotredotide and 0.81kgCO2e for Lu-177 PSMA therapies. ***Conclusion:*** This early work estimates the environmental impact of patient transport, paper usage and consumable waste in radionuclide therapies. Patient transport had the highest estimated emissions equivalent followed by consumable disposal and paper usage.This initial work is limited in the radionuclide therapies included and number of centres together with their geographical distribution but may help priortise sustainability projects.Further work to estimate whole life-cycle environmental impact of radionuclide

therapies across the full range of practices will be required as we work towards net-zero. ***References:*** [1]"Climate Change" Fact sheet, World Health Organisation, October 2023; [2]Delivering a 'Net Zero' National Health Service, NHS England, October 2020 [3] UK Government GHG Conversion Factors for Company Reporting v1.1 2023[4]NHS England. NHS Clinical Waste Strategy v1, 2023

Technologists e-Poster

EP-70

e-Poster Area

EP-1258

A promising new era for diagnosis and therapy of Spinocerebellar Ataxia

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Aim/Introduction: Currently, polyglutamine (polyQ) disorders, such as spinocerebellar ataxia (SCA), are lethal and lack of effective treatment. Diagnosis largely relies on post-mortem examinations, and tools like the Scale for the Assessment and Rating of Ataxia (SARA) and coordination tests suffer from a lack of objectivity. Consequently, there is a critical need for the development of effective diagnostic and therapeutic approaches for SCA. In this study, we aim to explore the use of exosomes derived from adipocyte mesenchymal stem cells (ADSC) as a therapeutic agent and assess their efficacy in treating SCA through the Rotarod performance test and F18 Florbetaben (F^{18} FBB) PET imaging. ***Materials and Methods:*** The identification of spinocerebellar ataxia in transgenic mice is conducted using polymerase chain reaction (PCR) techniques and genetic mapping when the mice reach one month of age. Behavior assessments were evaluated using a multi-channel Rotarod for measuring the time until they fall. F^{18} FBB, known for its beta-amyloid imaging capabilities, was utilized in SCA transgenic mice studies. A therapeutic dosage of 2x10^5 exosomes from ADSCs was injected into the SCA transgenic mice through the tail vein weekly for a duration of four weeks. Post-treatment, the Rotarod test assessed the mice's motor skills, and F^{18} FBB imaging was used to detect accumulation in the cerebellum. Additionally, the exosomes were tagged with Ga-68 to study their distribution within the body. ***Results:*** The Rotarod performance on SCA transgenic mice treated with ADSC-derived exosomes indicated that some of the transgenic mice exhibited improved excercise capability, and there was a decrease in cerebellar uptake of F^{18} FBB among these SCA transgenic mice. Furthermore, imaging revealed that the exosomes displayed significantly higher accumulation in the cerebellar region of SCA mice compared to normal mice. ***Conclusion:*** Our finding suggest that F^{18} FBB, widely recognized as a beta-amyloid imaging agent, holds potential for imaging protein agglomerates, and exosomes derived from ADSCs has promising as a therapeutic agent for SCA.

EP-1259

Investigating therapeutic and imaging applications of exosomes in leukemia

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Aim/Introduction: Childhood acute lymphoblastic leukemia represents 26% of all pediatric cancer cases, poses significant challenges with traditional treatments due to associated toxicities. This study explores the role of exosomes in the growth of leukemia cells and combines the use of radiolabeled exosomes to detect infiltration outside the bone marrow. ***Materials and Methods:*** Exosomes from Wharton's jelly mesenchymal stem cells (WJMSC) and leukemia cells were isolated through tangential flow filtration and ultracentrifugation techniques. The effect of WJMSC exosomes on the proliferation of human acute lymphoblastic leukemia cells (Reh cells) and acute myeloid leukemia cells (HL60 cells) was evaluated using cell proliferation assays. Additionally, a 67Ga-oxine-labeled Reh exosome was created to explore its ability to return to the original cells in a human leukemia xenograft model. ***Results:*** The findings indicated that WJMSC exosomes reduced the growth of Reh cells but did not affect HL60 cell proliferation, and they extended the lifespan of leukemia xenograft mice. The 67Ga-oxine-Reh exosome showed promise in detecting extra-medullary lesions, demonstrating its bio-distribution and selective localization within the lymphatic system of a mouse leukemia model via whole-body SPECT/CT imaging. ***Conclusion:*** The preliminary results suggest that WJMSC exosomes could serve as a potential drug delivery mechanism for treating leukemia. Furthermore, the 67Ga-oxine-Reh exosome could enhance diagnostic precision and contribute to improved management of leukemia cases involving extra-medullary spread. ***References:*** Cancer Epidemiol Biomarkers Prev 2023 Aug 1; 32(8):1030-1037.

EP-1260

New Theranostic Approach in the Treatment of Bone Metastases: 161Terbium-DOTAZOL

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Aim/Introduction: Prostate cancer is one of the most common types of cancer among men, and the progression of the disease often leads to the development of bone metastases, significantly impacting patients' quality of life. Prostate cancer-associated bone metastases are typically osteoblastic lesions that involve increased bone formation and cause bone pain, and also lead to complications such as pathological fractures, spinal compression, and hypercalcemia, thereby increasing morbidity and mortality. The conjugation of bisphosphonates with macrocyclic chelators holds great potential in bone-targeted radionuclide therapy and imaging. Currently, DOTAZOL based on zoledronic acid, the most potent bisphosphonate, has shown high potential in initial patient studies, especially when treated with the low-energy β-emitter 177Lu. Recently, 166Terbium (161Tb) has been considered as an effective alternative to 177Lu. The superior therapeutic effects of 161Tb demonstrated in vitro and in vivo studies present a new approach in the treatment of prostate cancer bone metastases. This study examines the radiolabeling and biodistribution of 161Tb labeled DOTAZOL in vivo for the treatment of bone metastases. ***Materials and Methods:*** DOTAZOL was radiolabeled with Tb-161, and conditions such as pH, temperature, and TLC solvent systems were optimized by researchers. The radiochemical yield of Tb-161-DOTAZOL was determined using High-Performance Liquid Radiochromatography (HPLRC) and Thin Layer Radiochromatography (TLRC). In vivo studies were conducted on Albino Wistar rats, involving scintigraphic imaging and biodistribution studies ***Results:*** The radiochemical yield of Tb-161-DOTAZOL was found to be 99.98 ± 0.02% (n=3). The binding efficiency of 161Tb-DOTAZOL was observed to be an

average of 98.37 ± 2.78% over 24 hours. The log P value of 161Tb-DOTAZOL was determined to be 0.61 ± 0.19. Biodistribution and scintigraphy studies of 161Tb-DOTAZOL showed low soft tissue uptake and high bone accumulation. High retention was observed in the epiphyses, where bone growth is actively occurring and osteoblastic activity is high, suggesting DOTAZOL's accumulation in osteoblastic bone lesions. All scintigraphic images showed similar levels of low renal retention. ***Conclusion:*** The findings of this study evaluating the radiochemical yield of 161Tb labeled DOTAZOL in the treatment of osteoblastic bone metastases indicate that 161Tb-DOTAZOL has high radiochemical efficiency and stability. Scintigraphic imaging and biodistribution studies show significant retention of 161Tb-DOTAZOL in bone tissue. Consequently, more detailed preclinical studies are planned for the therapeutic use of 161Tb-DOTAZOL in bone metastases.

EP-1261

Assessing the therapeutic potential of exosomes derived from Wharton's jelly mesenchymal stem cells in the 5xFAD mouse of Alzheimer's disease

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Aim/Introduction: Alzheimer's disease is the leading cause of dementia, severely affecting patients' memory and cognitive functions. In this study, we explored the potential therapeutic benefits of exosomes derived from Wharton's jelly mesenchymal stem cells (WJMSC exosomes) on β-amyloid accumulation and spatial learning and memory capabilities in the 5xFAD mouse model of Alzheimer's disease ***Materials and Methods:*** WJMSC exosomes were administered intravenously to 5xFAD mice at a dosage of 2 ×109 particles weekly for a duration of four weeks. Neurogenic function was evaluated by conducting amyloid imaging of the 5xFAD mice's brains using positron emission tomography-computed tomography (PET-CT) with ^{18}F-Florbetaben. Additionally, spatial learning and memory abilities were assessed using the Barnes maze test to determine the therapeutic effectiveness of WJMSC exosomes in the mouse model of Alzheimer's disease. ***Results:*** WJMSC exosomes provided dual advantages, notably improving spatial memory in 5xFAD mice ($p = 0.003177$, n=6) and diminishing the buildup of β-amyloid peptides in the brains of the 5xFAD mouse model of Alzheimer's disease ($p = 0.005356$, n=6). ***Conclusion:*** The outcomes suggest that exosomes from Wharton's jelly mesenchymal stem cells offer considerable promise as a non-cellular therapeutic approach for combating Alzheimer's disease.

EP-1262

Optimizing Image Quality in Meningioma Diagnosis: Retrospective Analysis of Reduced Scan Time Utilizing $^{[18F]}$SiFAlin-TATE PET Imaging

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Aim/Introduction: Meningiomas are the most common benign tumors of the adult brain. Meningiomas typically overexpress somatostatin receptors (SSTR). $^{[18F]}$SiFAlin-TATE is a novel diagnostic agent for Positron Emission Tomography (PET) to assess expression of SSTR. This study aimed assess image quality by reducing scan time while maintaining the radiopharmaceutical activities. ***Materials and Methods:*** Fifteen patients with 22 World Health Organization (WHO) grade I and II meningiomas undergone list-mode $^{[18F]}$SiFAlin-TATE PET/CT, were retrospectively assessed. Images were acquired 30-60 minutes, after administration of average of 146 MBq, for 10-minutes (PET10min). Subsequently, images were reconstructed for each patient using the first 5 (i.e. 50% time reduction; PET5min) and 3 (i.e. ~67% time reduction; PET3min) minutes of acquisition. Besides a visual interpretation from two experienced readers, a quantitative image quality assessment was conducted by measuring the mean, max, and peak, SUV values and comparing them with those obtained from PET10min. Tumour to Background Ratio (TBR) were calculated for each lesion, along with descriptive statistics. Statistical analysis employed a single-factor ANOVA with a significance level set at $P < 0.05$ and an Fcrit value of 3.14. ***Results:*** In the qualitative evaluation, no significant differences were observed between PET10min, PET5min and PET3min across the 22 lesions. For the PET10min the TBRmean (using SUVmean) was 53.19 and the TBRmax (using SUVmax) was 50.20. In the case of PET5min, TBRmean and TBRmax increased by 44% and 38%, respectively. Similarly, PET3min led to an increase in TBRmean and TBRmax by 31% and 32%, respectively. ANOVA analysis did not show any significant difference in TBRmean ($P = 0.34$, Fcrit=1.10) or TBRmax ($P = 0.37$, Fcrit=1.02). ***Conclusion:*** Reconstructed images using reduced scan times of 5 and 3 minutes maintained qualitative and quantitative diagnostic quality. The reduction in acquisition time could increase patient throughput and minimize patient discomfort (thus reducing the possibility of motion artifacts).

EP-1263

Elevated Serum Osteocalcin Levels Correlate Positively with Abnormal Nuclear Scintigrams in Lame Thoroughbred Racehorses.

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Aim/Introduction: The purpose of this study was to determine if serum biomarkers can be used to accurately predict musculoskeletal injury based on positive nuclear scintigraphic studies of the distal limbs of racehorses in training. ***Materials and Methods:*** This was a prospective observational case control study that concurrently measured serum Osteocalcin (OC) and C-terminal telopeptides of type I collagen (CTX) as well as radiomic markers of radionuclide uptake in bone and joints of racehorses in training. The source population comprised racehorses referred for nuclear scintigraphy as part of lameness investigations. Blood samples taken from study subjects at the time of imaging were analysed for levels of serum biomarkers for OC and CTX using commercial equine-specific ELISA kits. Comparison between serum biomarker levels for horses with normal and abnormal scintigraphic findings was determined using the Wilcoxon signed-rank test and paired t test. ***Results:*** A total of 68 racehorses were included in the study. Fifteen percent of horses (10/68) had normal qualitative bone scans and 85% of horses had increased radiotracer uptake as determined by qualitative assessment. In the latter group, 31/68 (46%) has moderate radiotracer uptake and 27/68 (40%) had strong uptake in at least one skeletal region, which was supported by the radiomic analysis of the scans. Mean serum OC levels were normal for the normal bone scan group of horses. Moderate and strongly positive scans had significantly elevated OC levels compared to those from the normal group (Figure 1). Mean CTX

levels were not significantly elevated for any group of horses. ***Conclusion:*** The results of our study support the hypothesis that a positive correlation exists between elevated serum osteocalcin levels and abnormal scintigrams in lame racehorses. Therefore, significant serum elevations of OC in racehorses with clinical or subclinical lameness could forewarn of significant, even catastrophic, musculoskeletal injury. However the results did not support the same correlation for CTX. It is apparent that continued investigation of musculoskeletal biomarkers as a screening tool for injury in athletic horses is warranted. ***References:*** Currie, G., et al., 2019. Budan F, et al., 2018. Watabe H, et al., 2011. Huang C and Ogawa R., 2010.Dobrindt, O., et al., 2012.Periyapattana, K. (2010). Rhemrev SJ, 2010.Groves AM, 2005. Huiskes R., et al., 2000. Mayer-Kuckuk P , Boskey AL., 2006.Watabe H, Furuhama T, Tani-Ishii N, et al. 2011.Huang C and Ogawa R. 2010.Seref-Ferlengez, Z., Kennedy, O. D. & Schaffler, 2015.Ivaska K.K., et al., 2004.

EP-1264

A technical improvement about ct-SPET in sentinel lymph node study

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Aim/Introduction: Lymphoscintigraphy(LS) is the gold standard practice for pre-operative staging of cutaneous cancers such as melanomas. Nevertheless the localization of sentinel lymph node(SLN) with a standard acquisition protocol may not be sufficient for a precise surgical access when cancer is located in complex anatomical region such as in head-neck district. The role of ct-SPET images in the detection of SLN of melanoma located in eyelid region is shown our clinicar routine. ***Materials and Methods:*** 37 Mbq-[Tc99m]nanocolloidal radiotracer in a small volume of max 0.3 ml, splitted into to three tuberculin syringes, was injected using a 30 G needle in the eyelid region of a 67-year-old patient with melanoma of the right lower eyelid. Three subcutaneous injections were performed by nuclear physician, in the medial canthus of the right eye, in the medial portion of the upper eyelid, and in the middle area of the lower eyelid. Dynamic planar anterior images were immediately acquired using a dual-head gamma-camera; patient's head was rotated in left lateral position to better visualize any lymph node of contralateral-cervical basins. Three min. anterior and lateral static planar images were acquired after positioning one Cobalt-57 sheet source under patient's head for attenuation correction of tissue. Additional ct-SPET was performed with a low-dose co-registrated ct raw data. ***Results:*** On early dynamic images, SLN was grossly identified and marked with dermographic pen in right latero-cervical region. At images acquired using the Cobalt-57 sheet source, SLN was better depicted in the upper latero-cervical area, even though the anatomic cervical level remained unclear. Finally, SLN was identified in the right latero-cervical IB level at ct-SPET images and the patient underwent radical surgery about 5/6 hours after LS. Hybrid image-guided surgery allowed an easy and precise identification of SLN with intraoperative gamma probe. ***Conclusion:*** In recent years the use of image-guided surgery is being increasing, allowing safer, less invasive and time-consuming surgical procedures. The case here presented is paradigmatic of how the evolution of LS acquisition techniques has improved the accuracy of localization of SLN especially in complex anatomical districts such as latero-cervical lymphatic chain. However, besides the use of coupled ct-SPET images, also the oldest image techniques may still have a role in anatomic localization of SLN, especially if "tricks" such as the Cobalt-57 sheet source are used.

EP-1265

Impact of music intervention on psychological and physiological parameters of patients undergoing myocardial perfusion scintigraphy

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Aim/Introduction: Myocardial Perfusion Scintigraphy (MPS), a well-established imaging procedure for diagnosing ischemic heart disease, has multiple phases that can induce patients' anxiety, discomfort, and dissatisfaction. Several non-pharmacological strategies have been used to alleviate anxiety and improve patient comfort and satisfaction, such as music-intervention. The aim of this study was to evaluate the efficacy of musical-intervention in the outcomes of patients undergoing MPS. ***Materials and Methods:*** A randomized clinical trial was conducted on patients undergoing a MPS one-day protocol stress-rest, in a Nuclear Medicine Department between January 15, and March 18, 2024. Patients were divided into a control group (CG) and the experimental group (EG). In the EG, a musical-intervention was performed during the rest image acquisition, allowing patients to choose from a selection of musical tracks curated by a music lecturer. Anxiety levels were assessed at four different moments in both groups: before and after the stress image acquisition (T1 and T2), and before and after the rest image acquisition (T3 and T4), using physiological parameters at all times and psychological parameters for CG at T1 and T4 and for EG at T1, T3 and T4. Image quality analysis was performed using measures of contrast, noise, number and amplitude of patients movements. All studies were reviewed by two researchers and evaluated by three nuclear medicine technologists. ***Results:*** The sample comprised 30 participants with an average age of 71±11.02yrs [45-87yrs] with 15 participants enrolled in each group. Patients in EG reduced their anxiety scores from 36±9.44 at T1 to 33±7.07 at T3 and 28±9.11 at T4, while patients in CG reduced their anxiety scores from 39±10.62 at T1 to 33±9.66 at T4. Regarding patient motion, there was a reduction from the CG to EG in movements between 1-2 pixels (CG = 21, EG= 19) and movements higher than 2 pixels (CG =19, EG=6). In some myocardial walls on the three tomographic slices, the correlation between psychological parameters and image noise were lower in T4 for the EG. No significant results were found to image contrast. ***Conclusion:*** For the EG, the image noise was ~3% lower than in CG. Anxiety decreased throughout the MPS procedure with lower values at T4 for the EG. Additionally, the musical intervention seems to be effective as the EG showed lower values of patients movement. Acknowledgements: The authors would like to thank the support from the funding from IDI&CA - IPL, to the IDI&CA2023/I2P2_MPS project.

EP-1266

PET-MRI Quantification of ^{18}F-Florbetaben Uptake in the Brains of Asymptomatic Middle-aged and Elderly Chinese Subjects

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Aim/Introduction: Alzheimer's disease (AD) is a progressive neurological disorder characterized by the accumulation of senile plaques primarily composed of β-amyloid, leading to neurodegeneration, cognitive decline, and ultimately, death. 18F-Florbetaben (FBB) has emerged as a highly promising tracer due to its strong affinity for β-amyloid deposits and its favorable radiochemical attributes that render it suitable for positron emission tomography (PET). With 18F-FBB PET, the diagnostic approach has evolved from simple visual categorization to a more nuanced, quantitative assessment of amyloid deposition. This study aims to determine the metabolic characteristics and standardized uptake values (SUV) of various brain regions in middle-aged and elderly cognitively normal Chinese individuals through 18F-FBB imaging, thereby establishing a normative database. ***Materials and Methods:*** A retrospective analysis was conducted on 45 cognitively healthy adults (mean age 65.0±6.69 years), consisting of 20 males (mean age, 64.4±8.51 years) and 25 females (mean age 65.4±5.56 years). All participants underwent magnetic resonance imaging (MRI) and 18F-florbetaben PET scans. Utilizing the uAI Research Portal, we employed super-resolution reconstruction algorithms and brain analysis methods based on T1-weighted images to divide the patients' brains into 109 regions of interest (ROI). Rigid registration was applied to align T1 images with PET images, allowing for the mapping of 109 ROIs onto the PET images, thereby calculating the SUV. The mean SUV for each brain region was computed for every subject, and independent sample T-tests were utilized to investigate potential sex-based differences in SUV across brain regions, with statistical significance set at $P<0.05$. ***Results:*** The SUV showed a high uptake in white matter (1.61±0.47), intermediate uptake in gray matter (1.02±0.26), and low uptake in cerebrospinal fluid (0.75±0.22). Statistically significant sex-related differences were observed in several brain regions, including the left globus pallidus (1.56±0.26 vs. 1.39±0.24, P=0.03), left cerebellar white matter (1.88±0.33 vs. 1.69±0.26, P=0.03), right cerebellar white matter (1.85±0.31 vs. 1.67±0.27, P=0.04), and the medulla oblongata (1.70±0.29 vs. 1.50±0.27, P=0.02), where SUVs were higher in males compared to females. ***Conclusion:*** Through the performance of 18F-FBB PET-MRI imaging on a cohort of cognitively normal middle-aged and elderly subjects, we have successfully established a standard database for β-amyloid deposition in their brains. Our findings revealed that β-amyloid deposits in the left globus pallidus, bilateral cerebellar white matter, and medulla oblongata were significantly higher in males, suggesting potential gender-specific physiological variations or incipient β-amyloid deposition in these brain areas among middle-aged and elderly individuals with normal cognition.

EP-1267

Medication Interaction In [18F]FE-PE2I PET - Evaluation Of A New Questionnaire In Daily Practice

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Aim/Introduction: Switching from [123I]FP-CIT SPECT to [18F] FE-PE2I PET has increased patient flow due to shorter injection-to-scan and acquisition time. Patient preparation now includes peripheral vein catheterization, tracer administration and no prearrival precautions is needed from the patients. As several medications can interfere with tracer binding to dopamine transporters, our department implemented a questionnaire to the daily patient preparation about medication that could interfere with [18F]FE-PE2I binding, such as methylphenidate, modafinil and the antidepressant sertraline*. The aim was to evaluate the implementation of additional patient preparation. ***Materials and Methods:*** In a quality assurance study approved by the local authorities, we included 145 patients who underwent [18F]FE-PE2I PET from Jan-24 to ultimo Feb-24 (Group A) after implementing the new patient preparation. For comparison, we used a control group (Group B) of 145 patients without the questionnaire from Nov-23 to ultimo Dec-24. Examination comments and final interpretations were reviewed for comments about medication. Technologist experienced in patient preparation with [18F]FE-PE2I PET, were asked to fill out a questionnaire regarding minutes spent on asking for relevant medication and how the workload was experienced. Reading physicians were also asked to fill out another questionnaire. ***Results:*** In patient group A, 16% (23/145) had an examination comment regarding relevant medicine. Of these, 43% (10/23) of the comments were used in the final interpretation conclusion. Thus, 7% (10/145) of patients in group A had an examination comment that was included in the final interpretation. In patient group B 1,4 % (2/145) of the patients had included comments about relevant medicine that could influence the interpretation in the conclusion. 80% (4/5) of the reading physicians thought it was helpful when comments of relevant medicine were added to the examination description. 15% (2/13) of the technologists found the questionnaire difficult. 38 % (5/13) spend < 1 min, 38% (5/13) spend 1-2 min, 15 % (2/13) spend 2-5 min and 8 % (1/13) spend > 5 min. ***Conclusion:*** The new questionnaire is helpful with acceptable consumption of time. The number of final interpretations taking medication into account increased from 1.4% to 7% after implementation of a new questionnaire for medication during patient preparation. Further, 80% of reading physicians found the questionnaire helpful. The median technologist time spend on the questionnaire was 1-2 min, although 15% found the questionnaire difficult and spend >2 min. ***References:*** *Justesen et al. (2023) EJNMMIres 13:46.

EP-1268

Comparison of quantification methods in dopamine transporter SPECT

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Aim/Introduction: Dopamine transporter (DAT) single-photon emission computed tomography (SPECT) is an important tool in the early diagnosis of Parkinson's disease (PD). Normal DAT SPECT results rule out presynaptic striatal dopaminergic insufficiency. Inter-software and interoperator variability in measurements may impede accurate diagnosis, especially when the measured values are close to the cut-off point. The objective of the present study was to compare the quantification methods of two different software packages that are clinically used in DAT SPECT quantification. ***Materials and Methods:*** DAT SPECT datasets of patients referred from November 2023 until March 2024 were semi-quantitively analyzed using the Neurology module of Symbia.

NET and the newer MI Neurology application in Syngo.via. Left and right striatal-to-occipital ratios of all patients were measured by two experienced nuclear medicine technologists (HTC and KH), expressed as mean ± standard deviation, and evaluated by paired-tests. Interoperator variability between both technicians was assessed for both quantification methods using the Pearson correlation test. P-values ≤0.05 were considered significant. ***Results:*** DAT SPECT datasets of 50 patients (female n=31(62%) and male n=19(38%); mean age 70±8 years) were included in this study. The mean±SD of the striatal/occipital ratios were 2.6±0.55 for ratios obtained from the Symbia.NET software but 2.8±0.54 for the ratio's produced by syngo.via (p <0.001). Correlation between both reading technologists was r =0.945 for the Symbia.NET module, and r =0.990 for the Syngo.via application (p <0.001). ***Conclusion:*** Syngo.via's MI Neurology application produces slightly, but significantly higher striatal-to-occipital ratios in DAT SPECT datasets, compared to the older Neurology module of Symbia.NET. Interoperator variability proved to be low for both software packages, given the very high correlation between measurements of both reading technologists. ***References:*** Akdemir ÜÖ, Bora Tokçaer A, Atay LÖ. Dopamine transporter SPECT imaging in Parkinson's disease and parkinsonian disorders. Turk J Med Sci. 2021 Apr 30;51(2):400-410. doi: 10.3906/sag-2008-253. PMID: 33237660; PMCID: PMC8203173.

EP-1269

Evaluating Diagnostic and Quantitative Outcomes of Thyroid Scintigraphy With a Reduced Post-Injection Time

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Aim/Introduction: The EANM Guidelines for thyroid scintigraphy recommends acquisitions 15-20 min post [99mTc]-pertechnetate injection due to optimal activity uptake and the reported wash-out effect that occurs 20 min post-injection. As the mean time from injection to acquisition at the current department is 30 min, the aim of this study was to evaluate an early acquisition compared to the standard, both in regards to diagnostic and quantitative outcomes. ***Materials and Methods:*** A patient dose of 170 MBq ± 10% [99mTc)-pertechnetate was injected and static acquisitions were acquired on a gamma camera with pinhole collimator. Identical acquisitions consisting of an overview image of 5 minutes and a zoom image of 10 minutes/200 kilo-counts, were performed 5 and 25 minutes post-injection. Three nuclear physicians examined all images in regards to diagnostic value, to determine whether the same conclusion could be obtained from both images. To eliminate interpretation bias, images were blinded in regards to time from injection to acquisition, prior to evaluation by the observers. To obtain qualitative measurements, images were analyzed by inserting ROI's in the thyroid gland and the background, after which the contrast-to-noise ratios (CNR) were calculated. To determine potential significant differences between the early and late acquisitions, a Student's t-test was applied. ***Results:*** Forty-five patients were included in the study, and the observers were able to conclude identical diagnostic outcome regardless of time from injection in 40 patients (88.9%). The diagnostic outcome was uncertain/different for five patients, however there was not consensus among the three observers. It is noticeable that the observer, who categorized all patients with the same diagnosis, was the most experienced. The mean activity uptake in the images was slightly higher 25 minutes post-injection (31.4) compared to the uptake 5 minutes post-injection (30.0), however this difference was statistically significant (p=0.00024). The CNR might be more valuable for the diagnostic outcome than activity uptake, and no significant differences were determined between the images 5 and 25 minutes post-injection, with CNR's of 12.6 and 13.7, respectively. ***Conclusion:*** The vast majority of patients received the same diagnostic outcome regardless of time from injection to acquisition. No patients were categorized with different diagnostic outcome by all nuclear physicians, suggesting interpreter variability. While performing early thyroid scintigraphy results in a significant reduced activity uptake in the thyroid gland, it does not lead to a significant lower CNR when compared to later acquisitions, which is more valuable for accurate diagnosis.

EP-1270

Assessment of correlation between 2-hour radioactive iodine uptake and ^{99m}Tc-pertechnetate uptake on thyroid scintigraphy in patients with thyrotoxicosis

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Aim/Introduction: The thyroid uptake is an important factor in the diagnosis of thyrotoxicosis. The thyroid uptake is determined by using 123Iodine and 99mTechnetium radioisotopes, with 131Iodine being used where 123Iodine is not available. Studies assessing correlation between 99mTc -Pertechnetate and 2hr 131Iodine RAIU values are scarce. Since many centers in our country do only 99mTc -Pertechnetate uptake due to its easy availability, cost effectiveness and no requirement of thyroid uptake probe, it would be useful to establish this relation. ***Materials and Methods:*** Thirty adult patients (mean age = 40.5 ± 14 years) with diffuse toxic goiter were intravenously administered 3-5 mCi 99mTc pertechnetate through cannula. The static images (anterior view) of the loaded syringe, empty syringe, thyroid gland and cannula was taken under a Gamma camera (GE Healthcare, Brivo NM 615). The 99mTc pertechnetate thyroid uptake was calculated by drawing a region of interest around the loaded syringe, empty syringe, cannula and thyroid image of the patient to know the counts in them. The percentage uptake was obtained by dividing the thyroid counts by syringe counts with background counts correction. The same patients were administered 10 to 20 µCi 131I orally. The radioactive iodine uptake was determined by using a thyroid uptake probe and was calculated by taking background corrected neck counts divided by reference dose counts in thyroid neck phantom. The percentage thyroid uptake by both the radioisotopes (99mTc-pertechnetate and 131I) was correlated. ***Results:*** The median (IQR) 99mTc-pertechnetate uptake and 2hr radioactive iodine uptake was found to be 10.4 (6 - 24) % and 25.6 (13.6- 57.9) %, respectively. The median uptake percentage of RAIU was approximately 2.4 times of 99mTc-pertechnetate uptake. The result indicated a positive coefficient of correlation (0.917) between 2hr RAIU and 99mTc-pertechnetate uptake (p value <0.001). A positive correlation between 99mTc-pertechnetate uptake % and RAIU % with T3 and T4 was also observed. Moreover, the results also indicated a possible association of goiter grades with the uptake percentage of RAIU and 99mTc-pertechnetate. ***Conclusion:*** The simplicity and reproducibility of 99mTc-pertechnetate % uptake with no requirement of Uptake probe make 99mTc-pertechnetate uptake a viable option in patients with Diffuse Toxic Goiter.

EP-1272

Evaluation of ^{99m}Tc-DMSA administered activities in paediatric patients

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Aim/Introduction: Balancing image quality with radiation dose is a goal with every diagnostic procedure requiring radiation, especially in paediatric population. Children have a greater risk to experiencing undesirable health effects from exposure to radiation than adults. Our institution evaluated the dosing of 99mTc-DMSA (dimercaptosuccinic acid) for paediatric patients, comparing prescribed activities with administered activities to evaluate compliance with our local Diagnostic Reference Levels (DRLs) based on the figures given in the ARSAC Guidance Notes 2022. ***Materials and Methods:*** Data was collected for all patients younger than 17 years receiving a Renal Nuclear Medicine procedure with 99mTc-DMSA between February 2024 and September 2024. Data collected included age, weight, prescribed activity, assayed activity, and residual syringe activity. For paediatric patients, prescribed activity is calculated based on weight. 99mTc-DMSA syringe was assayed before and after administration, and the residual was recorded to calculate syringe adsorption and administered activity. Administered activity should be +/- 10% of the prescribed activity. ***Results:*** The mean activity remaining in the syringe after administration was 24%, with a range of 11%-50%. No correlation was found between time in syringe and residue. 99mTc-DMSA is more adsorbed in 3ml syringes than in 1ml syringes, with an average of 43% and 20% of activity adsorbed respectively. On average 73% of prescribed activity was administered with only one patient received less than 50% of prescribed activity. No patient was overdosed. (Study still on-going. Further results will be added at later date). ***Conclusion:*** All administered activities failed to comply with our local DRLs (+/- 10% of the prescribed activity). The activity administered was significantly affected by the amount of residue left in the syringe. This data can provide clinicians with greater guidance in dosing 99mTc-DMSA in paediatric patients. Syringe residue needs to be considered when standardizing protocols and calculating patient dose. The inclusion of residual activity during patient dose calculations or the use of a system that eliminates the activity lost needs further investigation.

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EP-1273

Analysis of outcomes of peptide receptor radionuclide therapy as a third line therapy in patients with advanced neuroendocrine tumors

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Aim/Introduction: Surgical treatment of neuroendocrine neoplasms (NEN) is primary whenever possible, followed by the use of somatostatin analogs, chemotherapy, immunotherapy, mTOR inhibitors, and radiation therapy in treatment. Peptide receptor radionuclide therapy (PRRT) represents one of the modalities in the treatment of these tumors, especially for well-differentiated neuroendocrine tumors. The aim of this study is to present the outcome of advanced NEN treatment as well as to demonstrate the response to treatment and survival of patients with G2 NEN treated with peptide receptor radionuclide therapy. ***Materials and Methods:*** The study included 34 patients who were treated with PRRT in accordance with a standard procedure involving the administration of labeled Y90 and/or Lu177 peptides, as the third line of treatment after surgery and other therapeutic modalities. PRRT was the first treatment option for only one patient due to an inoperable tumor of large dimensions. There were a total of 15 women with an average age of 64.8 ± 10 years and 19 men with an average age of 63.1 ± 11.4 years. Regarding localization, there were 25 patients with gastroenteropancreatic tumor (GEP-NET), among which 20 patients were of G2 grade, one of G3 grade, and 4 of G1 grade. Among 3 patients with pulmonary NET, two were of G2 grade and one of G1 grade. Among 5 patients with tumors of unknown primary localization, 4 were of G2 grade and 1 of G1 grade, while the patient with paraganglioma had a G2 grade tumor. Twenty-six patients received one cycle of PRRT, while 8 received repeated cycles of PRRT. ***Results:*** Twenty-six patients received only 1 cycle of PRRT, while 8 received repeated cycles of PRRT. Patients were followed up for 48 months after the last PRRT, and longer in patients who received repeated cycles of PRRT. The time to disease progression was 26.0 ± 15.6 months, while overall survival was 44.6 ± 21.2 months. In patients who received repeated cycles of PRRT, survival was significantly longer (57.8 ± 33.1 months) compared to those who received only one cycle, with 40.6 ± 14.6 months ($p < 0.05$). Leukopenia occurred in two subjects during and after therapy, and renal function impairment occurred in one subject. ***Conclusion:*** Peptide receptor radionuclide therapy is a powerful therapeutic tool in the complex treatment of patients with NET, showing significant slowing of disease progression and contributing to longer patient survival. Repeated cycles further extend patient life.

EP-1274

Evaluation of voxel-based absorbed doses calculated using SPECT imaging in iodine-131 therapy for hyperthyroidism

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Aim/Introduction: In Iodine-131 therapy for hyperthyroidism, pretreatment evaluations of the thyroid mass, radioiodine uptake (RIU), and effective half-life (EHL) are used to estimate the absorbed doses and determine the required radioactivity for administration. These estimates assume a homogeneous distribution of I-131 within the thyroid gland; however, its accumulation is often heterogeneous. This is particularly evident in Plummer's disease, in which I-131 uptake is intensive only in autonomous nodules, leading to heterogeneous I-131 distribution within the thyroid. Such heterogeneity in absorbed doses can result in either excessive or insufficient radiation in parts of the thyroid gland, potentially affecting treatment outcomes. In this study, we aimed to assess the heterogeneous distribution of absorbed doses within the thyroid during I-131 therapy and compared the dose distributions in Plummer's disease and Graves' disease. ***Materials and Methods:*** We included 15 patients with Plummer's disease

and 35 with Graves' disease. Single-photon emission computed tomography (SPECT) images were captured on days one and seven after I-131 administration to calculate the 24-h RIU and EHL for each voxel. Prior to the dose calculations, a phantom filled with iodine-131 (78 MBq) was used to compute the cross-calibration factor (CCF). The RIU (24 h) was calculated by converting voxel counts into radioactivity based on SPECT images captured 24 h after administration using CCF and dividing by the administered radioactivity. The EHL per voxel was derived by approximating the voxel-based RIU from the SPECT images on days one and seven through exponential fitting. Based on this data, voxel-based absorbed doses were calculated using the Medical Internal Radiation Dose (MIRD) method. Average absorbed doses, standard deviations, and coefficients of variation were calculated for each patient. ***Results:*** In patients with Graves' disease, the EHL per voxel was almost uniform. Similarly, the absorbed doses were visually uniform with a coefficient of variation within 40%. Conversely, in patients with Plummer's disease, the EHL was shorter in the autonomous nodular areas and exhibited an overall heterogeneous distribution. The absorbed dose variability was more pronounced, with some cases showing a coefficient of variation over 50%. ***Conclusion:*** The method of calculating voxel-based absorbed doses from SPECT images post-I-131 administration was proven effective for evaluating thyroid dose distributions in both Plummer's and Graves' disease. Particularly in Plummer's disease, the significant variability in thyroid-absorbed doses underscores the importance of considering the heterogeneous uptake of I-131 when assessing dosimetry.

EP-1275

Management of Pregnancy in Metastatic Differentiated Thyroid Cancer

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Aim/Introduction: Differentiated Thyroid Cancer (DTC) is more common in young women during their reproductive period. Management of DTC during pregnancy is the same as non-pregnancy except for the use of radioactive iodine which is an absolute contraindication, and this can be extremely difficult when we are facing pregnant metastatic patient with active DTC. The aim of this study is to manage and support women with metastatic DTC and to see the impact of pregnancy on the disease. ***Materials and Methods:*** This study was conducted at the Nuclear Medicine department of Bab El Oued University Hospital, Algiers. Pregnant metastatic DTC women were managed and seen at least 4 times. All the data were reported including biological profile under Levothyroxine (LT4) treatment, TSH, FT4 and Thyroglobulin (Tg), and neck ultrasonography, also the morphogram of the fetus on obstetric ultrasound. After delivery, the same biological profile under LT4, neck ultrasound and more radiological exams are performed, we also looked at the childbirth. ***Results:*** 10 pregnant women with metastatic Papillary Thyroid Cancer (mean age 32 years). 9 lung and node metastases and for one patient an association of bone and lung metastasis. We kept a low TSH level inferior to 0,1 µUI/ml for all patients. All the birth went well except for one death in utero, due to toxemia gravidarum. We reported no progression of the disease during pregnancy and after delivery. And we continue to treat with iodine 131 after birth. ***Conclusion:*** Management and monitoring metastatic Differentiated Thyroid Cancer during pregnancy is a difficult situation that must be based on a suppressive treatment with Levothyroxine until using radio iodine 131 after delivery. We noticed no impact of pregnancy on the progression of the disease.

EP-1276

Enhancing the accuracy of vertebral bone metastasis detection in non-small cell lung cancer with high-resolution xSPECT/CT imaging

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Aim/Introduction: Traditional bone scintigraphy, while widely used, lacks specificity and could result in false-positive results, particularly in the context of benign spinal lesions such as osteoarthritis [1]. The high resolution xSPECT/CT bone imaging can enhance image quality and without any additional increase in radiation dose [2]. However, xSPECT/CT bone imaging for vertebral bone metastasis of non-small cell lung cancer(NSCLC) have not been well studied. This study was conducted to evaluate the effectiveness of xSPECT/CT in the prompt and precise identification of vertebral bone metastases in patients diagnosed with NSCLC. ***Materials and Methods:*** A prospective trial enrolled 22 patients with NSCLC and concurrent vertebral bone metastases, as well as 20 patients with non-neoplastic spinal osteoarthritis as a control group. The study was approved by the local IRB, and written informed consent was obtained from all subjects. Quantitative analysis was performed to calculate the SUVmax, SUVavg, and SUVmin in all cases of vertebral bone metastases in the NSCLC group and for the control group's spinal osteoarthritic changes. Receiver Operating Characteristic (ROC) curves were utilized to determine the optimal SUV cutoff values for distinguishing between vertebral bone metastases and benign spinal lesions. ***Results:*** The analysis included 33 NSCLC vertebral bone metastases, which exhibited a mean SUVmax, SUVavg, and SUVmin of 30.85±13.64, 10.37±5.96, and 5.44±4.36, respectively. For the control group 58 spinal osteoarthritic lesions, the mean SUVmax, SUVavg, and SUVmean were 14.34±5.96, 5.91±2.12, and 3.20±1.8, respectively. Significant differences were observed in SUVmax, SUVavg, and SUVmin between the metastatic and osteoarthritic groups ($p \leq 0.001$). With a SUVmax cutoff of 18.23 for NSCLC vertebral bone metastases, sensitivity and specificity predictive values were 94% and 81%, respectively. ***Conclusion:*** The results of this study demonstrate that xSPECT/CT scans can aid in distinguishing malignant from benign spinal lesions more reliably, enhancing the diagnostic performance of bone scintigraphy. This approach shows promise in improving the accuracy of detecting vertebral bone metastases in NSCLC patients, potentially leading to better clinical management and improved patient outcomes. ***References:*** 1. Palmedo, H., Marx, C., Ebert, A., et al. Whole-body SPECT/CT for bone scintigraphy: diagnostic value and effect on patient management in oncological patients. European Journal of Nuclear Medicine and Molecular Imaging. 2014; 41:59-67. 2. Miyaji N, Miwa K, Tokiwa A, et al. Phantom and clinical evaluation of bone SPECT/CT image reconstruction with xSPECT algorithm. EJNMMI Res. 2020; 10(1):71.

EP-1277

The Step-and-Shoot Continuous Mode Improves SPECT Scanning Efficiency:A Preliminary Phantom and Clinical Test

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Aim/Introduction: The aim of the study was to investigate the value of Step-and-Shoot Continuous (SSC) scanning mode in enhancing image quality, and to explore the appropriate scanning parameters in reducing the scan time. ***Materials and Methods:***

This study was composed of a phantom study and two clinical tests. The differences in the visual score of image quality, in the Coefficient of Variance (COV) of the background, in the image Signal-to-Noise Ratio (SNR) and Contrast-to-Noise Ratio (CNR), and in the Recovery Coefficient (RC) of the sphere in different "shoot" acquisition times (5s/10s/15s) and "step" (3-degree/6-degree/9-degree) were compared between SSC mode and conventional SS (Step-and-Shoot) mode in the phantom study. The differences in the visual score of image quality, in the COV of the background, in the image SNR and CNR, and in the Standard Uptake Value (SUV) of lesions were compared correspondingly in a bone scan test and a parathyroid scan test, with 15 patients enrolled in each of them. ***Results:*** In the phantom study, the visual score of SSC mode was higher than that of SS mode; the COV of the background of SSC mode reduced significantly ($P<0.05$); the SNR and CNR of SSC mode increased significantly ($P<0.05$); while no significant alteration of RC was found ($P>0.05$). In the clinical tests, there were not significant differences between the optimal SSC scan combination (10-second "shoot" and 6-degree "step") and the traditional SS scan combination (15-second "shoot" and 6-degree "step") in the visual score of image quality, in the COV of the background, in image SNR and CNR, and in the SUV of bone and parathyroid high uptake lesions ($P > 0.05$). ***Conclusion:*** The acquisition time of SSC mode can be of 33% reduced, while keeping the similar image quality and quantification accuracy compared to those of the SS mode. An SSC scanning with 10-second "shoot" acquisition and 6-degree "step" of a 360-degree rotation is suggested clinically.

EP-1278

Low energy all-purpose collimator provides superior image quality to low energy high-resolution, for imaging cold defects of sizes seen in lung ventilation/perfusion SPECT

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Aim/Introduction: Diagnosis of pulmonary emboli with lung ventilation/perfusion SPECT involves fast acquisitions for identification of defects typically ≥20mm diameter. Low energy high resolution (LEHR) and low energy all purpose (LEAP) collimators allow scans to be optimised for high resolution or high sensitivity (low noise). The aim was to determine which collimator provides the best image quality for detecting cold defects, corresponding to optimal detection of pulmonary emboli in clinical practice. ***Materials and Methods:*** The NEMA-IEC PET Body-Phantom background was filled with 111MBq Tc-99m-pertechnetate and water solution. The spheres were filled with inactive water providing cold volumes, representing lung perfusion defects. Six consecutive step-and-shoot SPECT-CT acquisitions were made with both LEAP and LEHR collimators, with a dual-headed SPECT-CT system at 5, 10 and 20 minutes sampling time. Acquisition times were decay-corrected for comparable acquisition time for LEAP and LEHR scans. Reconstructions were made with ordered subset expectation maximisation and resolution recovery, with CT-based attenuation correction. Volumes of interest were assigned to the 4 largest spheres (17-37mm) on the CT images (corresponding to real physical sphere size) and copied to the SPECT reconstructions. The 10-13mm spheres being smaller than defect sizes of clinical interest were omitted from analysis. Contrast-to-noise-ratio (CNR) was calculated for each sphere: [(mean background counts/mean sphere counts)/(standard deviation of background/mean background counts)]. CNR was compared between LEAP and LEHR collimators for each sphere at each scan time. ***Results:*** For both collimators, CNR increased with increasing scan time and increasing sphere size, due to reduction in noise and partial volume effect, respectively. When comparing collimator for a given sphere size and scan time, CNR was consistently higher for the LEAP as compared with LEHR, with CNR values at: 14.4-17.1, 17.2-20.7 and 24.0-31.5 for the LEAP collimator for 5, 10 and 20 min scans respectively; and 10.7-12.7, 12.4-15.6 and 16.6-22.9 for the LEHR collimator. These data demonstrate 33-45% increase in CNR depending on sphere size and scan time for the LEAP as compared with LEHR collimator. ***Conclusion:*** These findings indicate that the LEAP collimator is more suitable than the LEHR, for SPECT imaging of relatively large, cold defects. Hence, we can infer that general purpose (LEAP) collimators are more appropriate than high resolution (LEHR) for lung ventilation/perfusion imaging, allowing improved image quality for the same scan time, or reduced scan time for comparable image quality. These data also demonstrate the importance of optimising collimator choice according to scan type.

EP-1279

Towards Whole Body imaging-Institutional experience

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Aim/Introduction: Conventional nuclear medicine has been upgraded with the introduction of the hybrid Single Photon Emission Tomography (SPECT) with Computed Tomography (CT). This new modality significantly increased sensitivity and specificity of the scintigraphy procedures. After new detector systems have been created, focus of the clinical research is on advanced software solutions. All major nuclear medicine equipment producers offer new acquisition and reconstruction modalities such as resolution recovery (RR) algorithms with focus on dose/time reduction. Since major disadvantage of the conventional SPECT is long acquisition duration these new solutions offer same image quality with reduced scanning time. Fery fast SPECT acquisition can eliminate patient discomfort and incidence of the artifacts created with patient movement during very long scanning procedure. Fast SPECT acquisition offers possibility to create SPECT sequence of more than one anatomical region which then can be implemented in Whole Body (WB) SPECT/CT. WB SPECT/CT potential is well documented for bone, parathyroid, Somatostatin Receptor Scintigraphy (SSRS) and I-131 scintigraphy. ***Materials and Methods:*** We performed prospective study for 100 patients who underwent planar WB bone scintigraphy. After planar imaging, we performed SPECT/CT acquisition with conventional and ultra-fast scan duration. For the process of reconstruction of tomographic images, we used classic and specific (with RR algorithm) program. For the image quality we measured noise index, Signal to Noise Ratio (SNR) and Contrast to Noise Ratio (CNR). Two experienced nuclear medicine specialists evaluated image sharpness, lesion detection and lesion background ratio. ***Results:*** Conventional SPECT acquisition with standard reconstruction protocol offers good image quality while RR reconstruction protocol results in better image quality. Ultra-fast scanning acquisition with standard reconstruction algorithm results in poor image quality, while RR reconstruction protocol offers the same image quality as the one obtained during conventional acquisition. Subjective image quality assessment performed by physicians confirmed these

findings since lesion detection and demarcation can be preserved. Use of RR reconstruction protocol results in high sensitivity and specificity for ultra-fast SPECT acquisition. ***Conclusion:*** Ultra-fast SPECT acquisition can be utilized in the WB SPECT/CT not just for bone scintigraphy. New studies suggest WB SPECT/CT procedure has potential for detection of ectopic parathyroid tissue and thyroid cancer metastases. Furthermore, 2-3 Field of View (FOV) WB SPECT/CT has become a standard imaging technique in SSRS scintigraphy. Our clinical study has been performed for bone scintigraphy only, but new research suggests every other SPECT/CT protocol can be optimised for future WB SPECT/CT purpose.

EP-1280

Optimizing reconstruction updates in SPECT imaging enhances visualization of cold defects relevant for pulmonary emboli detection

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Aim/Introduction: To diagnose pulmonary emboli with lung ventilation/perfusion SPECT, the detection of cold defects is crucial. Iterative reconstruction methods enhance image quality to improve the detection of cold defects, compared with filtered back projection. In the 2009 EANM-guideline, 16 updates were recommended, and in the 2019-version, 32 updates were recommended, without a clear justification. The aim was to determine the optimal number of updates for reconstructing lung SPECT, according to qualitative and quantitative measures. ***Materials and Methods:*** Cold defects were provided using the NEMA body phantom, with a background of 111 MBq Tc-99m pertechnetate and spheres filled with inactive water. Step-and-shoot SPECT acquisitions were performed using a low-energy all-purpose collimator at 5, 10, and 20 minutes sampling times, all decay-corrected. Images were reconstructed with 16, 30, and 60 updates with CT attenuation correction. The four largest spheres (17, 22, 28, and 37mm) were used for contrast-to-noise ratio (CNR) calculation. A simple Visual Grading Analysis (VGA) was conducted using one physician as observer. Visualization of each sphere size was graded -2 to 2, resembling "Clearly inferior" to "Clearly superior" to the reference, respectively. Grade 0 representing "Equal to the reference". VGA reference was 30 updates. Visual evaluation was done with a white-on-black color scale. ***Results:*** CNR increased notably with a lower number of updates and larger sphere sizes. Comparison of CNR values for 16, 30, and 60 updates at 5, 10, and 20-minute sampling times, with sphere sizes ranging from 17 to 37mm, revealed the highest CNR at 16 updates (28.17-32.6, 41.1-48.4, and 57.7-70.8) compared to 30 (20.3-24.2, 28.5-34.8, and 40.6-52.3) and 60 (13.9-17.9, 20.8-26.7, and 28.3-39.7). VGA showed 60 updates to be comparable or superior to 30 and 16 updates at each scan time. At larger sphere sizes (28 and 37mm) and most relevant for pulmonary emboli detection, 30 and 60 updates were comparable, with 16 updates being inferior. At smaller sphere sizes (17 and 22mm) less relevant for detecting emboli, 60 updates were superior to both 30 and 16 updates. ***Conclusion:*** For optimal CNR, 16 updates are preferable, but 30 and 60 updates are preferred visually, with optimal visualization provided by an even greater number of updates than those recommended in the latest EANM guidelines . This discordance between CNR, visual-evaluation, and guideline, combined with only one observer in this study, suggests a need to further investigate and document the optimal settings for lung ventilation/perfusion SPECT.

EP-1281

A Comparison of Image Quality and Scan Speed between Digital and Non-Digital ^{18}F-FDG PET-CT for a Weight Based Activity

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Aim/Introduction: This study used signal to noise ratio (SNR) to evaluate image quality following install of a digital PET scanner. 235 patients received a whole body 18F-FDG PET-CT scan on a digital PET using flow motion (A) (n=136) or pre-existing non-digital PET scanner using "step and shoot" (B) with regularised iterative reconstruction (n=101). Scan time, patient positioning and patient weight were investigated as contributing variables. ***Materials and Methods:*** A target activity of 4 MBq/kg of 18F-FDG (+/- 10%) was set as per local guidelines. Two scan speeds were used on scanner A (1 mm/second and 1.5 mm/second) and a bed duration of 3 minutes per bed on scanner B. Automated placement of a 3cm diameter ROI in the liver helped with standardisation, though region was moved if necessary - patients with extensive liver disease or where large respiratory artefacts were present were excluded. SNR was calculated as mean counts in ROI divided by standard deviation. SNR versus scan time, arm position and weight were compared. ***Results:*** For a bed speed of 1 mm/s, scanner A had similar SNR (p= not significant) to scanner B at 3 minutes per bed: however, scan time is significantly shorter at an average of 15 mins compared to 22 minutes ($p< 0.0001$). For scanner A, the SNR was significantly lower for 1.5 mm/sec compared to 1 mm/sec ($p< 0.0001$) - images were visually assessed by radiologists as maintaining sufficient image quality (this became standard protocol and reduced overall scan time from an average of 15 minutes to 9.8 minutes). Patient positioning (arms up/down) had no significant effect on SNR for either scanner or at different speeds. 95% patients were administered with target activity of 4 MBq/kg (+/- 10%). The 4 MBq/kg weight-based protocol was introduced to help equalise SNR across the patient weight range, however this project shows it working for scanner B, but not scanner A (significant downward trend on SNR with increasing weight). ***Conclusion:*** Scanner A shows similar image quality as scanner B for a reduced average scan time (15 versus 22 minutes). Scan time can be reduced further to 9.8 minutes on scanner A while maintaining clinically suitable image quality. The department prioritised acceptable image quality with reduced scan time for operational reasons. Further research will be conducted on whether an adjustment of weight-based activity or adjusting scan speed for heavier patients on the digital scanner will equalise the SNR.

EP-1282

Can Deep Learning Reconstruction Enable Low-Dose ^{18}F-FDG PET Imaging?: A Validation Using Clinical Data

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Aim/Introduction: The advanced intelligent clear-IQ engine-integrated (AiCE), a deep learning reconstruction (DLR) technology, effectively reduces noise without compromising contrast, thereby improving image quality despite lower fluorine-18 fluorodeoxyglucose (18F-FDG) doses compared with conventional methods. This study aimed to evaluate the association of AiCE with the image quality and quantification of low-dose positron emission tomography (PET) images using clinical data as well as verify the practicality of low-dose PET examinations. ***Materials and Methods:*** Cartesion Prime (Canon

Medical Systems, Otawara, Japan), a SiPM-PET/CT, was used to conduct abdominal imaging, including the liver, with 2-3 min of list-mode acquisition for each case. The participants consisted of 51 cases in the low-dose group (LD, ≤2.5 MBq/kg) and the standard-dose group (SD, 3.7 MBq/kg). Image reconstruction was conducted using 3D-OSEM + TOF + PSF, 4 mm Gaussian filter (GF), and AiCE. The evaluation was conducted based on the liver signal-to-noise ratio (SNR) and liver SUV (max, mean). ***Results:*** The median liver SNR for GF and AiCE was 8.8 and 16.3 in the LD group and 10.1 and 16.3 in the SD group, respectively. Additionally, the median liver SUV (max, mean) was 3.7, 2.6 for GF and 3.2, 2.6 for AiCE in the LD group, whereas 3.5, 2.7 for GF and 3.4, 2.7 or AiCE in the SD group. ***Conclusion:*** Even with low 18F-FDG doses, DLR technology demonstrated equivalent liver SNR to standard-dose PET images compared with conventional image reconstruction methods. Additionally, this technology obtained stable quantitative values compared with conventional reconstruction methods, indicating improved image quality and quantitative accuracy of low-dose PET images, thereby demonstrating the feasibility of low-dose PET examinations. ***References:*** 1) Tsuchiya J, Yokoyama K, Yamagiwa K, et al. Deep learning-based image quality improvement of ^{18}F-fluorodeoxyglucose positron emission tomography: a retrospective observational study. EJNMMI Phys. 2021 Mar 25;8(1):31.2) Yamagiwa K, Tsuchiya J, Yokoyama K, et al. Enhancement of ^{18}F-Fluorodeoxyglucose PET Image Quality by Deep-Learning-Based Image Reconstruction Using Advanced Intelligent Clear-IQ Engine in Semiconductor-Based PET/CT Scanners. Diagnostics (Basel). 2022 Oct 15;12(10):2500.3) Mori M, Fujioka T, Hara M, et al. Deep Learning-Based Image Quality Improvement in Digital Positron Emission Tomography for Breast Cancer. Diagnostics (Basel). 2023 Feb 20;13(4):794.

EP-1283

Accuracy of hybrid PET-MRI combined with whole body PSMA PET-MRI in diagnosing prostate cancer recurrence: New horizon and future perspectives

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Aim/Introduction: Prostate cancer (PCa) shows the second highest incidence of all cancers among the male population worldwide. Despite increasing therapeutic options, early diagnosis is crucial for a favorable prognosis. In the past decade, several tests contributed to the early diagnosis, such as the measurement of Prostate Specific Antigen (PSA). MRI sequences represent the gold standard examinations for the definition of PCa morphology, while PET acquisitions are essential for its staging. This study aims to develop a hybrid PET-MRI protocol in order to obtain the simultaneous morphological and stage imaging of a biochemical recurrence after radical prostatectomy. ***Materials and Methods:*** We conducted a retrospective evaluation of patients with suspected biochemical relapse using a Hybrid 3T PET/MRI system, using homemade Fluorine18 coupled with PSMA as a tracer. Every patient who underwent Total Body PET/MRI acquisition and PET-MRI High Statistic-Fluoro-PSMA couch, combined with prostate-specific MRI sequences such as T1, T2 weighted sequences, DWI with b-value 50/800/1400/1600 and synthetic reconstruction value of 2000 with related ADC map. ***Results:*** ^{18}F-PSMA-1007 PET/MRI imaging appears very promising in staging and restaging patients with PCa, especially when biochemical relapse is under consideration. Currently available ^{18}F-labeled PSMA agents provide a more accurate and earlier detection of prostate disease than conventional imaging. Labeling PSMA agents as ^{18}F has several advantages over 68Ga. Studies has shown an overexpression of PSMA in PCa tissue compared with normal tissue, which increased even further at advanced stage and grade of PCa. PET/MRI acquisition is quite sensitive for detecting bony metastases, but its specificity is lacking as both neoplastic and inflammatory causes of MRI signal abnormality exist. Normal bone marrow signal intensity is homogeneous, whereas early bone metastases disrupt this normal signal, creating heterogeneity within the marrow space. Diffusion-weighted and dynamic contrast- enhanced (DCE) MRI have potential to furnish biological characterization of tumor aggressiveness in PCa patients. ***Conclusion:*** This study demonstrated a potential quality improvement over conventional imaging. The combination of high- resolution prostate PET/MRI associated with PET/MRI Total Body, serving as the reference modality for local tumor assessment and biochemical recurrence, along with ^{18}F-PSMA-1007-PET for staging presents a very promising diagnostic approach. Using both techniques: PET/MRI for Total Body acquisition and PET/MRI for prostate couch significantly reduces the time required for the entire protocol, completing two specific exams in the duration of one, unlike other studies that last more than one.

EP-1284

Ventilation Simulation: An effective technique to assess gas flow

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Aim/Introduction: Ventilation agents are used for lung VQs and various manufacturers produce these agents using different equipment. Recently, our [99mTc]-ventilation machine failed and an engineer was unable to attend for over a week; limiting our options for lung VQs, a high-priority procedure. Despite the patient breathing well, the ventilation machine did not deliver the radiopharmaceutical. With a second attempt using a new kit and burn, the issue persisted due to a faulty battery. To maintain the clinical service, [81mKr]-ventilation agent was ordered but the quality control failed, leaving us without ventilation agent. To address the issue, the engineer sent a battery with replacement instructions. We enquired about testing the machine following repair but there was no formal test to confirm the ventilation agent was being delivered before use with a patient. ***Materials and Methods:*** To ensure that the ventilation machine was working properly, we had to simulate patient's breathing in a contained manner to avoid unnecessary radiation exposure. We required an instrument that would extract air out of the ventilation - we utilised a balloon pump. A ventilation kit was attached to the ventilation machine and the mouthpiece attached to a balloon pump set to extract air. The balloon pump was placed into a bag and the opening of the bag was zip-tied to ensure a tight seal. The filter on the kit would prevent any ventilation agent from being pushed back out and by confining the balloon pump to an airtight bag, we could ensure no radiopharmaceutical would escape into the background. ***Results:*** We successfully built a breathing simulation instrument and tested it on our gamma camera; we burned the [99mTc]-ventilation agent and placed our instrument on the bed. The balloon pump simulated breathing while the gas was being delivered. We started with one breath to check for leaks, then gradually increased the breaths to check if the counts were increasing. After acquiring a few breaths, we

left the instrument under the camera to investigate any leaks. We found that there were no leaks and that the ventilation agent was contained within the instrument. ***Conclusion:*** This instrument was developed due to issues with availability of ventilation agents for lung VQs while waiting for an engineer visit. The instrument we developed was successful at simulating ventilation before using the [99mTc]-ventilation machine on a patient and was used to confirm the counts increased as expected.

EP-1285

Evaluation of Deviceless AI Gating System in PET-CT

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Aim/Introduction: This study evaluates the efficacy of Siemens' deviceless AI respiratory gating system in PET scanners, focusing on its precision in tracking respiratory motion and its potential impact on improving PET image quality ***Materials and Methods:*** A CIRS programmable phantom motor emulating respiratory movements and a phantom plate with NEMA IEC spheres were utilized. The spheres were filled with a ^{18}F-FDG solution at a concentration of approximately 20 kBq/mL, precisely meeting the requirements for the image quality test for EARL accreditation. Imaging was performed while the spheres were affixed to the moving motor, with assessments of the gating system's effectiveness conducted through image reconstruction with and without the AI algorithm provided by a Siemens Biograph Vision Edge 600 PET/CT scanner ***Results:*** The analysis focused on the largest sphere (37 mm)to avoid partial volume effects. The image quality showed a marked improvement when using the AI-based gating algorithm. In the static condition, the RC for this sphere was 0.95. For dynamic imaging, the RC improved from 0.62 in the non-gated reconstruction to 0.85 in the gated reconstruction, showing a significant increase of approximately 37%. This substantial enhancement in RC suggests a significant reduction in motion artifacts and an increase in lesion detectability ***Conclusion:*** The Siemens deviceless AI gating system has proven effective in compensating for respiratory motion in PET imaging, as demonstrated in a controlled phantom study. The increase in RC with the gated reconstruction, especially in the largest sphere, underscores the potential for this technology to enhance diagnostic accuracy in clinical PET imaging, paving the way for more reliable oncological assessments without the need for external devices

EP-1286

Using Recursive Feature Elimination in Random Forest for Progression Prediction of Mild Cognitive Impairment with Tc-99m ECD SPECT Images

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Aim/Introduction: Identifying individuals at risk of progressing from Mild Cognitive Impairment (MCI) to Alzheimer's Disease (AD) is crucial for early intervention and appropriate therapy application. Our study aims to utilize Tc-99m ECD SPECT images of MCI patients and the random forest-recursive feature elimination (RF-RFE) algorithm to classify MCI into progressive (pMCI) and stable (sMCI) subtypes. ***Materials and Methods:*** The study included 58 sMCI and 62 pMCI subjects. In this retrospective study, we collected Tc-99m ECD SPECT images from MCI subjects, distinguishing between pMCI (patients progressing to AD) and sMCI (unchanged status after 30 months). Spatial normalization using SPM5 software and intensity normalization with the cerebellum as a reference region standardized the images. After preprocessing, the images were segmented into 91 brain regions, and cerebral blood flow statistics in each region served as features for machine learning. We employed RF-RFE algorithm for pMCI/sMCI classification, comparing RFE-selected features with those from F-score feature selection and regions with significant voxel statistical differences from Statistical Parametric Mapping (SPM) analysis. Training on 80% of the data, with 20% for independent testing, and 5-fold cross-validation mitigated overfitting and selection bias. Model performance metrics included sensitivity, specificity, precision, accuracy, and F1 score. ***Results:*** The classification of pMCI/sMCI using RF-RFE resulted in an accuracy of 75.00%, sensitivity of 83.33%, specificity of 66.67%, an AUC of 0.80, and an F1 score of 76.90% after RFE. Without RFE, the accuracy was 70.83%, sensitivity was 83.33%, specificity was 58.33%, AUC was 0.79, and F1 score was 74.10%. Feature importance analysis revealed key regions including the inferior temporal gyrus, fusiform gyrus, parahippocampal gyrus, and orbital part of superior/inferior frontal gyrus across all three feature selection methods. ***Conclusion:*** Our study demonstrates the efficacy of utilizing Tc-99m ECD SPECT images and a RF-RFE algorithm for progression prediction of MCI. It also identifies the brain regions that are indicated to be meaningful for predicting transitions in MCI patients.

EP-1287

Optimization Of Technical Aspects For Using The Innovative Stepbrain Brain Phantom In Nuclear Medicine Imaging Simulations

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Aim/Introduction: The standardization of hybrid diagnostic brain imaging in nuclear medicine is a challenging task to allow evaluation of the sensitivity of different equipment and methods, also through multicenter studies. To this aim, anthropomorphic brain phantoms are developed for the assessment of medical equipment, reconstruction, and partial volume effect correction algorithms, or even to study the impact of different compartmental concentrations of tracers on images. In this study, the technical and procedural aspects of using an innovative anatomical brain phantom, StepBrain (SB), which is the first composed of 3 compartments: dorsal striatum (DS), gray (GM), and white matter (WM), for the simulation of images of normal brains and patients suffering from dementia, were presented. ***Materials and Methods:*** The radiopharmaceutical preparations, the filling and mixing of phantom solutions, as well as the image acquisition parameters on Siemens Biograph PET/CT scanner,

were optimized. In an FDG-PET-like simulation, the phantom was filled with different concentrations of ^{18}F-FDG to simulate the correct concentration ratios GM/WM = 2.80 and a BG/WM = 2.63 of a healthy brain, as reported in other studies, to obtain the counting gradients of real PET/CT. After filling, SB was placed on an automatic rotating system, set up to mix the solutions and avoid air bubbles, as detected on a preliminary CT. Similarly, amyloid-PET acquisitions were simulated, thus also evaluating the different acquisition and processing protocols of both CT and PET images, simulating concentration ratios ranging from 0% GM and 100% WM, up to 120% GM and 100% WM. ***Results:*** The filling procedure favored the absence of significant air bubbles, particularly in the DS, in over 80% of the acquisitions. Furthermore, thanks to the automatic mixing system, the radioactive fluids inside the compartment were homogeneously distributed. The acquisition/reconstruction parameters provided images of comparable quality to real patients. The simulations obtained, both FDG-PET-like and PET-Amyloid, were qualitatively evaluated by three experts in PET/CT studies. ***Conclusion:*** The likelihood of the images obtained has been assessed as optimal, both in reproducing the activity ratios of a healthy brain and in simulating different degrees of disease progression in patients suffering from dementia (i.e., Alzheimer's disease).The technical-procedural methodology developed in our laboratory allowed the use of the SB phantom for technical, qualitative, and quantitative evaluations of the performance of nuclear medicine hybrid imaging scanners, with a degree of accuracy never achieved before with imaging phantoms.

EP-1288

SUV Evaluation of ^{99m}Tc Myocardial Perfusion Scintigraphy in Stand-alone SPECT: Accuracy Evaluation by Cardiac Phantom

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Aim/Introduction: It is widely known that evaluation of ischemic heart disease by myocardial scintigraphy underestimates multi-vessel disease because of the relative assessment of blood flow. The EANM practice guideline for quantitative SPECT-CT [1] mentions the possibility of quantitative assessment of myocardial perfusion using SPECT-CT. However, about 60% of nuclear medicine facilities in Japan have stand-alone SPECT scanner, and many of these facilities do not perform attenuation correction (AC) and scatter correction (SC), so quantitative SPECT-CT images cannot be obtained. The purpose of this study was to compare the accuracy of SUVs that can be calculated from non-AC/SC SPECT images obtained with a stand-alone SPECT scanner with SUVs obtained from quantitative SPECT-CT images as a reference. ***Materials and Methods:*** RH-2 myocardial phantom (theoretical SUV: 3.82) was acquired by Symbia E (Canon). Acquisition parameters were as follows: LEHR collimator, 64 matrix size, zoom 1.45, scan duration of 1200s/72 views, and scan mode of detector auto-contouring. All projection data were reconstructed using OSEM (subsets of 6, iteration of 8, Butterworth filter of 0.55cycles/cm) without AC/SC. AC/SC SPECT images were also generated as reference data with similar acquisition and reconstruction parameters using CT images acquired by different CT scanners and SC of TEW method. All SPECT images were converted to the SUV scale by normalizing using dose and volume after applying Bq calibration factor. SPECT images were converted to Polar-map and the accuracy of the mean SUV of 17 segments was evaluated with mean recovery coefficient (meanRC). The uniformity of SUV between segments was evaluated by ΔSUVsegment and standard deviation (SD) of ΔSUVsegment (SDΔSUVsegment), where ΔSUVsegment is the deviation between the average SUV of 17 segments and the SUV of the individual segments. The meanRC, ΔSUVsegment, and SDΔSUVsegment were compared for non-AC/SC and AC/SC. ***Results:*** The meanRC in non-AC/SC and AC/SC were 0.35, 0.57, respectively. The maximum ΔSUVsegment in non-AC/SC and AC/SC were +12.6%, +12.7%, respectively. The SDΔSUVsegment in non-AC/SC and AC/SC were 0.069, 0.054, respectively. ***Conclusion:*** The mean RC of the non-AC/SC SPECT images was lower than that of the AC/SC SPECT images, but the ΔSUV segment and SDΔSUV segment were only slightly different, indicating that the uniformity of SUV between segments is comparable. The SUV evaluation of stand-alone SPECT scanner has acceptable accuracy, although the absolute value of SUV may be slightly lower than that of quantitative SPECT-CT. ***References:*** [1] Dickson JC, et al. Eur J Nucl Med Mol Imaging. 2023 Mar;50(4):980-995.

EP-1289

No More Tossing and Turning: The Type of Pillow has a Significant Impact on Patient Head Movement During PET/CT Acquisition

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Aim/Introduction: Accurate image-registration between CT and PET signals during a PET/CT-scan, is crucial for image quality and thus diagnostic outcome. Comfortable patient positioning prior to scan is very important to maintain same position throughout the scan duration. Different aids, such as armrests, head- and knee pillows are used, all in an effort to reduce patient movement. There are currently two different head pillows used at our department, one of them has an indent for cranial support. The aim of this study was to examine, if the use of the cranial-support-pillow(CSP) with indent results in fewer artefacts due to patient head movement when compared to the standard arm-rest-pillow(STD). ***Materials and Methods:*** Consecutive patients for PET/CT-scans were included and the use of pillow type alternated on a daily basis on the two used PET/CT-scanners. Patients were excluded if scanned as head-and-neck scanning protocol, a demetia patient or other positioning aids had been used. Information regarding pillow type, scan duration, age and gender were recorded. Patient movement was evaluated both visually and was quantified, as an angle measurement between the CT- and PET signal at the tip-off the nose to evaluate head rotation, and was categorised in groups of 0°, 1-9° or ≥10° difference. The technologists evaluating images for movement were blinded to pillow type. Significant differences between the CSP and STD were evaluated with Chi2 test for categorical data and ANOVA test for quantitative data. ***Results:*** In the study, 141 patients were included; 74 in the ARP-group and 67 in the CSP-group. The two patient groups were identical, with no significant differences between ages, gender and scan duration. A significant reduction in head movement was observed between the two groups, as 42 patients (62.7%) in the CSP-group had no registered movements between CT and PET compared to 22 patients (29.7%) in the STD-group ($p<0.0001$). Angle differences from 1-9° was 15 patients (22.4%) in the CSP-group compared to 35 patients (47.3%) in the STD-group. Measured differences ≥10° was reported in 10 patients (14.9%) in the CSP-group and 7 patients (22.9%) in the STD-group. The angle differences between the two groups were statistically significant ($p<0.001$). The mean scan duration in the degree-groups were 11:37, 13:46 and

12:48 minutes for group 0°, 1-9° and ≥10°, respectively (p>0.05). ***Conclusion:*** Using the CSP pillow results in a significant reduction in registered head movement of patients, which is crucial to ensure satisfactory image quality.

EP-1290

Clinical Study of Amyloid PET Dose and Collection Time

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Aim/Introduction: The Amyloid PET examination represents a pivotal diagnostic modality that enables visualization of amyloid β protein deposition within cerebral tissue. This imaging technique, utilizing the radiopharmaceutical Flutemetamol (^{18}F), an activity ranging from 185 Mbq to 370 Mbq, as specified in the product infomation. Notably, the commencement of imaging exhibits considerable variability, spanning a window of 60 to 90-minutes post-administration.However, there is a paucity of clinical literature concerning Fultemetamol formulations with respect to dosing and imaging timing, specifically the initiation of imaging at the 60-minute mark. Consequently, we undertook a rigorous investigation employing the following methodology. ***Materials and Methods:*** The investigation encompassed a cohort of 22 patients, whose images were acquired during the period spanning December 2022 to December 2023.The instrumentation employed consisted of the Celesteion Canon. Additionally, the VIZCalc C.I.1 software, developed by Nihon Medi-Physics and facilitated the subsequent analysis.Image acquisitions were conducted at 10-minutes (aligned with an administration of 143 to 185 Mbq) and 20-minutes (standard protocol) relative to the 60-minute imaging initiation timepoint.Subsequently, a visual assessment was performed on each image. Quantitative analysis involved measuring pixel values using the Centiloid VOI method, calculating the standardized uptake value ratio (SUVr), and scrutinizing changes on the Centiloid Scale. ***Results:*** The visual assessment results revealed no discernible disparity between negative and positive evaluations.In the context of physical evaluation, no statistically significant variation in standardized uptake value ratio (SUVr) was observed among negative cases. However, a notable discrepancy emerged in positive cases, contingent upon the reference site. Analogous findings were obtained using the Centiloid Scale.The phenomenon of brain drug accumulation diminishing over time due to washout likely contributes to the observed differences, particularly influenced by the imaging start time. ***Conclusion:*** This study, encompassing 22 cases (comprising 13 negative cases and 9 positive cases), suggests that despite the limited sample size, it remains feasible to generate clinical images under distinct conditions. Encouragingly, each facility should persist in testing consistently within the parameters established by the facility itself.If concordance could be established with the 90-minute post-administration image employed in the preceding study, it would facilitate the harmonization of protocols across different institutions and radiopharmaceuticals.

EP-1291

Enhancing SUV values determination through Lean Body Mass Normalization to Reflect Patient Weight and Body Composition Variations using ^{18}F-FDG and ^{18}F-somatostatine analogue PET-CT imaging.

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Aim/Introduction: This study aimed to evaluate the impact of standardizing SUV measurements by weight (SUVbw) in comparison to lean-body-mass (SUL) within both FDG and AlF-NOTA-Octreotide (FAN) PET/CT scans. We focused on SUVmean in the liver comparing outcomes derived from the two normalization methods across different patient cohorts. Moreover, we compared these two methods within a cohort of patients undergoing weight fluctuations between two consecutive visits to our center. ***Materials and Methods:*** SUVmean measured both FDG and FAN PET/CT scans were normalized utilizing the weight (SUVbw) and the lean-body-mass (SUL) parameters. For FDG PET/CT scans, we conducted a retrospective analysis of data encompassing 172 patients stratified into three groups according to their BMI: normal (<25), overweight (25-29.9), and obese (≥30). Additionally, a cohort of 11 patients who lost weight during two consecutive visits, characterized by a decrease within ±10% of initial weight, was followed. For FAN PET/CT scans, we grouped 60 patients into normal and overweight groups. Statistical analyses were conducted to compare the SUV values between weight-based and LBM-based normalization methods within each patient category. ***Results:*** In FDG PET/CT scans, SUVbw mean was significantly higher in obese patients (43 patients) compared to those with a normal BMI (62 patients) (2.23 ± 0.48 and 1.88 ± 0.36 respectively; P ≤0.001), showing significant differences across BMI categories, while SUL mean did not exhibit such differences (P >0.05). In FAN PET/CT scans, SUVbw mean exhibited significant differences between BMI categories (P = 0.038), with higher values observed in obese patients (31 patients) compared to those with normal BMI (29 patients)(3.66 ± 1.35 and 2.72 ±1.19 respectively), whereas SUL measurements failed to show differences between normal BMI and obese groups (P >0.05). Analysis of patients who lost ±10% of their initial weight during consecutive visits to our center, revealed no statistical differences when normalized by the two distinct methods. However, SUVbw measurements showed considered variation between the assessed time-points compared to measurement with SUL. ***Conclusion:*** Our findings showed that LBM normalization provides a more consistent and reliable approach for SUV measurements in both FDG and FAN PET/CT scans. Weight-based normalization resulted in significant differences across BMI categories, a phenomenon not observed with LBM normalization. Likewise, SUL is more consistent in evaluating patients undergoing repetitive PET/CT compared to SUVbw. Thus, our results suggest that using LBM normalization enhances the reliability of quantitative SUV measurements in PET/CT imaging, leading to more accurate clinical interpretation.

EP-1292

Comparison of Image Quality and Quantification Parameters between Q.Clear and OSEM Reconstruction Methods in FDG-PET/CT Imaging

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Aim/Introduction: With the advancement in hardware features and reconstruction algorithms in PET/CT imaging, image quality has improved significantly. Q.Clear, a block sequential regularized expectation maximization reconstruction algorithm, reduces noise and enhances image contrast. This study compared image quality and quantification parameters between Q.Clear and OSEM algorithms in patients with liver metastases undergoing

F^{18} FDG-PET/CT imaging ***Materials and Methods:*** Twenty patients (8 females, 12 males; average age 62 ± 10.9 years) were included in the study. Prior to PET/CT imaging, patient preparation and acquisition parameters were standardized. To assess image quality, three-dimensional regions of interest (ROIs) were drawn in the right lobe of the liver and the aortic arch as a blood pool. Analyses were performed on ROIs of three different sizes (1.26, 3.51, 6,72 cm^3) using both reconstruction methods. The Q.Clear and OSEM algorithms were compared for maximum standardized uptake value normalized by lean body mass (SULmax in g/mL), SUVmax (g/mL), contrast, signal-to-noise ratio, and background variability. Statistical analysis was conducted on the calculated image quality and quantitative parameters (SULmax and SUVmax). ***Results:*** Q.Clear reconstruction showed higher SUVmax (8.05 ± 3.2 vs. 7.6 ± 3.3) and SULmax (5.5 ± 2.2 vs. 5.4 ± 2.1) values compared to OSEM reconstruction. However, there was no significant difference in the calculated SUVmax and SULmax across all volumes of interest. When comparing image quality-related parameters, Q.Clear significantly outperformed OSEM reconstruction in terms of contrast, signal-to-noise ratio, and background variability. ***Conclusion:*** In conclusion, Q.Clear reconstruction demonstrated better signal-to-noise ratio, contrast, and higher SUVmax and SULmax. No significant differences in terms of artifacts were observed between the two reconstruction methods. These findings highlight the importance of using the same reconstruction method for monitoring patients' treatment response and follow-up.

EP-1293

Exploring the Influence of Time-of-Flight on Lesion Detection and Quantification in Somatostatin Receptor PET Imaging: A Simulation of Patient Study Across Various Acquisition Durations

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Aim/Introduction: Time-of-flight (ToF) PET enhances lesion detection and quantification, especially for small lesions with low counts. This study investigates the impact of varying ToFs and acquisition times on neuroendocrine tumors (NETs) lesion detection and quantification by simulating different ToFs using SSTR imaging patient PET rawdata from uMI Panorama, a 190-ps ToF PET system. ***Materials and Methods:*** We prospectively analyzed 13 patients (6 males, 7 females; mean age 46.3 ± 12.2 years; mean BMI 22.7 ± 3.5 kg/m2) undergoing list-mode SSTR PET/CT scans (n=7, 4, 2 for 18F-ALF-NOTA-LM3, 68Ga-NODAGA-LM3 and 68Ga-DOTATATE, respectively) at 120 s/bed with an average dose of 217 ± 72 MBq. ToF images (190, 350, 500 ps, and non-ToF) were reconstructed using ToF rebin simulation. Each ToF group underwent further OSEM reconstruction (2 iterations, 10 subsets, matrix 192×192) into 120, 90, 60, 45, 30 s/bed by data trimming. Lesion detection rates were calculated for all image groups, with 190-ps-120 s/bed images (G190-120) as the reference. Volumes of interest (VOIs) were delineated for lesions, and SUVmax measured. A 30-mm circular ROI was placed in the right liver lobe for SD and SUVmean. Tumor-to-Background Ratio (TBR) and Signal-to-Noise Ratio (SNR) were calculated. The Cochran's Q test supplemented by the Wilcoxon signed-rank test, and repeated measures ANOVA or the Friedman test (with Bonferroni corrections for multiple comparisons), were used to compare the lesion detection and quantification across groups, respectively. ***Results:*** Out of 250 lesions detected in the reference group, no significant differences were observed between this group and G190-90, G190-60, G190-45, G350-120 and G350-90 groups ($P > 0.05$). Among 126 lesions consistently detected across all groups (SUVmax 13.5 ± 12.4; diameter 12.7 ± 9.1 mm; TBR 5.6 ± 5.5; all measured in reference group), both SUVmax and TBR of these lesions were significantly lower in non-190-ps groups ($P < 0.001$). For inter-duration subgroup comparison, SNR in each duration subgroup of the 190-ps group was significantly lower than the corresponding subgroup of the non-ToF group ($P < 0.001$), but statistically comparable ($P > 0.05$) to the 300/500-ps subgroups. ***Conclusion:*** Findings suggest that the NET lesion detection rates for the G190-45 and G350-90 groups can be comparable to the reference group. Lesions measured at 190-ps exhibited higher SUVmax and TBR relative to other groups while maintaining an acceptable SNR compared to the 350/500-ps group. A ToF setting of 190-ps allows shorter acquisition times while still providing sufficient compatibility and feasibility for NETs imaging.

EP-1294

Comparison of Zero-Time-Echo and Atlas Attenuation Correction in ^{11}C-β-CFT PET Imaging Using PET/MR

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Aim/Introduction: This study aimed to evaluate the accuracy of zero-echo-time attenuation correction (ZTEAC) and atlas-based attenuation correction (AtlasAC) compared to Computed Tomography (CT) attenuation correction in 11C-β-CFT PET imaging for patients with Parkinson's disease (PD). ***Materials and Methods:*** A prospective study included 13 PD patients undergoing PET/MR imaging. 11C-β-CFT PET data and MRI sequences such as ZTE and LAVA-Flex were acquired, followed by a 18F-FDG PET/CT examination. Attenuation correction was performed using CTAC, AtlasAC, and ZTEAC maps. Standardized uptake value ratio (SUVR) calculations were done with SPM12 software. Paired t-tests were utilized to analyze SUVR deviations among various attenuation correction methods across the entire brain and specific brain regions, with statistical significance set at $P < 0.001$. ***Results:*** ZTEAC demonstrated lower deviation in whole-brain PET SUVR (1.05% ± 1.29%) compared to AtlasAC (2.44% ± 2.17%). AtlasAC overestimated PET SUVR in the amygdala (3.76% ± 1.24%) and hippocampus (2.99% ± 0.01%). No significant differences were found between ZTEAC and CTAC across all evaluated brain regions ($P > 0.001$). ***Conclusion:*** In the context of 11C-β-CFT PET imaging in PD patients, ZTEAC demonstrates superior accuracy over AtlasAC, presenting a more reliable diagnostic tool in clinical practice.

EP-1295

The DPL algorithm optimizes PET imaging for patients with different BMIs and enhances the diagnostic value of lesions of various sizes

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Aim/Introduction: This study aims to evaluate the impact of the Deep Progressive Learning (DPL) reconstruction algorithm on the image quality and diagnostic performance for lesions of varying sizes in patients with different Body Mass Index (BMI) undergoing PET/CT imaging. ***Materials and Methods:*** The study included 146 patients who underwent PET/CT imaging with ^{18}F-FDG. According to the Chinese BMI standards, patients were divided into three groups: underweight (BMI<18.5, 42 cases),

normal (BMI 18.5-24, 66 cases), and obese (BMI>24, 38 cases). All PET images were reconstructed using both the Ordered Subset Expectation Maximization (OSEM) and Deep Progressive Learning (DPL) algorithms. Subjective image quality was assessed using the Likert five-point scale, involving overall score, clarity, noise, and diagnostic credibility. Objective evaluation was based on parameters such as the Standard Uptake Value Standard Deviation (SUVSD), Maximum SUV (SUVmax), Mean SUV (SUVmean), Signal-to-Background Ratio (SBR), Signal-to-Noise Ratio (SNR), Contrast-to-Background Ratio (CBR), and Contrast-to-Noise Ratio (CNR), quantifying the image quality of different BMI patients and reconstruction algorithms. Additionally, 277 sub-centimeter lesions and 177 lesions larger than one centimeter from the included patients were selected to compare SUVmax, SBR, SNR, CBR, and CNR, assessing the impact of different reconstruction algorithms and BMI values on the quantitative performance of lesions of different sizes. ***Results:*** In subjective evaluations, the DPL algorithm significantly outperformed the OSEM algorithm across all BMI groups ($p<0.05$). Objective evaluations showed that the DPL algorithm's SBR, CBR, SNR, and CNR values were significantly higher than those of the OSEM algorithm in all groups, with a more notable improvement in the obese patient group. For lesions of different sizes and patients with different BMI, the DPL algorithm's SBR, CBR, SNR, CNR, and SUVmax values were significantly higher than those of the OSEM algorithm ($p<0.001$). Particularly in the obese patient group, the SNR and CNR of sub-centimeter lesions increased significantly after using the DPL algorithm, by 156.59% and 174.29%, respectively. ***Conclusion:*** The DPL reconstruction algorithm provides superior image quality within the same acquisition time compared to the OSEM algorithm, and this advantage is influenced by the patient's BMI. The quantitative performance of lesions of different sizes is also affected by BMI and the reconstruction algorithm.

EP-1296

Evaluation of Radiomics Based Information to Detect Stenosis in Gated Myocardial Perfusion Imaging

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Aim/Introduction: Radiomics, a collection of techniques used to automatically extract large amounts of quantitative features from medical images, holds significant promise for predicting coronary artery disease in Myocardial Perfusion Imaging (MPI) SPECT when combined with machine learning methods. In this study, we assess the utilization of functional radiomics features extracted from gated-single photon emission computed tomography (SPECT) studies to detect coronary artery stenosis diagnosed by coronary angiography (CA). ***Materials and Methods:*** 250 patients who underwent both MPI SPECT and CA are comprised the dataset. The population average age was 58.3, with 40% being male. Patients those with significant stenosis were categorized based on CA reports. LV gated segmentation and quantification were performed using Cedars QPS/QGS package 2015. Subsequently, radiomics features were extracted through the SERA framework from four polar maps generated by QGS (end diastole perfusion amp, end systole perfusion map, wall motion map, wall thickening map). Area Under the Curve (AUC) metric was used for a comprehensive analysis of univariate feature performance. A multivariate analysis was conducted to detect coronary artery stenosis where a subset of extracted features was selected. Features were primarily selected statistically and followed by a recursive feature selection algorithm. A support vector machine was used as the classifier, and its performance was assessed through multiple criteria, including AUC, accuracy, precision, recall, and F1-score. ***Results:*** Some extracted gated-features exhibited high AUC values in effectively distinguishing patients with stenosis from those without (the highest AUC reached 0.75). The most relevant features were extracted from the end diastole perfusion polar map and wall motion polar map. Furthermore, machine learning models demonstrated impressive performance in classification, with the highest AUC and accuracy reaching 0.78 and 0.81 respectively. ***Conclusion:*** Based on the results, it can be concluded that radiomics features extracted from gated-single photon emission computed tomography (SPECT) studies, specifically those contributed to end diastole perfusion and wall motion, can provide useful information for precise quantitative analysis in MPI scans and disease detection when coupled with machine learning methods. This approach has the potential to improve the accuracy of predicting coronary artery disease in MPI-SPECT.

EP-1297

The impact of reconstruction parameters on the discriminatory performance of texture analysis for HER2 status on dbPET

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Aim/Introduction: In recent years, discriminating HER2-low and -positive (ie, immunohistochemistry (IHC) score of 1+, 2+, or 3+) from HER2-zero (ie, IHC score of 0) has become important in determining treatment strategies for breast cancers (BCs). We aimed to investigate the impact of reconstruction parameters on the discriminatory performance of HER2-zero and HER2-low+positive using texture analysis on dedicated breast PET (dbPET). ***Materials and Methods:*** A total of 31 BCs in 29 patients who underwent dbPET with 18F-fluorodeoxyglucose were retrospectively analyzed. HER2 status assessed by IHC staining: Tumors scored as 1+, 2+, or 3+ were classified as HER2-low+positive, otherwise HER2-zero. dbPET images were reconstructed using the 3D-DRAMA method with different regularization parameters (β) of 10, 20, 50, 70, and 100. BCs were semi-automatically delineated and 93 texture features (TFs) were calculated using PyRadiomics. For each reconstruction protocol, a prediction model for HER2 status classification was built using a random forest method. The discriminatory performance of the HER2 status for each model was assessed using Out-Of-Bag (OOB). In addition, TFs of high importance for discriminating HER2 status were selected by using the mean decrease gini. The selected TFs extracted from dbPET images reconstructed with different β values were compared to that from β of 20 (standard setting in the clinical practice). Furthermore, associations between these TFs and HER2 status were assessed for each β value. ***Results:*** dbPET images reconstructed with high β values showed better ability to discriminate HER2 status, with OOB of 47.1, 41.9, 32.3, 36.1, and 32.9 for β value of 10, 20, 50, 70, and 100, respectively. For HER2 status discrimination, 6 important TFs (Kurtosis, Skewness, Idmn, Large-Area-Emphasis, Zone-Variance, and Dependence-Variance)

were selected. In all reconstruction conditions, Large-Area-Emphasis, Zone-Variance, and Dependence-Variance showed statistically significant differences between β of 20 and the other β values. Kurtosis and Large-Area-Emphasis were significantly lower for HER2-low+positive tumors than for HER2-zero tumors with any β values. For HER2-low+positive tumors, Dependence-Variance and Skewness were significantly lower than for HER2-zero tumors for all β values except for β of 10 and 100, respectively, and Zone-Variance for HER2-low+positive tumors was significantly lower than HER2-zero only at β of 50 and 100. ***Conclusion:*** Some TFs important for HER2 status discrimination were affected by β values. dbPET images reconstructed with high β values may have better ability to discriminate HER2 status than those of standard β value (20).

EP-1298

Treatment response evaluation using texture analysis on F^{18} FDG PET/CT in patients with locally advanced breast cancer

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Aim/Introduction: The objectives of this study were firstly, to utilize the ability of texture analysis to evaluate the treatment response and overall survival (OS) in patients with locally advanced breast cancer (LABC) and secondly to compare the results of texture analysis with PET/CT parameters. ***Materials and Methods:*** 57 patients with histopathologically proven LABC were retrospectively analysed. ^{18}F Fluorodeoxyglucose positronemission tomography/computed tomography (^{18}F FDG PET/CT) scan was performed at the baseline and after 6-12 cycles of chemotherapy. Thirteen haralick texture features were derived from the baseline scan. An independent nuclear medicine physician evaluated the ^{18}F FDG PET/CT parameters in the baseline scan. Mann Whitney U test & independent T-test were performed to determine the significance of the difference in the mean value of texture parameters & PET/CT parameters. Cox-regression & Kaplan- Meier tests were applied for survival analysis. ***Results:*** Mean age of patients was (46.07 ± 1.46 years). Based upon the clinical follow-up, out of 57 patients, 39 patients were categorized as responders & 18 patients as non - responders. Out of the thirteen texture parameters, two of the texture parameters: sum average (V6) with p = 0.071 & sum variance (V7) with p= 0.069 were found to approach a statistically significant level. Responders had higher values of TLG and MTV than non-responders. The trend for OS, according to the Kaplan-Meier test was such that patients with higher values of metabolic tumor volume (MTV) and total lesion glycolysis (TLG) had a lower overall survival (OS) compared to patients who survived. Neither texture parameters nor PET parameters showed statistical significance in distinguishing between responders and non-responders. Additionally, these parameters did not demonstrate significant differences between the two survival groups (those who died and those who survived). ***Conclusion:*** It was concluded that the two texture parameters, specifically sum average (V6) and sum variance (V7), which were approaching significance, could potentially play a role in predicting treatment response if studied in a larger sample size with a more homogenous patient population.

EP-1299

A Multicenter Study on the Application of [18F]FDG PET/CT-Derived Molecular Radiomics in Predicting Lymph Node Metastasis and PD-L1 Expression in Non-Small Cell Lung Cancer

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Aim/Introduction: To develop and validate the effectiveness of a molecular radiomics model, built upon [18F]FDG PET/CT imaging, for predicting lymph node metastasis and programmed death-ligand (PD-L1) expression in non-small cell lung cancer (NSCLC) patients. ***Materials and Methods:*** We retrospectively analyzed clinical data on NSCLC patients who underwent surgical resection and tumor proportion score (TPS) testing at two hospitals between 2016 and 2024. All patients were examined using preoperative [18F]FDG PET/CT imaging. The study participants were divided into two groups: the lymph node metastasis prediction cohort and the PD-L1 expression prediction cohort. ITK snap 3.8.0 was employed to segment the region of interest and automatically generate the peritumoral region. Radiomics feature extraction was carried out using Python 3.7.0 (extracting 1967 features from both CT and PET signatures). The LASSO algorithm and Spearman correlation analysis were applied to select the most relevant radiomics features. Subsequently, based on these selected features and multiple classifiers, models for tasks A (lymph node metastasis task) and B (PD-L1 expression task) were constructed, including the PET intra-tumoral model, PET peritumoral model, CT intra-tumoral model, CT peritumoral model, PET and peritumoral model, and CT and PET/CT peritumoral fusion models. The predictive performance of each model was analyzed using the receiver operating characteristic (ROC) curve, area under the curve (AUC), sensitivity, specificity, accuracy, positive predictive value, negative predictive value, and F1-score. The clinical utility of each model was also assessed through decision curve analysis (DCA). ***Results:*** For task A, the SVM_IPF_LNM model outperformed both the clinical model and the other six radiomics models, achieving an AUC of 0.845 (95%CI: 0.716-0.973) in the test. In task B, the PET/CT peritumoral fusion model (LR_IPF_PD-L1) established using logistic regression was better than others, with an AUC of 0.776 (95%CI: 0.664-0.942) in the test. DCA demonstrated that the molecular radiomics models hold clinical advantages in predicting lymph node metastasis and PD-L1 expression. ***Conclusion:*** The molecular radiomics model based on PET/ CT can accurately predict lymph node metastasis of NSCLC patients and continuously monitor the PD-L1 status during treatment, which provides a non-invasive tool for clinicians to formulate precise treatment plans.

EP-1300

Personal comparison of Dose Exposure before and during pregnancy in a PET-CT Department

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Aim/Introduction: Personal Comparison on the dose exposure and daily practices of 1 technologist before and during pregnancy ***Materials and Methods:*** Using a Tracerco PED Blue (Model: T414-1) data from 1 PET-CT technologist was acquired during October 2021 before declaration of pregnancy and November 2021 While pregnant. The acquisition of the extra data (in addition to Badges Laundauer Luxel+ passive dosimeters) was already a

normal practice of this Technologist ***Results:*** Dose exposure in October 2021, before declaration of pregnancy and in 23 working days, was 97.18 µSv and in November, whilst pregnant and in 17 working days, was 2.94 µSv. Badge readings on the passive dosimeter in October are 0.15mSv for body, 10.31mSv for left finger and 6.38mSv for right finger. In November the readings are below detectable levels. The drastic difference of exposure values is a result of awareness of pregnancy and applying change of practices during working time (non-radioactive tasks only) with collaboration of colleagues ***Conclusion:*** According to the guidelines for expectant mothers working safely with ionising radiation from HSE and over the declared term of pregnancy from Regulation 9(6) of IRR, the maximum dose exposure to the foetus is 1mSV. Extrapolating the results to the remaining months of pregnancy, we can say that in terms of dose exposure, it is safe to continue to work in a PET-CT department with change of practices. During the research about this subject a lack of papers about pregnant workers in PET-CT was noted, probably due to the process being personal and confidential ***References:*** Working safely with ionising radiation, Guidelines for expectant mothers, Health and Safety Executive. The Ionising Radiations Regulations 2017.

EP-1301

Use of conventional hospital rooms for [177Lu]Lu-DOTA-Octreotate treatment, for high risk patients at an established hospital.

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Aim/Introduction: Peptide Receptor Radionuclide Therapy (PRRT) treats somatostatin receptor-expressing neuroendocrine neoplasms. Hospital admission may be necessary for certain patients experiencing acute symptom flares during or after PRRT. Previously, treatments were conducted in shielded rooms, albeit with staffing ratios not optimised for such patients. This study aims to investigate if PRRT could be safely provided from a radiation safety standpoint, in a room with enhanced staffing ratios and resources for handling symptom flares, despite the absence of structural radiation shielding. ***Materials and Methods:*** On average 46% of [177Lu]Lu-DOTA-Octreotate (LuTate) is excreted within 4 hours of administration. In Australia, treatments are commonly performed as an outpatient procedure (in accordance with State Regulations). The Enhanced Care Unit (ECU) provides intensive nursing care for patients requiring specialised care. Two single occupancy ECU rooms were identified as potential LuTate therapy treatment areas for patients at high risk of hormone flare. Before treating the first patient, a comprehensive radiation risk assessment was conducted. Radiation protection measures included staff training, mobile lead shields, patient toilet designation, contingency plans for waste and spill management and radiation signage. The patient received 10 GBq of LuTate. Utilising a handheld survey meter, radiation dose rates were measured at locations in and adjacent to the patient's room before and after LuTate therapy infusion at various time points over 24 hours. The Radiation Safety Officer and a Medical Physicist calculated radiation doses for ECU staff, patients, and visitors based on measurements. An application for continued room use was submitted to local authorities. ***Results:*** The maximum radiation dose rate in adjacent areas to the patient's room was 0.5 µSv/hr above background. For staff standing behind a lead shield next to the patient, the maximum dose rate during infusion was 0.6 µSv/hr, decreasing to 0.4 µSv/hr 18 hours post-infusion. The calculated ECU staff's radiation dose performing hourly observations was about 30 µSv per patient per 12-hour shift, well below the public dose limit of 1 mSv in a 12-month period. Rooms were chosen based on low occupancy in surrounding areas (due to external walls and stairwell behind both rooms). The Victorian Department of Health granted regulatory approval for two treatment rooms for ongoing LuTate use. Five treatments have been performed without ICU escalation, fatalities, or radiation incidents. ***Conclusion:*** In Victoria, Australia, delivery of LuTate in conventional hospital rooms is safe and feasible. Radiation risk to occupationally and publicly exposed persons is very low.

EP-1302

Investigation On Current Situation Of Knowledge And Practice Of Radiation Protection Among Medical Staff In Radiology Department And Analysis Of Influencing Factors

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Aim/Introduction: To investigate the current situation of radiation protection knowledge and practice of medical staff in radiology department and analyze the influencing factors, so as to standardize the radiation protection behavior of medical staff and provide basis for enriching the radiation protection training content ***Materials and Methods:*** A self-designed radiation protection knowledge and practice questionnaire was used to investigate conveniently selected radiology medical staff, and the factors affecting radiation protection knowledge and practice were analyzed by multiple linear regression ***Results:*** A total of 351 questionnaires were sent out, and 335 were effectively collected, with an effective recovery rate of 95.4%. The total score of radiology medical staff was 59.0 (10.4) points, 8.65 (4.63) points for knowledge, 21.35 (2.45) points for attitude and 28.99 (5.85) points for behavior. The results of multiple linear regression analysis showed that age, education level, Experience of radiation protection education, Number of children born, Knowledge about radiation protection and Attitude towards radiation protection were the factors affecting the score of radiation protection (Adjusted $R2 = 0.516$, $F = 30.655$, $p < 0.001$). ***Conclusion:*** Medical staff in radiology department have good knowledge and practice of radiation protection, positive attitude and behavior, but lack of knowledge of radiation protection. The relevant organizations and departments of the hospital should take specific measures, such as providing regular training and education on radiation protection, to ensure the safety of medical staff and patients during the examination.

EP-1303

Self-service Station for Patient Dose-rate Measurements

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Aim/Introduction: External dose-rate is measured from patients treated with radiopharmaceuticals before their discharge from the hospital. The process of measuring dose-rate is relatively straightforward, and it can be further simplified and made more accessible through the implementation of a self-service station. Here, we report how we constructed such a station and validated the dose-rate measurements. ***Materials and Methods:*** A high-sensitivity gamma detector was mounted to a mobile cart at a

height of one meter. The detector was connected to a monitor displaying dose-rate reading, and a traffic light indicator (red light indicating > 30 µSv/h, the dose-rate limit for discharging outpatients). A tape was fixed on the floor one meter away from the detector, to mark the place where to stand during the measurement. Written operating instructions were also provided. We performed dose-rate measurement comparison between the self-service station and a hand-held survey meter. The dose-rate calibration of both detectors had been checked using a traceable quality assurance source, and the devices were also tested using I-131 and Lu-177 radiopharmaceutical samples. To keep the measuring geometry identical, the survey meter was placed each time in the same location on the cart as the mounted detector. ***Results:*** We measured 30 patients using both the self-service station and the handheld survey meter: ten patients treated with ablative I-131, ten patients treated with Lu-177-DOTATATE (dodecane tetraacetic acid-octreotate), and ten patients treated with Lu-177-PSMA (prostate specific membrane antigen). The treatment activities and time of the dose-rate measurement varied between the patients, but the comparative measurements were always taken at the same time-point. Paired samples t-tests were conducted to see if there was a difference between the dose-rate measurements. The results indicated no significant difference between the hand-held device (mean M=0.77 µSv/h, standard deviation SD=0.64 µSv/h; M=6.7 µSv/h, SD=5.1 µSv/h; M=8.0 µSv/h, SD=6.0 µSv/h) and the self-service station (M=0.74 µSv/h, SD=0.55 µSv/h; M=6.2 µSv/h, SD=4.0 µSv/h; M=8.1 µSv/h, SD=5.8 µSv/h) for I-131 ablation, Lu-177-DOTATATE or Lu-177-PSMA treated patients, respectively. ***Conclusion:*** We built a self-service station for patients to measure dose-rate in a repeatable manner. The dose-rate measurements were validated with 30 molecular radiotherapy patients. The self-service station offers a reliable and patient-inclusive way to ensure compliance with radiation safety regulations and has mostly replaced our department's manual dose-rate measurement procedures.

EP-1304

Contribution of CT scan range to patient's effective dose in parathyroid SPECT/CT scintigraphy

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Aim/Introduction: Dual phase technetium-99mTc-methoxy isobutyl isonitrile (MIBI) SPECT/CT may be the most accurate conventional imaging approach for localization of enlarged parathyroid gland (EPG). The EPG can only be localized from the angle of the lower jaw to the mediastinum, so it makes sense to limit the CT scan to the site of location, because the limitation of the FOV is the basic in the optimization of the diagnostic procedure. This study aimed to estimate and optimize the contribution of computed tomography (CT) scan and scan range to effective dose (ED) in dual-phase MIBI SPECT/CT parathyroid scintigraphy. ***Materials and Methods:*** The study included seventy-four patients; thirty-seven with reduced and thirty-seven with extended CT scan range. The ED caused by the CT scan was calculated using Dose Length Product (DLP) data and estimated using the Imaging Performance Assessment of CT scanners (ImPACT) calculator. ***Results:*** For all patients, the contribution of CT to the ED in a combined SPECT/CT examination was 2.62 ± 0.29 mSv (48%). The contribution of CT to the total ED was 1.8 ± 0.18 mSv (33%) when using reduced and 3.44 ± 0.23 mSv (64%) when using extended scan range. The DLP and ED were statistically significantly different between the reduced and extended CT scan range ($p < 0.001$) in the first and second phases. The individual organ dose was reduced from 8% to 94%. ***Conclusion:*** The hybrid SPECT/CT improves the interpretation of nuclear medicine images and also increases the radiation dose to the patient. An adequately defined CT scan range on SPECT/CT imaging, can significantly reduce a patient's ED. ***References:*** Rep S, Hocevar M, Vaupotic J, Zdesar U, Zaletel K, Lezaic L. ^{18}F-choline PET/CT for parathyroid scintigraphy: significantly lower radiation exposure of patients in comparison to conventional nuclear medicine imaging approaches. J Radiol Prot. 2018;38:343-356. Czarnecki CA, Einsiedel PF, Phal PM, Miller JA, Lichtenstein M, Stella DL. Dynamic CT for Parathyroid Adenoma Detection: How Does Radiation Dose Compare With Nuclear Medicine. AJR Am J Roentgenol. 2018;210:1118-1122.

EP-1305

Radiation Safety: the Impact of an Automated Preparation and Administration System

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Aim/Introduction: In Nuclear Medicine, especially during PET/CT procedures, the handling and administration of radiopharmaceuticals significantly influence the radiation exposure of involved personnel. The recent shift in many hospitals towards automated preparation and injection systems aims to minimize staff exposure to radiation, while improving the accuracy and efficiency of the radiopharmaceutical injection process. However, studies on their efficacy and potential benefits are still limited. The aim of this pilot study is: comparing radiation exposure of Nuclear Medicine radiographers using the automatic preparation and administration technique with the manual preparation and administration technique. ***Materials and Methods:*** Radiographers' chest radiation exposure during routine clinical practice with 100 $^{[18F]}$FDG PET/CT examinations was prospectively recorded with thermoluminescent dosimeters from December 2023 to February 2024. In 50 cases the examinations were handled using a commercially available automated preparation and injection system, while in the remaining 50 a manual preparation and administration technique was employed. In both cases, the stages of the operational chain evaluated are: $^{[18F]}$FDG vial insertion, activity preparation, $^{[18F]}$FDG intravenous injection, and patient positioning. ***Results:*** The mean individual chest radiation exposure for each PET/CT examination was 4.03 µSv ± 1.2 using the automatic preparation and administration technique, and 6.93 µSv ± 1.5 employing the manual preparation and administration technique. This resulted in a significant reduction of 41.85 % in chest radiation exposure with the automatic preparation and administration technique ($p < 0.05$). ***Conclusion:*** The use of an automated preparation and injection system holds the potential for a significant reduction of the radiation exposure of Nuclear Medicine radiographers. The results of this study aim to pave the way for an increase in the adoption of such systems in routine clinical practice, to the benefit of the whole Nuclear Medicine staff.

EP-1306

Personal radiation exposure in robotic arm assisted FDG PET/CT guided biopsy

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Aim/Introduction: Positron emission tomography (PET/CT) -guided biopsy plays an important role in tissue diagnosis when the target lesion is unidentifiable through conventional imaging modalities and in the presence of necrosis which may result in inconclusive or false-negative histopathological results. However, PET/CT guided biopsy procedures result in radiation exposure to the physicians and staff performing the procedure which must be kept as low as possible according to ALARA principle. The main aim of our study was to find the personal radiation exposure to physicians and technologists during robotic arm-assisted F^{18} fluoro-deoxy glucose (FDG) PET-CT guided biopsy and to assess its relationship with procedure time. ***Materials and Methods:*** This is a prospective study done at a tertiary care institution. Institutional ethics committee approval was taken. All patients who were referred for ^{18}F FDG PET/CT guided biopsy from January 2024 to May 2024 were included. Informed written consent was taken. All patients were injected ^{18}F FDG followed by an uptake period. Then a limited field of view PET/CT was taken depending on the site of biopsy using a hybrid PET/CT scanner followed by confirmation of FDG uptake in site of biopsy and planning of biopsy path. Under robotic arm guidance, FDG PET/CT guided core biopsy of the target lesion was done. All persons (Physician and technologist) were provided with pocket dosimeters before the start of the procedure and individual radiation exposure was measured at the end of the procedure. ***Results:*** A total of 9 patients were included in our study. The mean age was 48 years and there were 4 males and 5 females. The site of biopsy was thorax in 4 patients and abdomen & pelvis in 5 patients. The median injected activity was 137±66 MBq. The median uptake time post FDG injection was 58 minutes. The median procedure time was 36±14 minutes. The mean radiation dose for physician and technologist were 2.3±1.8 µSv and 1.6±1.1 µSv respectively. There was no significant correlation between uptake time and radiation exposure for physician and technologist. However, we found a significant correlation between procedure time and radiation exposure to physician (p=0.05). ***Conclusion:*** The procedure time must be kept as low as possible to reduce the radiation exposure to the performing physician. However, in view of small sample size studies with larger sample size are needed to support our findings.

EP-1307

Dose rate measurements when working with Gallium 68

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Aim/Introduction: When using radiotracers labelled with gallium 68 (68Ga) we administer the tracer to the patient with a syringe and not an auto injector. Compared to Fluor 18 (18F) 68Ga results in a higher skin dose to the handler due to higher positron energy (68Ga: E max=1.89 MeV vs. 18F: E max = 0.634 MeV) [1]. Another study [1] has shown that 1 GBq of 68Ga in a 5 ml syringe, will result in a 8,7 mSv dose rate to the skin is enough to exceed the Norwegian 500 mSv skin dose limits for radiation workers in less than a minute. Shielding the user from positron exposure is therefore critical to reduce skin dose. Syringe shields made of tungsten is an efficient way of reducing the dose, but are unpractical due to weight. Shields made of polymethyl methacrylate (plexiglass) are easier to handle and have shown to reduce skin dose by stopping positrons, but do not reduce the dose received from gamma photons. We have investigated whether plexiglass syringe shields are useful in our workflow to reduce skin dose to the user.. ***Materials and Methods:*** A Thermo Radeye B20 was used as doserate meter. Two 1 ml syringes was prepared with 1 MBq of 18F and 68Ga respectively. Dose rates were measured at distances of 5, 15 and 30 cm. The syringes were measured unshielded and with shields of plexiglass, lead and tungsten. We used 1 MBq in the syringes to not exceed the dose rate limit of the dose rate meter at 2 mSv/h. ***Results:*** Our measurements show that the dose rate is 20 times higher for 68Ga than 18F. At 5 cm distance, the plexiglass shield reduces the dose rate by 97 %. In comparison, the tungsten shield reduces the dose rate by 99%. ***Conclusion:*** Plexiglass is adequate for shielding the user from positrons. Even though tungsten has higher efficiency in shielding the user, the weight is a considerable hindrance when preparing and injecting the tracer. ***References:*** [1] Kemerink GJ, Vanhavere F, Barth I, Mottaghy FM. Extremity doses of nuclear medicine personnel: a concern. Eur J Nucl Med Mol Imaging. 2012 Mar;39(3):529-32. doi: 10.1007/s00259-011-1973-z.

EP-1308

Potential utility of SPECT/CT based absolute quantification of ^{177}Lu-DOTATATE uptake and tumor volume in patients with inoperable/ metastatic neuroendocrine tumor for determining therapeutic efficacy.

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Aim/Introduction: 177Lu-DOTATATE has emerged as a promising theragnostic agent in neuroendocrine tumors (NET) facilitating post-therapy imaging and image-based quantification to measure the response to therapy. For dosimetry, necessary absolute quantification has become possible using quantitative SPECT/CT that can also be calibrated to provide standardized uptake values (SUV). The aim of the study was to quantify uptake and tumor volume in patients with inoperable/ metastatic NET using quantitative SPECT/CT and estimate the absorbed dose delivered in one cycle. ***Materials and Methods:*** The prospective study was performed in Department of Nuclear Medicine, PGIMER, Chandigarh. A total of 10 inoperable/ metastatic NET patients (6 F/4M; mean age 46±5; range 10-61 years) on 177Lu-DOTATATE were included in this study. Post-therapy regional quantitative SPECT/CT were acquired in all the patients and data was reconstructed and analyzed using QMetrix software for absolute uptake, SUVmean and tumor volume and compared for consecutive post-therapy scans for the efficacy of therapy. Wilcoxon signed-rank test (W) was applied to see the difference in value of the quantitative parameters (significance level p=0.05). The mean absorbed dose for tumor was also estimated using MIRD. ***Results:*** The W-test showed statistically significant decrease in absolute uptake and absorbed tumor dose (z= -2.191, p=0.028), and SPECT SUVmean (z= -2.293, p=0.022) in the two consecutive cycles on SPECT/CT, showing the efficacy of therapy with statistically significant decrease in SUVmean b/w baseline and interim PET/CT. However no statistically significant difference was observed in tumor SPECT volumes (z=-.561, p=0.575) in the two consecutive cycles. An average mean dose of 11±7.2Gy was delivered to tumor in a cycle. ***Conclusion:*** Absolute Uptake of 177Lu-DOTATATE and SUV derived from quantitative SPECT/CT using Q.Metrix is reproducible and may be used for dosimetric analysis with higher accuracy with its utility in response evaluation to therapy. However, larger samples are required to confirm the results.

EP-1309

The practicalities and challenges of centre participation in multi-centre dosimetry based clinical studies

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Aim/Introduction: INSPIRE (ClinicalTrials.gov Identifier: NCT04391244) is an investigator-led prospective observational multi-centre clinical trial to investigate radiation dosimetry in 150 thyroid cancer patients treated with radioiodine. The aim of the current work was to identify considerations and challenges encountered by participating centres in this study, to inform future trials in this field. ***Materials and Methods:*** The present work evaluated the practicalities and challenges in patient recruitment, data collection and data analysis. As part of the INSPIRE study, questionnaires were sent to the 10 participating centres to determine the potential of centres to perform quantitative imaging, to identify variations in clinical practice with imaging timepoints, and to assess readiness to perform clinical dosimetry. ***Results:*** Across all sites, to-date 74 patients have been approached for INSPIRE, with 26% declining due to concerns including radiation exposure and treatment anxiety. Data collection revealed variations in post-therapy imaging protocols, ranging from 24 hours to 7 days, including differences in whole-body, SPECT, and SPECT/CT imaging, potentially leading to inadequate data collection. Additionally, discrepancies were noted in the extent of biochemical data collection before radioiodine therapy. Challenges such as CT artefacts and saliva uptake complicated thyroid and salivary gland data analysis, further affected by variations in patient positioning. The set-up questionnaire indicated that 4 out of 20 SPECT/CT systems were previously calibrated for Iodine-131 quantitative imaging. Survey results showed barriers to local dosimetry calculations, including insufficient staffing (67%), camera availability (67%), clinical demand (56%), and lack of reimbursement (44.4%). Two sites performed dosimetry post-Iodine 131 therapy for research and radiation advice. Centres reported that technologists/radiographers, physicists, clinicians, and nurses were involved with I-131 administrations. ***Conclusion:*** As part of this non-interventional, observation study, challenges in data collection were observed due to local differences in standard of care across the INSPIRE sites, potentially leading to missing or inconsistent data. Communication with sites was found to be essential for the acquisition of consistent data, such as standardisation of patient positioning for accurate dosimetry calculations. The involvement of multiple staff groups in I-131 therapy is encouraging. Acknowledging and addressing these difficulties will help assess readiness for future multi-site dosimetry studies.

EP-1310

Construction and preclinical evaluation of a ^{68}Ga-labeled peptide-based PET probe for imaging TIM-3 expression in preclinical tumor models

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Aim/Introduction: T cell immunoglobulin and mucin domain-containing-3 (TIM-3) is an immune checkpoint expressed mainly on CD4+ and CD8+ T cells. In addition to negatively regulating inflammatory T cell function, TIM-3 is a promising immunotherapy target. Herein, it is necessary to develop an immuno-positron emission tomography (immunoPET) probe for noninvasively characterizing TIM-3 expression and our goal is to develop a first-in-class peptide-based positron PET probe for imaging TIM-3 in various animal models. ***Materials and Methods:*** The lead compound NOTA-GK12 was radiolabeled with 68Ga in NaAc-buffer at pH 4 (100°C, 10min). The stability and purity of [68Ga]Ga-GK12 were measured by Radio-HPLC. Cellular uptake assays were performed using the human peripheral blood mononuclear cells (hu-PBMCs), which were activated by IFN-γ. Micro-PET/CT imaging was conducted with [68Ga]Ga-GK12 at 0.5 h p.i in hu-PBL-SCID (PBL) mice and NOD-scid IL2Rgamma null (NSG) mice. Immunohistochemical and HE staining studies were also carried out using the tissue of mice models. ***Results:*** The radiochemical yield of [68Ga]Ga-GK12 was 82.76 ± 6.37% and the radiochemical purity (RCP) of the tracer was more than 99%. For in vitro stability, the tracer incubated in saline and serum maintained relatively high stability (RCP>95%). Cellular uptake experiments confirmed that the uptake of [68Ga]Ga-GK12 in activated PBMCs was significant higher than that in normal PBMCs at each time point. Until 17 days after injection of PBMCs, the prominent [68Ga]Ga-GK12 uptake (1.81 ± 0.17 % ID/g) was observed in the spleen of PBL mice, while hardly any uptake was observed in NSG mice without PBMC injection. IHC staining of spleen in PBL and NSG mice illustrated the TIM-3+ lymphocytes infiltrate, corresponding with the uptake of [68Ga]Ga-GK12 as delineated by PET. ***Conclusion:*** [68Ga]Ga-GK12 enables easy radiosynthesis and shows excellent in vitro and in vivo TIM-3 targeting characteristics.The high spleen uptake of PBL mice at early imaging time points demonstrate the feasibility of [68Ga]Ga-GK12 for imaging of TIM-3 expression in vivo models. These results demonstrate the feasibility of [68Ga]Ga-GK12 immunoPET in tracking TIM-3 and highlight a new opportunity to optimize TIM-3-targeted immunotherapies.

EP-1311

^{68}Ga-labeled peptide-based PET radiotracers for imaging PD-L2 expression in lung cancer

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Aim/Introduction: Programmed Death Ligand-2 (PD-L2), another crucial immune checkpoint molecule interacting with PD-1, correlates with the efficacy of various tumor immune therapies. What's more, we investigate the expression of PD-L2 in non-small cell lung cancer (NSCLC) patients following anti-PD-1 therapy and its predictive value for clinical survival outcomes. Herein, it is necessary to develop PET radiotracers for noninvasively characterizing PD-L2 expression and our goal is to develop first-in-class peptide-based PET radiotracers for imaging PD-L2 in lung cancer. ***Materials and Methods:*** The lead compounds NOTA-HN11-1 and NOTA-HN11-2 were radiolabeled with 68Ga in NaAc-buffer at pH 4 (100°C, 10min). The stability and purity of [68Ga]Ga-HN11-1 and [68Ga]Ga-HN11-2 were measured by Radio-HPLC. Cellular uptake assays were performed using the transduced PD-L2 expressing lung cancer cell line A549 (A549-PD-L2) and wild-type A549 cells as negative control. Micro-PET/CT imaging was conducted with [68Ga]Ga-HN11-1 and [68Ga]Ga-HN11-2 at 1 h p.i in A549-PD-L2 mice and A519 mice. Immunohistochemical and HE staining studies were also carried out using the tissue of mice models. ***Results:*** The radiochemical yield of [68Ga]Ga-HN11-1 and [68Ga]Ga-HN11-2 were 84.16 ± 6.17% and 82.53 ± 5.95% respectively. The radiochemical purity (RCP) of both tracers were more than 99% and the stability of both tracers were high (RCP>95%) in saline and serum. Cellular uptake experiments confirmed that the uptake of [68Ga]Ga-HN11-1 in A549-PD-L2

cells was 4.51 ± 0.04%, which was 3 times that of [68Ga]Ga-HN11-2 ($P < 0.001$, $n = 5$). Dynamic PET imaging of [68Ga]Ga-HN11-1, [68Ga]Ga-HN11-2 were performed in A459-PD-L2 tumor xenograft models. At 10, 20, 30, 40, 50 and 60 min after injection, the tumor uptake values of [68Ga]Ga-HN11-1 were 2.61 ± 0.16 %, 2.97 ± 0.18 %, 3.36 ± 0.29 %, 3.22 ± 0.23 %, 3.06 ± 0.36 %, and 2.76 ± 0.42 %ID/g in A459-PD-L2 tumor xenograft models. These values notably exceed those observed in the [68Ga]Ga-HN11-2 group, which were 1.71 ± 0.14 %, 2.17 ± 0.12 %, 2.29 ± 0.17 %, 2.10 ± 0.03 %, 1.97 ± 0.07 %, and 1.82 ± 0.06 %ID/g. Immunohistochemistry showed that A549-PDL2 was highly expressed in A549-PDL2 mice. ***Conclusion:*** We successfully synthesized two peptide-based PET radiotracers with high yield and purity. [68Ga]Ga-HN11-1 showed better imaging capability for PD-L2 than [68Ga]Ga-HN11-2 in both cell and animal experiments. Experiments results also demonstrate the feasibility of [68Ga]Ga-HN11-1 immunoPET in tracking PD-L2 and are encouraging for further clinical applications of screening potential beneficiaries of ICI therapy.

EP-1312

A Promising PET Imaging Agent Targeting Asialoglycoprotein Receptors for Assessing Liver Disease Severity

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Aim/Introduction: The survival of patients with liver diseases heavily relies on the competent residual liver function. Given the significant difference in the number of asialoglycoprotein receptors (ASGPR) present on the parenchymal cell membrane between a normal and a diseased liver, imaging of asialoglycoprotein receptors offers a sensitive method to distinguish between healthy and diseased liver tissues. Ga-68 Hexa-Lactoside, developed at our institute, demonstrates effective targeting of the asialoglycoprotein receptors on the hepatocyte membrane. This study aims to explore its potential in assessing the severity of chronic hepatitis and liver cancer. ***Materials and Methods:*** Thirty subjects scheduled for hepatic carcinoma surgery were selected to measure residual liver function using Ga-68 Hexa-Lactoside and Computer Tomography Volumetry (CTV), respectively. Each subject received a single intravenous injection of approximately 2 mCi of Ga-68 Hexa-Lactoside (40μg). Conventional liver function tests, including Fibroscan, Indocyanine Green Excretion Rate, and Histopathological Examination, were conducted to assist in the evaluation. ***Results:*** Ga-68 Hexa-Lactoside sensitively detects changes in liver disease severity, offering an assessment tool for chronic hepatitis and liver cancer. It provides a more accurate delineation of hepatoma, differentiates benign from malignant lesions, and evaluates liver function. This plays a crucial role in future clinical diagnosis and decision-making. The intravenous administration of Ga-68 Hexa-Lactoside showed no toxicological findings. ***Conclusion:*** The clinical utility of Ga-68 Hexa-Lactoside hinges on its binding to the asialoglycoprotein receptor on the hepatocyte surface. In hepatoma patients, the number of ASGPRs is significantly reduced. The unique information provided by Ga-68 Hexa-Lactoside, which is not readily available through other methods, will enable physicians to clearly visualize the severity of liver disease and the hepatoma region, thereby facilitating accurate planning for hepatectomy.

EP-1313

Optimization study of radiopharmaceutical activity measurements of the automated dose activity dispenser

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Aim/Introduction: Quantitative imaging in nuclear medicine procedures is becoming increasingly important in the diagnosis and staging of cancer. Radiation measurements should be performed with the highest possible accuracy to avoid systematic errors. The aim of this study was to investigate the most efficient method of deriving activity measurements in a well-type dose calibrator that uses a reentrant ionization chamber ***Materials and Methods:*** An automated dose activity dispenser, a commercial well-type dose calibrator, and 740 MBq of the radiopharmaceutical ^{18}F-FDG were used for the measurements. First, the point of highest activity reading within the dose calibrator well (effective point) was determined. Since the automated dispenser positioned the syringe 8 cm away from this point, a tube extension was added. Activity measurements, ranging from 185 MBq to 444 MBq, which are commonly used in clinical practice, were then performed with and without the extension. Finally, the shielding factor, calculated from the ratio of activity measurements with and without shielding using the three available configurations, was determined ***Results:*** The effective point of the dose calibrator was found at 5 cm from the bottom and 20 cm from the top of its well chamber. The measurements taken with and without the tube extension, showed a difference of 27±5 % of their values and the shielding factor was calculated at the value of 6,1 ***Conclusion:*** Proper calibration of the dose calibrator is essential for obtaining reliable activity measurements. This is a critical step before performing quantitative imaging procedures, such as PET/CT scans, which rely on accurate activity values ***References:*** 1.Zimmerman BE, Cessna JT Experimental determinations of commercial dose calibration settings for nuclides used in nuclear medicine. Appl. Radiat.isotop.2000 52, 615-619.

EP-1314

In-house synthesis of ^{99m}Tc Ethambutol as a tubercular imaging agent: Experience from tertiary centre

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Aim/Introduction: Ethambutol is a popular antitubercular agent used in the treatment of tuberculosis. We aimed to label the drug with 99mTechnetium in house to assess its utility in various clinical settings. Data pertaining to its labelling efficiency and various other parameters from a large number of in house synthesis procedures is presented here. ***Materials and Methods:*** Labelling procedure described in literature was standardized for in house synthesis and carried out under aseptic precautions. To 3.5mg Ethambutol, aqueous solution of 10mg/mL mannitol was added followed by 2mg pyrophosphate, 0.5mg stannous hydrochloride, and 99mTc pertechnetate. Solution was incubated at room temperature and then passed through 0.22um Millipore filter. Standardization was done for amount of ethambutol, mannitol, SnCl2, amount of radioactivity and incubation period to attain the highest labelling yield. 60 in-house synthesis of 99mTc ethambutol were performed over a period of 40 months from November 2019 to April 2024. Visual analysis was done to check for the colour

and clarity of solution, pH was determined using litmus paper and radiochemical purity was tested by paper chromatography. 101 patients were injected, followed by sequential imaging to study bio-distribution and to assess uptake in suspected lesions. ***Results:*** Mean starting activity was 25.80±3.41 mCi averaged over 60 synthesis, out of which 4.88±1.70 mCi was retained in the filter and average of 15.75±3.53 mCi was received after filtration. Average 90.65±12.44% labelling efficiency was obtained with >90% in 47 synthesis showing satisfactory bio-distribution in the form of liver, kidneys, bladder and gall bladder activity, with no evidence of free pertechnetate. Very few scans, in-vivo colloid formation was seen characterised by enhanced liver and bone marrow uptake. Reduced labelling yield and/or increased in vivo colloid formation was observed to be most likely associated with stale elution, increased preparation time or inappropriate mixing order. No patients reported any early or delayed adverse effects. ***Conclusion:*** Inhouse labelling was standardised successfully with reproducible labelling yield. Long duration between elution and synthesis, mixing order of the chemicals was observed to play crucial role in determining efficacy of the labelled product, however 80% of the times the labelling efficiency exceeded 90%. Inhouse labelling has a distinct advantage of ready availability as per patient needs. ***References:*** 1.Kartamihardja, A.H.S., Kurniawati, Y. & Gunawan, R. Diagnostic value of 99mTc-ethambutol scintigraphy in tuberculosis: compared to microbiological and histopathological tests. Ann Nucl Med 2018, 32 60-68.2. This study was funded by ITR division, ICMR, New Delhi.

EP-1315

Inhouse synthesis of ^{99m}Tc-Ubiquicidin (29-41) as an infection imaging agent: Experience from a tertiary center

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Aim/Introduction: 99m Tc- Ubiquicidin is an cationic antimicrobial peptide helpful in diagnosis of infection. In the present study, we present data from inhouse synthesis of 99mTc UBI 29-41 over four years. ***Materials and Methods:*** Briefly, to 50ug Ubiquicidin, buffered 99mTcO4- and stannous hydrochloride was added followed by incubation at room temperature. After passing through millipore filter (0.22um) and saline addition, radiochemical purity was analyzed. One hundred and nine in-house syntheses were performed using the aforementioned method. Standardization was done for amount of Ubiquicidin, SnCl2, amount of radioactivity, pH and incubation period to attain the highest labelling yield. ***Results:*** A total of 109 syntheses were carried over a period of 42 months. A total of 122 patients underwent imaging with 99m Tc- UBI. Out of 109 syntheses, 11 syntheses were cold kit based (procured from a commercial supplier). In the remaining 98 syntheses, mean labelling efficiency was 94.24±10.46%. In the initial 8 syntheses reaction pH was kept 3-4 which showed in-vivo colloid formation with visualization of liver, kidneys, bladder and spleen. In rest of the 90 syntheses when reaction pH was kept at 7-8, tracer uptake was observed in kidneys and bladder with minimal liver and no spleen uptake. Reduction in amount of SnCl2 from 2.5mg to 30ug and its prompt handling during the synthesis, improved the labelling efficiency of the final product. Mean retained radioactivity in the millipore filter was 5.68±4.05mCi and in the filtrate was 11.21±4.23 mCi. ***Conclusion:*** Procedure of In-house radiolabelling of 99mTc UBI was standardized with consistent labelling efficiency and satisfactory biodistribution. It is a simple, cost effective procedure but factors such as reaction pH, SnCl2 amount need stringent control. Inhouse labelling has a distinct advantage of ready availability as per patient needs. ***References:*** 1. Sarda-Mantel L, Saleh-Mghir A, Welling MM, Meulemans A, Vrigneaud JM, Raguin O, Hervatin F, Martet G, Chau F, Lebtahi R, Le Guludec D. Evaluation of 99m Tc-UBI 29-41 scintigraphy for specific detection of experimental Staphylococcus aureus prosthetic joint infections. European journal of nuclear medicine and molecular imaging. 2007 Aug;34(8):1302-92.Arjun C, Mukherjee A, Bhatt J, Chaudhari P, Repaka KM, Venkatesh M, Samuel G. Studies on batch formulation of a kit for the preparation of the 99mTc-Ubiquicidin(29-41):An infection imaging agent. Applied Radiation and Isotopes.2016;107:8-123. This study was funded by ITR division, ICMR, New Delhi

EP-1316

Validation of radiosynthesis and first in-human dosimetry of 68Ga-NOTA-UBI-29-41: A Proof of Concept study

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Aim/Introduction: Antimicrobial peptides (AMPs) like UBI-29-41 offer a distinctive approach for precise detection due to their unique interactions with bacteria and makes them promising candidates for specific and selective imaging. The aim of the study was to validate the in-house manual synthesis of 68Ga-NOTA-UBI-29-41, evaluate its uptake in patients with suspected infection and estimation of patient-specific dosimetry to ensure optimal clinical application. ***Materials and Methods:*** 68Ga-NOTA-UBI-29-41 was synthesized by adding the variable amount of UBI-29-41 (60-90µg) to 555MBq of Ga-68 in 0.05M HCl and heating the reaction mixture at 90°C for 12 mins at pH:3.5-4 to obtain the radiotracer with high radiochemical purity (RCP) and high yield. 68Ga- NOTA-UBI-29-41 PET/CT scans at variable timepoints were done to assess its biodistribution and maximum uptake time. Furthermore, patient specific dosimetric estimation were done using the HERMES software. ***Results:*** 5µg /37MBq (5µg/mCi) of NOTA-UBI-29-41 at 90°C for 12 mins were the optimal parameters to obtain 88-90% of yield and 98-99% of radiochemical purity. 68Ga-NOTA-UBI-29-41 showed high renal excretion and rapid blood clearance. PET/CT imaging (n=8) at 60mins post injection was found to be the optimal time for imaging with 68Ga-NOTA-UBI-29-41. The critical organ was the urinary bladder wall with a mean dose of 138.02 ± 58.48µSv/MBq followed by 53.81 ± 31.23µSv/MBq for kidneys with a mean effective dose of 1.52 ± 0.64mSv. ***Conclusion:*** The protocol for in-house manual labelling of 68Ga- NOTA-UBI-29-41 was reproducible providing high yield and radiochemical purity. 68Ga-NOTA-UBI-29-41 administration was found to be safe and non-toxic. The favourable tracer biodistribution and the first-in-human patient-specific dosimetry ensures optimal clinical application.

EP-1317

In-house synthesis of 68Ga NOTA UBI as an infection imaging agent: Experience from tertiary centre

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Aim/Introduction: UBI is a synthetic antimicrobial peptide, which

when labelled with 68Ga using NOTA as the bifunctional chelating agent is helpful in better diagnosis of infection. We labelled NOTA-UBI with 68Ga in-house to analyse its utility as an infection imaging agent. ***Materials and Methods:*** Manual synthesis procedure was performed using 12-15 mCi buffered 68GaCl3, to which 150-450ug NOTA UBI was added followed by incubation at 90°C for 15 minutes. It was then passed through the charged C-18 cation exchange cartridge and subsequently flushed using the solution of 50% Ethanol with 50% ultrapure water, 10 ml saline and 10 ml air. Final eluate was received in product vial and filtered using a 0.22um Millipore filter. Radiochemical purity was analysed using ITLC SG and sodium citrate. A total of 35 patients were recruited in the study between December 2022 to August 2024. ***Results:*** A total of 24 synthesis were performed with an average of 322.85±98.54ug of peptide(NOTA UBI). Mean 10.76±3.28 mCi of radioactivity was used, out of which only 0.9±0.3 mCi was retained in the C-18 cation exchange cartridge. 6.59±2.85 mCi of radioactivity on an average was received finally, ensuring the radioactivity yield of 57.57±13.56%. Reproducible labelling efficiency was observed with mean 94.38±4.34%. Tracer showed normal bio-distribution with physiological uptake in liver, kidney, and urinary bladder in all patients with pathological uptake at site of disease in some patients. ***Conclusion:*** In-house labelling of NOTA-UBI with 68 Ga can be performed on a routine basis with acceptable radioactivity yield, consistent labelling efficiency and good in-vivo representation. Clinical indications of 68 Ga NOTA-UBI PET/CT are currently being explored. ***References:*** 1. Ebenhan T, Sathekge MM, Lengana T, Koole M, Gheysens O, Govender T, Zeevaart JR. 68Ga-NOTA-Functionalized Ubiquicidin: Cytotoxicity, biodistribution, radiation dosimetry, and first-in-human PET/CT Imaging of Infections. Journal of Nuclear Medicine. 2018 Feb 1;59(2):334-9.2. This study was funded by ITR division, ICMR, New Delhi.

EP-1318

Production of ^{68}Ga-labeled DOTATOC and PSMA-11 in the same automated module: Our one-year experience

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Aim/Introduction: The use of 68Ga on the strength of worldwide growth in positron emission tomography (PET) as well as radionuclide ligand therapy (RLT) has been considerably increased, especially during the last two decades. Due to clinical needs and short half-life of 68Ga, it is important to maintain the consistency of 68Ga radiopharmaceuticals for in-house production. Here, we introduce our one-year experience with a cassette-type automated module (BIKBox®) was used for producing of 68Ga-PSMA-11 and 68Ga-DOTATOC in our hospital. ***Materials and Methods:*** The eluted 68GaCl3 from 68Ge/68Ga generator (iThemba Labs) by the help of 0.6 N HCl (2.5 mL) was transferred to BIKBox® (BIK Therapeutics) contained the precursor (20 µg for 68Ga-PSMA-11 and 50 µg for 68Ga-DOTATOC) and HEPES buffer (600 mg, pH 4). After 68Ga-labeling at 100 oC for 10 minutes, the product was purified on a tC18 cartridge and then passed through a 0.22 µm sterile filter for the final formulation. The quality control of 211 batches of 68Ga-PSMA-11 and 49 batches of 68Ga-DOTATOC were performed under EP guidelines from May 2023 to April 2024. ***Results:*** 68Ga-PSMA-11 and 68Ga-DOTATOC were successfully produced with 72.0 ± 2.5% (n = 211) and 66.3 ± 4.3% (n = 49) radiochemical yields, respectively, at end of synthesis. The total synthesis time was 27 minutes from the elution of 68Ge/68Ga generator to the final formulation. The radiochemical purity of 68Ga-radiopharmaceuticals was continuously reported greater than 99% by the radioTLC scanner. The final products were determined to be sterile, colorless and pH 6-7. ***Conclusion:*** Based on our results, two 68Ga-radiopharmaceuticals were well established in the one automated module was shown the applicable performance for routine clinical use without critical failures.

EP-1319

Successful applicability of 68Ga-UBI for debridement surgery in chronic osteomyelitis patient.

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Aim/Introduction: Identifying the source of infection during debridement surgery in patients with chronic osteomyelitis is crucial for successful treatment. In this context, antimicrobial peptides, such as the 29-41 fragment of Ubiquicidin (UBI29-41) labeled with PET radionuclides, emerge as a radiopharmaceutical for identifying infectious processes. This study aims to describe the adapted radiolabelling and quality control processes of 68Ga-UBI under GMP conditions at the hospital radiopharmacy. In addition, we report a successful case of a patient referred for a PET/CT with this tracer as a preoperatory planning of a surgical debridement for chronic osteomyelitis. ***Materials and Methods:*** The 68GaCl3 was eluted with 0.1 M HCl through a cationic filter, which was extracted by 5N NaCl/ 5.5N HCL into the reaction vial, reacting with 50µg of DOTA-UBI (29-41) of acetate buffer pH = 4.5. After 15 minutes at 90oC, the product was purified by a SepPak C18-Plus cartridge. The radiochemical yield was determined, as well the radiochemical purity, by Sep-PakC18 and ITLC-SG strip, confirming the stability at room temperature until 120 minutes by uHPLC.The radiochemical purity remained >97% for up to 120 minutes. The radiochemical yields and purity were 78±11% and 97.7±2%, respectively (n=12), resulting in a sterile and endotoxin-free final product. The 68Ga-UBI PET/CT was performed on Biograph mCT 40 PET/CT scanner (Siemens Healthineers); the image began 60 minutes postinjection of the radiotracer. ***Results:*** To demonstrate the successful applicability of this tracer, we report a 39-year-old patient who had several surgical cleanings associated with prolonged antibiotic therapy because of an infected pseudoarthrosis after a comminuted fracture of the right tibia. PET/CT images revealed 68Ga-UBI focal uptake suspicious to bacterial infection in the edges of the pseudoarthrosis cavity, in adjacent deep soft tissue and in a cutaneous fistula in the right leg. Surgery for local cleaning was performed and culture of a specimen collected from the surgical site confirmed the presence of Staphylococcus aureus corresponding to the areas of abnormal 68Ga-UBI uptake. Clinical exam and laboratory tests after surgery demonstrated no signs of infection. ***Conclusion:*** The 68Ga-UBI synthesized in a hospital radiopharmacy included all the characteristics for a radiopharmaceutical to be administered intravenously. In the present case, 68Ga-UBI PET/CT, a non-invasive imaging modality, identified the infectious foci in vivo, indicating its potential clinical use for surgical

EP-1320

^{18}F-FDG PET/CT for detection and follow-up of immune-mediated hepatitis: a case report.

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Aim/Introduction: Immunotherapy has increased the life expectancy of cancer patients but has also resulted in an increase in immune-related adverse events (IRAEs) due to drug toxicity. This report demonstrates the importance of ^{18}F-FDG PET/CT for early detection and monitoring of hepatitis caused by immune-mediated toxicity. ***Materials and Methods:*** A 62-year-old male patient with melanoma showed a focal ^{18}F-FDG uptake in a non-calcified nodule in the basal segment of the left inferior lobe of the lungs. The nodule was 0.8 cm in size (SUV=2.5). A follow-up ^{18}F-FDG PET/CT scan, conducted six months after the initial diagnosis, demonstrated increased size and radiopharmaceutical uptake in the pulmonary nodule. It now measures 1.4 cm (SUV=14.6), which is suspicious of metastasis. The medical recommendation was to start treatment with a combination of ipilimumab/nivolumab (ipi/nivo) and repeat the ^{18}F-FDG PET/CT scan after three treatment cycles. ***Results:*** The new scan carried out in January 2024 showed a reduction of pulmonary nodule dimensions. However, there was also new glycolic hypermetabolism in cervical, axillary, pulmonary hilar, upper abdominal, and retroperitoneal lymph nodes. Furthermore, there was an increase in the dimensions and ^{18}F-FDG uptake in the liver, possibly due to inflammation. After the PET/CT scan, the laboratory tests reported increased serum hepatic enzyme levels. A liver biopsy confirmed acute immune-mediated hepatitis. As a result, the immunotherapy was immediately suspended, and the standard corticoid treatment was initiated. Following a 3-month treatment period, a new ^{18}F-FDG PET/CT scan was carried out. It revealed the total absence of abnormal lymph node uptake, a reduction in the liver's ^{18}F-FDG uptake and dimensions, and a decrease in hepatic enzyme levels, confirming the reversal of immune-mediated toxicity. Despite the excellent response rate, therapies based on the combination of ipi/nivo increase the risk of irAEs, one of which is immune-mediated hepatitis, which can be lethal in critical cases. In such patients, immediate interruption of immunotherapy should be mandatory. Because ^{18}F-FDG PET/CT is essential for monitoring melanoma patients, reports of the detection of irAEs have become increasingly frequent. In this context, it can be inferred that the probability of observing irAEs increases with the widespread use of immunotherapy. ***Conclusion:*** This report provides evidence that, in addition to its usefulness for disease staging,^{18}F-FDG PET/CT is an essential tool for detecting and following up on irAEs in melanoma patients.

EP-1321

The impact of the duration of the hypoglycemic diet for the study of endocarditis by ^{18} F-FDG PET-CT - Case study

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Aim/Introduction: Endocarditis can lead to acute complications and significant costs to hospitals. PET-CT with $^{[18F]}$FDG has demonstrated to play a pivotal role in diagnosing challenging cases of endocarditis and its associated complications. A strict hypoglycemic and hyperproteic diet prior to the exam is essential to minimize the physiological expression of heart GLUT4, thus ensuring accurate results. Clinical assessment is performed prior to the exam, to ensure patients' adherence to the prescribed diet. Nevertheless, communication challenges often arise, and patients frequently struggle to comply with the diet, compromising exam results, resulting in rescheduling, or repeating the exam. Our aim was to outline various hypoglycemic diet protocols lasting for 12, 24, and 72 hours, with the goal of reducing physiological uptake by the heart during endocarditis scans, as demonstrated through a case report. ***Materials and Methods:*** A 73-year-old male, non-diabetic, underwent a 43-day course of targeted antibiotic therapy for infective endocarditis involving a biological valve, caused by E. faecalis. After completing the treatment, a PET-CT with $^{[18F]}$FDG was requested to evaluate any remaining peri-valvular complications. However, due to communication issues, 3 separate separate scans were required to complete the procedure and answer the clinical question. The first scan was conducted after a 12-hour fasting period. For the second and third scans, the patient followed hypoglycemic diets lasting 24 and 72 hours, respectively. All procedures were performed on a PET-CT digital scanner (whole body, 2 minutes per bed with respiratory movement digital correction). Additionally, cardiac assessment was conducted for 10 minutes, synchronized with a 4 lead ECG. The time between scans and the dose of radiopharmaceutical were adjusted in accordance with the recommended guidelines by the specialist physicist, to minimize radiation exposure to the patient. ***Results:*** In the first scan, intense physiological uptake of $^{[18F]}$FDG was observed in the myocardium. In the second scan, there was a reduction in $^{[18F]}$FDG uptake, although some peri-valvular focal uptake was seen, that proved challenging to evaluate. In the final scan, no $^{[18F]}$FDG uptake was observed in the myocardium, and no signs of peri-valvular infection were detected. ***Conclusion:*** This case highlights the challenges in communication and information disclosure with patients. Frequently, patients require guidance from healthcare professionals to comprehend the dietary instructions and adhere to them accurately. Additionally, it emphasized the advantages of a 72-hour hypoglycemic diet compared to a 24-hour regimen, as it yields more precise and sensitive outcomes in the targeted area.

EP-1322

Lutetium-177 therapy and the role of the medical assistant

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Aim/Introduction: The number of 177Lu-therapies at our hospital has increased almost fivefold over the past eight years. This resulted in an higher workload for the nurses in the clinical/radionuclide therapy ward. Timing is crucial when working with radioactivity and due to the elevated workload it is often challenging to adhere to the Lutetium-177 administration timeframe. To ensure a seamless procedure, decrease the nurses workload and enhance patient service, medical assistants (MA) from the nuclear medicine department are taking over 'extended arm' nurses tasks at our radionuclide therapy ward since 05-2023. The aim of this research is to assess the added value of MA at the radionuclide therapy ward, particularly identifying their specific contributions and how to further enhance collaboration with the nurses. ***Materials and Methods:*** In 01-2024 an online questionnaire was sent to disciplines involved in 177Lu-therapies (nurses, nuclear physicians, technical physicians and nuclear technologists). Questions concerned the added value of MA's by word and rating (-3 till +3) and how the MA can further contribute in the 177Lu-therapy workflow. By gathering these insights, the

role and opportunities for improvement of this new collaboration became more clear. ***Results:*** All 20 responders expressed positive feedback to the added value of the MA at the therapy ward; 12/20 rated score 3, 8/20 rated score 2. Taking over tasks such as admission interviews, preparing materials, placing intravenous drips and answering patient questions lowers the nurses workload. The MA facilitates easy communication between the ward, administering team from the nuclear medicine department and the patient. This enables swift action in case of clinical queries resulting in better patient service and recognition. Task expansion suggestions were also made. Assisting by observing the patients wellbeing during administration may facilitate parallel administration of multiple patients. The MA's knowledge and experience in working with radioactivity could be utilized for correct handling in case of contaminations and releasing the radiation chambers after use. Taking over administrative actions concerning the Electronic Health Records would further enhance efficiency. Currently, the MA is locally not authorized to report anamnesis, perform second verification during 177Lu-therapies and medication administration, or dispense prescribed medication. However authorization for these tasks is being reconsidered. ***Conclusion:*** The MA adds value to the administration of 177Lu-therapies. Both in lowering the nurses workload and enhancing communication. Altogether these tasks are an extension and opportunity for growth in the occupation of the MA in the nuclear medicine department.

EP-1323

Hypnosis in nuclear medicine: Where, when, and how?

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Aim/Introduction: Since a year, we have been providing a support with the use of hypnotic techniques administered by a nuclear medicine technologist to our patients needing help to undergo their examination. ***Materials and Methods:*** A nuclear medicine technologist was trained to obtain a certificate of advanced studies in art and hypnotic techniques in the fields of health and social work. Data were acquired by direct observation of the patients by the nuclear medicine technologist team and by collecting the patient feedback at the end of the examination. ***Results:*** During the first year, 41 hypnotic supports have been realized, lasting an average of 38.5 minutes. The median duration was ≤45 minutes for 98% of patients with an excellent success rate of 98% (1 failure). The techniques used were formal hypnosis (66%), conversational hypnosis (19%) and combined formal and conversational hypnosis (15%). Most of the request (54%) came from patients themselves, 39% from referring or nuclear medicine and 7% from the nuclear medicine technologists. Requests mainly came from cardiology (23%), gynecology (23%) and oncology (18%). Most (65%) hypnosis supports have been realized for PET/CT imaging, while 19% for SPECT/CT imaging and 2% for radioactive therapy treatment. Most frequently, hypnosis support was for image acquisition due to claustrophobia (73%) and 20% for pain management during radiopharmaceutical injections or venous line placement. The remainder cases were associated with general anxiety about radioactivity, fear of diagnosis and others. ***Conclusion:*** Our experience shows that the use of hypnosis during the imaging has several advantages: (1) reduced anxiety and stress with improvement patient comfort and increase of a successful examination; (2) reduced pain associated with radiopharmaceutical injections and reduced negative experience of side effects; (3) realization of examinations likely to fail due to claustrophobia; and (4) better relaxation of patients during image acquisition and decrease of spurious motion related to a lack of comfort. Hypnosis in nuclear medicine is promising, as it improves patient experience and quality of examinations for claustrophobic and/or painful patients. Our first-year experience is very positive and patient feedback very encouraging. The use of hypnotic techniques has enabled the imaging of several patients for whom we had expected examination failure. This success and the increase in hypnosis support demand has prompted us to train a second nuclear medicine technologist in 2024.

EP-1324

Optimization of storage and disposal of solid radioactive waste in a nuclear medicine department

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Aim/Introduction: The generation of radioactive waste in solid, liquid, and gaseous forms that need to be managed safely to ensure that they are not dispersed in the environment is one of the major issues of the use of radioactive sources in Nuclear Medicine activities. Such management includes their collection, sorting, treatment, temporary storage in suitable places, and finally disposal. This process has a great impact on the management of the nuclear medicine department in terms of costs, time, responsibility, and dedicated staff. We aim to compare, in terms of cost-effectiveness, two ways to manage radioactive waste: i) delivery to an authorized private disposer; ii) storage in the hospital until complete decay (< 1KBq/Kg) to proceed later with their disposal as general medical waste. ***Materials and Methods:*** Management Control provided the data regarding the expenses for radioactive waste disposal incurred by our hospital in 2022, by comparing with a possible complete in-house management. We have performed an estimation of solid waste volumes, an assessment of local storage requirements, a cost analysis of the renovation of the storage room, an estimation of staff hours and the purchase of a system for automatic release authorization. ***Results:*** The waste delivered to an authorized disposer, who provides the transport drums and arranges for their collection, has the main advantage of having less legal and administrative responsibilities of the employer, in the face of higher operation costs. However, the savings produced by the in-house management are greater than 80% in the first year, nonetheless a greater amount of workload for the staff (approximately 300 hours/year). The savigings will be greater from the second year as the renovation expenses will be amortized. ***Conclusion:*** In conclusion, it is recommendable to set up an internal pathway within the hospital to store the radioactive waste generated on-site and then dispose it later as treated non-radioactive hospital waste, thus avoiding the need to deliver it to a private carrier with large savings in economic resources.

EP-1325

Undesirable events reporting in Nuclear Medicine: A necessary step towards continuous practice improvement

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Aim/Introduction: The management of undesirable events is a fundamental part of a Quality Assurance System as it helps improving safety of patients and healthcare staff through targeted actions that prevent incidents recurrence. We support

a "No-name, no-blame, no-shame" policy in our department, so that any employee can objectively and fearlessly report an event considered undesirable, via our institutional reporting platform. The aim of our retrospective study was to categorize the different reported undesirable events and identify the most recurrent ones to efficiently improve our overall quality assurance system. ***Materials and Methods:*** Data extracted from our institutional reporting platform are periodically analysed by a multidisciplinary group to identify recurrent issues and possible improvement. Reports received from January 2018 to December 2023 were analysed and divided into 5 categories: inter-departmental collaboration (e.g., miscommunication), patient care (e.g., incorrect patient preparation), scheduling flow (e.g., events impacting examination workflow), radiation protection (e.g., contamination events) or other cases (e.g., instrumentation and/or software failures). ***Results:*** Within the 6-year follow-up period, a total of 347 undesirable events were reported. Among these, 51 were related to inter-departmental collaboration, 82 to patient care, 83 to scheduling flow, 57 to radiation protection, and 74 other types of events. A peak of reporting was recorded in 2023, representing 26.6% of the overall cases. Since 2018, we have observed a constant increase of reporting undesirable events, mainly due to our policy of awareness-raising and non-punitive vigilance, as well as to the increase in the number of examinations carried out. All these reports lead us to reflect on our practices and promote continuous improvements in our department through constructive self-criticism. As part of our improvements, we have introduced targeted continuous training for healthcare staff, revised internal procedures and held discussions with the different departments to improve collaboration within our institution. ***Conclusion:*** These improvements have resulted in a better patient care policy and improved communications between healthcare professionals. The trend observed during this analysis is a direct consequence of the work performed within our department to raise awareness on the importance of adverse event reporting. This behaviour reflects the commitment of our healthcare professionals towards the continuous improvement of quality assurance system playing a crucial role in ensuring the safety of patients and healthcare staff and guarantees high-quality care.

EP-1326

Influence Of Patient's Arms Position On The Occurrence Of Motion Artifacts In Pet/Ct Imaging

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Aim/Introduction: PET/CT data acquisition is commonly performed with the patient's arms placed above the head during the examination. In cases where the patient is unable to place their arms above their head or when it is necessary due to clinical indication, patients have their arms down, which can lead to many artifacts. Aim of the research was to investigate whether differences exist in the presence of a motion artifact (uncorrected fusion) in the elbow area of PET/CT based on the patient's arms position. Additionally, we checked the impact of the patient's gender, body mass index (BMI) and the PET/CT system used to perform the examinations. ***Materials and Methods:*** The variable that we checked in the research was presence of motion artifacts (uncorrected fusion) on PET/CT images, depending on patient's arms position, gender, BMI and the PET/CT system. We retrospectively took a random sample of 119 patients who underwent a total body 18F-FDG (fluorodeoxyglucose) PET/CT examination. Examinations were performed in 2023 at the Department of Nuclear Medicine of the Institute of Oncology Ljubljana on Siemens Biograph mCT 40 and Biograph Vision PET/CT systems. After accessing the data, we made additional post-processing transverse plane fused PET/CT reconstruction in the elbow area for each case. These reconstructions were anonymously uploaded to the ViewDex 3.0 and evaluated by a nuclear medicine specialist. The collected data were analysed with Chi-squared tests in the SPSS Statistisc 20.0 with a significance level set at 5%. ***Results:*** Data analysis revealed statistically significant influence of patient's arms position on the occurrence of motion artifacts on PET/CT images (p≤0,001). The occurrence of motion artifacts was not statistically significant for the patient's gender (p=0,611), BMI (p=0,093) and the PET/CT system used to perform PET/CT examinations (p=0,742). ***Conclusion:*** 4.14% of patients with motion artifact had their arms positioned on their abdomen. On the other hand, 81.97% of those in whom motion artifacts did not occur had their arms positioned next to their body. ***References:*** 1. Corrigan A J G, Schleyer P J, Cook G J (2015). Pitfalls and artifacts in the use of PET/CT in oncology imaging. Semin Nucl Med 45:481-99. 2. Ledge M, Mhlanga J, Cho S, Wahl R (2011). Effect of patient arm motion in whole-body PET/CT. J Nucl Med 52:1891-7.

EP-1327

PET CT: Do we understand our patient's expectations?

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Aim/Introduction: The PET-CT department at St Barts Hospital provides patient care for the East London Region and beyond. PET imaging procedures particularly with $^{[18F]}$FDG and [82Rb]chloride are in constant high demand resulting in long patient appointment waiting times. Despite our service having implemented previously a robust booking system and recently increased service capacity and workforce, DNAs and cancellations remain to be a challenge. A preliminary audit between September and December 2023 of a total of 91 DNAs and cancellations for Rubidium procedures were carried out. Patient factors such as claustrophobia and non-compliant scan preparation were predominant, most of the time leading to cancellation on the day. As to ensure these could be tackled, we decided to improve the information offered to patients and empowered them to better understand PET-CT imaging. ***Materials and Methods:*** A survey of 500 patients was carried out on arrival to the department to understand how well prepared they were for their appointment. Dedicated staff contacted patients undergoing complex examinations to explain the full procedure and provide a risk assessment. While waiting for their examination, patients were given the opportunity to familiarize themselves with their specific journey in PET-CT scanning through text, media and video formats.Following the procedure, patients were invited to complete a questionnaire on their experience. A comparison of these patients experience with a control group was also performed. ***Results:*** Between September and December 2023, there were a total of 44 DNAs and 47 cancellations. The top three reasons in order were patient illness (12%), non-compliant scan preparation (11%) and claustrophobia/anxiety (8%). We are planning to carry out a further audit on DNAs and cancellations after all patients have completed this study. ***Conclusion:*** We aimed to improve patient experience when undergoing a PET-CT examination through the use of audit data. The outcome of this will increase patient wellbeing and improve service delivery for the NHS.

EP-1328

Adaptation of Nuclear Medicine procedures in the progressively older population (+65 years): studies in nuclear neurology and pneumology

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Aim/Introduction: The increase in life expectancy has led to a rise in the incidence of neurological and respiratory diseases in the elderly, resulting in a greater demand for Nuclear Medicine exams in these areas. However, it is crucial to adapt these procedures to the specific needs of this population, which faces challenges that may affect the performance of these exams. This study aimed to verify whether Nuclear Neurology and Pneumology procedures are properly adapted to the elderly population (+65 years) through questionnaires directed at Nuclear Medicine Technicians (NMTs), and to identify the most common adaptations. ***Materials and Methods:*** An online questionnaire via Google Forms, plus the informed consent, was sent by email to Nuclear Medicine technicians in clinical practice, excluding those unavailable for participation, working in commercial companies of medical equipment and software, radioisotope production and research. Ensuring anonymity and approved by the Ethics Committee and Data Protection Office of the Polytechnique Institute of Castelo Branco, the questionnaire presents questions about technician's adaptations in patient preparation, positioning, image acquisition, among others. ***Results:*** It was obtained 17 responses to the questionnaire. The results revealed a higher number of exams performed in Nuclear Pneumology to elderly patients, accounting for 41.2% of exams, while Nuclear Neurology represented 23.5%. Parkinson's Disease was the most common indication for Nuclear Neurology exams (94.1%), while in Nuclear Pneumology, Pulmonary Thromboembolism was predominant (100%). Positioning elderly patients was referenced as more challenging in Nuclear Neurology (64.71%) than in Nuclear Pneumology (35.29%), but in both areas, adaptation of communication to calm patients was the most performed (94.1% and 100%, respectively). About 57.14% of respondents reported that positioning adaptation improves image quality due to reduced patient movement during acquisition. The most frequently adjusted acquisition parameters included time/image counts (82.35% in Nuclear Neurology and 76.47% in Nuclear Pneumology). The complexity in administering the radiopharmaceutical in ventilation scintigraphy prompted 77.78% of professionals to consider adaptations, highlighting the need for flexible approaches in these clinical specialties. ***Conclusion:*** Clear communication and the use of immobilization accessories to improve patient comfort are the most adapted fields to ensure the quality of the exam performed in elderly patients. Some limitations were identified in this study, namely a small sample size and the inability to address all proposed hypotheses.

EP-1329

Artificial Intelligence in radiography education: A scoping review

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Aim/Introduction: The expansion of Artificial Intelligence (AI) in radiography is predicted to transform future clinical workflows, decision-making, and the role and responsibilities of practitioners. If AI is to be an important aspect of radiography practice, it may be reasonable to expect that future graduates need to be equipped to engage in competent and safe utilisation of these technologies. Little research has explored the current and emerging influences of AI in radiography education. The purpose of the scoping review is to map the existing literature regarding AI applications in radiography education and how these technologies will potentially impact radiography education. ***Materials and Methods:*** Using the Johanna Briggs methodology, an initial search was conducted in EBSCOhost to determine whether the search strategy that was developed with a librarian would capture the relevant literature by screening the title and abstract of the first 50 articles. Any additional search items identified in the articles were then added to the search strategy. Thereafter PubMed, Scopus and Web of Sciences databases were searched. Additionally, grey literature was also sourced from ProQuest and relevant university institutional repositories. Abstract and full-text articles will be reviewed by two reviewers according to the predefined inclusion and exclusion criteria of the study. Thereafter, results will be reported using the Preferred Reporting Items for Systematic Reviews and Meta-Analysis Extension for Scoping Reviews. ***Results:*** The database searches were concluded in April 2024 and yielded 2 827 results. The final scoping review will present the findings in tabular form and through narrative description. ***Conclusion:*** With the continued growth of AI in radiography, this scoping review will provide an understanding of the current applications of AI in radiography education and how this technology will impact radiography education. ***References:*** Hardy M. Harvey H. Artificial Intelligence in diagnostic imaging: impact on the radiography profession. British Journal of Radiology; 2020;93:20190840.Currie GM. Intelligent imaging: Artificial Intelligence augmented nuclear medicine. JNMT;2019;47:217-222 Potocnik J, Foley S, Thomas E. Current and potential applications of artificial intelligence in medical imaging practice: A narrative review. JMIRS; 2019;54:376-385.Peters MDJ, Marnie C, Tricco AC, et al. Updated methodological guidance for the conduct of scoping reviews. JBI Evidence Synthesis; 2020;2119-2126

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JANUARY 30 - FEBRUARY 1, 2025

EANM FOCUS 6

SHAPING THE FUTURE OF BREAST CANCER CARE WITH MOLECULAR IMAGING

European Association of Nuclear Medicine | e-Mail: office@eanm.org | www.eanm.org

OCTOBER 22, 2024

From 19:00

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GAGA CLUB

Addendum

S43:
305
Sunday, October 20, 2024, 09:45 - 11:15
Hall Y4-Y9
Cutting Edge Science Track - Featured Session:
Radiation Protection Committee / EARL:
Radiation Protection for Radionuclide Therapy
and Animal Protection

OP-091
The Rhisotope Project
J. Larkin;
University of the Witwatersrand, Johannesburg, SOUTH AFRICA.

OP-092
EARL: Radiation Protection for Radionuclide Therapy
O. Ivashchenko;
University Medical Center Groningen, Groningen, NETHERLANDS.

S235:
OP-492
What are the Steps to Accurately Perform a Semi-Quantitative Analysis?
D. Cecchin;
Nuclear Medicine Unit, Department of Medicine – DIMED, Padua, ITALY.

S268:
1208
Tuesday, October 22, 2024, 08:00 - 09:30
Hall G2
Joint Symposium 6 - Radiation Protection
Committee - Nuclear and Radiological
Emergencies - Preparedness and Response

OP-563

International Radiological Emergency Preparedness and Response - IAEA Response and Assistance Network

Takeo Kurita;

International Atomic Energy Agency (IAEA), Incident and Emergency Centre (IEC), Department of Nuclear Safety and Security, Vienna, AUSTRIA.

OP-564

Biological Dosimetry for Emergency Preparedness

Ursula Oestereicher;

Federal Office for Radiation Protection, Biological Dosimetry, Neuherberg, GERMANY.

OP-565

Medical Management of Persons in a Nuclear or Radiological Emergency

Wolfgang Burchert;

Universitätsklinik der Ruhr-Universität Bochum, Institut für Radiologie, Nuklearmedizin und Molekulare Bildgebung, Bad Oeynhausen, GERMANY.

S344:

OP-723

Imaging Non Oncological Targets

C. Decristoforo;

Medical University Innsbruck, Innsbruck, AUSTRIA.